

Institutions for management of transboundary water resources: their nature, characteristics and shortcomings[☆]

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Abstract

This paper examines the evolution structure and characteristics of the management systems of 12 transboundary river basins: The Mekong, Indus, Ganges–Brahmaputra, the Nile, Jordan, Danube, Elbe, Rio Grande and Colorado, Rio de la Plata, Senegal and Niger. The paper presents the legal principles which guide the legal regime of the studied rivers, particularly the principle of equitable use of transboundary water resources and the obligation not to cause harm in the management of transboundary water resources. The practice of management in the abovementioned rivers is divided into three categories:

(a) Treaties and agreements stopping short of allocating water between riparian states such as free navigation treaties or institutions which were established for a sole purpose such as combating pollution (Elbe, Danube, Rhine).

(b) Treaties and agreements allocating water between states (the Indus, Nile, Ganges, Jordan).

(c) Agreements for joint management of internationally shared waters (Colorado and Rio Grande, Mekong, Senegal and Niger).

Some of the institutions discussed in this paper have evolved only after a long conflict (Indus, Ganges, Jordan) and that there is a danger of adopting institutions for only a portion of a river basin (Mekong, Nile). The success of institutions which were founded on basin-wide joint management lie in their territorial coverage and broad functional frameworks. These institutions also reflect, in the best way, the current legal norms in the management of transboundary water resources. © 2001 Elsevier Science Ltd. All rights reserved.

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1. Introduction

Transboundary¹ water resources are of two types: groundwater resources or surface (rivers, lakes) water resources. Because water is continuously in motion, issues of control, jurisdiction and sovereignty are much more complicated than when dealing with static land resources. This task is even more difficult when water resources are shared by a number of political entities. The United National Register of International River Basins listed 214 international transboundary river basins in the world in 1987 (UN Registry of International River Basins, 1978). In a more recent updating of the inventory of transboundary river basins 261, international rivers, covering 45.3% of the land surface of the earth were identified and listed (Wolf et al., 1999, pp. 389–391). Some even extend this number of transboundary river basins to 280 (Green Cross, 2000, p. 6)

The management of water resources confronts many obstacles: first, because of the critical importance of water for human existence and secondly, because of its many uses: for drinking and domestic purposes, irrigation, fishing and navigation, hydropower generation, flood management, recreation, tourism and preservation of uses are often in conflict and the satisfaction of one obstructs the fulfillment of the other. Other major difficulties in the management of transboundary water resources are their sheer scale and the frequent gaps between policies, plans and practices (Savenije & van der Zaag, 2000, p. 14). However, the many institutions which govern the management of transboundary water resources point to the fact that in many river basins countries are able to overcome their differences and cooperate to the benefit of all. These patterns or models of cooperation are then discussed, in depth, in this paper.

Four additional features make the management of water resources extremely difficult:

- scarcity,
- maldistribution,
- sharing (Frey, 1993, p. 54),
- over-utilization and misuse.

Water scarcity is not only a natural outcome of climate patterns. It is more a result of population increase and the substantial growth in the demand for fresh water for urban use, agriculture, diverse amenities and industry. Already, more than a billion people in the developing world lack safe drinking water, which those in the developed world take for granted (Gleick 1998, p. 488). As over 40% of the world's population resides in the abovementioned 261 transboundary river basins, the management policies and institutions are extremely important (Green Cross International, 2000, p. 16). Because of future anticipated population growth (global water demand is currently said to double every 21 years), water resources, especially international river basins, have been transformed into tense arenas for competitive exploitation by neighboring nations. Consequently, international disputes have arisen in almost every part of the world (Vlachos, Webb, & Murphy, 1986; Bingham, Wolf, & Wohlgenant, 1994). However, we are reminded that water, because of its nature as a shared resource, tends to induce even hostile co-riparians to cooperate, even as dispute rages over other issues (Wolf, 1999, p. 160).

¹Transboundary or transborder water resources are defined as surface or groundwater resources shaped by two countries or more.

Maldistribution of water resources is shaped by nature and also by climatic fluctuations. As a result, water-scarce countries, which often have high rates of population growth, frequently find themselves involved in both internal and external conflicts over the scarce water resource. These conflicts may arise because national interests differ and nations develop diverging policies and plans which are not compatible (Savenije & van der Zaag, 2000, p. 14). Areas which are more likely to have conflicts are regions in which scarcity, maldistribution and increase in demand interlock. Over 90% of the conventionally calculated water resources of the Middle East cross international borders, and Africa alone contains 60 international rivers (Green Cross International, 2000, p. 16). African countries, with their agrarian economies, find themselves in a struggle over water resources with the expanding urban sector, which are often located outside the state borders. In many areas of the world transboundary water resources are shared but not managed jointly and, consequently, there are no prior principles to guide partners as to how much each of them can utilize from common water resources and for what purposes. Again, the outcome is disastrous, as water resources all over the world are overutilized and heavily polluted.

In contrast to water conflicts, more than 3600 water-related treaties have stood firm since 805AD, while in the same period, there have been only seven minor water-related skirmishes (Wolf, 1999). Rogers (1992) identified 286 treaties which settle the management of international rivers. Not surprisingly, two thirds of these treaties were ratified in Europe and North America, where problems became acute sooner.

It is the purpose of this paper to explore the nature, characteristics and particular management systems of organizations or institutions which manage international water resources. It will stress three specific research areas: the legal and organizational foundations for management of shared water resources, their structure and functions, and their strength and weakness as institutions. This paper is based on an in-depth study of 12 international river basins which developed elaborate institutions for the management of their transboundary water resource. The 12 river basins are: the Mekong, Indus, Ganges–Brahmaputra, the Nile, Jordan, Danube, Elbe, Rio Grande and Colorado, Rio de la Plata, Senegal and Niger. Other instances of river basins will be mentioned only briefly. The article is divided into two sections. In the first, general principles for the development of organizations for the management of transboundary water resources are presented; in the second part, the structure, functions, strength and weakness of the abovementioned institutions of the 12 river basins are discussed.

2. Part 1: organization for managing transborder water resources: principles of international law and treaties

It is evident that basin-wide cooperation is the optimal solution to the problem of managing international basins. Countries sharing international rivers face a two-dimensional problem, the first is to manage the water resource holistically; the second is to share the source internationally. In the absence of balanced cross-boundary and cross-sectoral integration, riparian countries may easily get into conflicts over shared waters. Most countries subscribe to international principles of good neighborliness, recognize that riparian countries are mutually dependent and have taken steps, signed agreements and instituted bodies through which emerging problems may be resolved

(Savenije & van der Zaag, 2000, p. 20). In this paper these institutions and agreements are presented within the framework of international law.

The classical definition of international law was given by Briefly as “the body of rules and principles of action which are binding upon civilized states in their relations with one another” (Brown-Weiss, 1996, p. 1). International law provides the normative framework and the procedures for coordinating behavior, controlling conflict, facilitating cooperation and achieving values (Brown-Weiss, 1996, p. 1). International law arises through explicit and implicit agreement of the participants. Explicit agreements are termed “treaties” or “conventions”. Implicit agreements are termed “custom” or “general principles”. This body, termed “customary international law,” is more complex and uncertain than formal agreement such as treaties and conventions. Customary international law consists of the practices of states undertaken out of a sense of legal obligation, that is out of a sense that the practice is required by law (Dellapenna, 1999, p. 1313).

International law has evolved out of experience and particular situations. The rules of international law reflect the common wisdom of nations (Solanes, 1992). International law of water resources, as a part of international law, regulates relationships between states with respect to the utilization of “shared” common or “transboundary” water resources. A river may be international geographically if it flows through or between the territories of sovereign states; from the legal standpoint, a river is international if a riparian state does not have all the powers over the waters of that river. Historically, an international river had to be navigable (Caponera, 1995, p. 121). As successful areas of customary law have tended to be codified under the auspices of the United Nations, perhaps it is acknowledged, by the community of nations, that international water law has reached this level. In 1997, the UN Convention on the Law of Non-Navigational Uses of International Water-Courses (although not yet in force) provides a common framework for cooperation within international river-basins (Green Cross, 2000, p. 12). Most rules of international water law derive from one of two categories of sources: (a) treaties or (b) international custom. Treaty-based rules are relatively easy to ascertain, but norms of customary international law are more difficult to establish.

(a) *Treaties*. There are more than 3600 instruments relating to international watercourses and some date from earliest times—the first and second centuries of the present millennium (Wolf, 1999). Worldwide, some 286 international treaties concerning fresh water have been concluded, about two-thirds in Europe and North America (Caponera, 1995). Most agreements concerning shared water resources are bilateral and relate to specific rivers that form or cross boundaries, or lakes that straddle them. There is a smaller number of multilateral agreements.

(b) *Customary International Law or State Practice*. The early doctrinal bases which guided state practice in relation to fresh water resources were:

1. *The Harmon Doctrine of Absolute Sovereignty*. The doctrine claims the absolute freedom of a riparian state, often the uppermost riparian, to utilize the waters flowing through its territory, regardless of the effect of its actions on other riparian states. The Harmon Doctrine has never won international acceptance and is contrary to current international law.
2. *The Doctrine of Absolute Riverian Integrity*. This doctrine stipulates that a state may not alter the natural flow of waters passing through its territory in any manner which will affect the

water in another state, be it upstream or downstream. This doctrine is too restrictive, is not very practical and therefore, rarely used. Typically, it was adopted by downstream states.

3. *The Doctrine of Limited Territorial Sovereignty*. This intermediate approach has been taken in resolving the majority of international water disputes. It appears to be the most widely accepted in treaties and in experts' opinions. It conforms to the general legal obligation to use one's property in a manner which will not cause injury to others. According to Dellapenna (1999, p. 1314) restricted sovereignty goes by the name of "equitable utilization" (see below).
4. *The Doctrine of the Communalism of International Waters*. This theory assumes a communalism or riparian communalism of interest between or among basin states, and treats the total volume of basin water as a shared resource. The theory of riparian communalism stipulates that the entire river basin constitutes a single geographic and economic unit that transcends national boundaries, and therefore the basin's waters are either invested in the whole community or shared among the riparians.
5. *The Doctrine of Correlative Rights*. In this doctrine the emphasis is on the most efficient utilization of joint water resources, rather than on ownership rights (Dellapenna, 1996; Caponera, 1995; Naff, 1993, p. 115).

Some of the principles drawn from these doctrines and accepted today as legal norms which are binding on states are (Caponera, 1995; Housen-Couriel, 1994):

- (a) The duty to cooperate and to negotiate in good faith with the genuine intention of reaching an agreement;
- (b) The prohibition of management practices likely to cause substantial injury to other states (prevention of harm);
- (c) The duty of prior consultation;
- (d) The principle of equitable utilization of shared water resources.

Various international organizations such as the Institute de Droit International, the International Law Associations (Helsinki Rules) and the UN Affiliated International Law Commission each prepared a draft of rules for the use of international water resources. The International Court of Justice and other tribunals in their decisions and rulings reinforced these principles (Solanes, 1992; McCaffrey, 1993, p. 98; Caponera, 1995).

The principles of international law which are agreed upon by the various sources of international water law are:

1. International drainage basins or international water courses are an aggregate of surface and groundwaters flowing into a common terminus (Caponera, 1995; Green Cross, 2000, p. 65).
2. *Equitable use*. The doctrine of equitable use requires the interests of all riparian countries to be taken into account when allocating and using the waters of international water courses. The doctrine has been applied by international courts and also by national courts of federal countries. It is also endorsed by most writers (Dellapenna, 1999, p. 1315; McCaffrey, 1991, 1996). It was endorsed by Helsinki Rules and by the UN 1997 Convention.
3. *The obligation not to cause harm*. This obligation includes the duty of preventive and cooperative action. The duty to curb adverse effects applies to many aspects of international water law, but is particularly relevant in relation to water pollution. The 1988 Report to the

International Law Commission suggests that appreciable harm resulting from water pollution is a violation of the principle of equitable use. The World Bank statement for projects in international waterways requires the assessment of potential significant harm before approving projects on international waterways (Solanes, 1992; Caponera, 1995; McCaffrey, 1996). The primacy of the rule of equitable utilization was confirmed by the International Court of Justice in its ruling on the Danube River Case in 1997. The case arose between Hungary and Slovakia over the construction of the Gabčíkovo-Nagymoros Dams on the Danube. The Court's opinion referred twice to the rule of equitable utilization and did not mention the "no harm" rule (Dellapenna, 1999, p. 1318; Green Cross, 2000, p. 52). Wouters (1992) also concluded that the principle of equitable utilization emerged as the central concept in reconciling the various interests of watercourse states in the development of their transboundary waters.

4. *Joint development of international rivers.* Joint development, which is ideal for shared water resources, is difficult to achieve because of questions of sovereignty, ownership of waterworks, jurisdiction, financing, scope of cooperation, etc.
5. The doctrine of absolute territorial sovereignty over international rivers has never been a generally recognized principle of international law. However, the idea of sovereignty affects the initiation of basin-wide programs, and is a major obstacle to achieving integrated development of international rivers. The result is that international agreements often refer only to certain aspects of water planning (data collection, for instance) or particular developments (like individual water projects), or create organizations that have a coordination, rather than an overall planning and management role. Moreover, many treaties divide ownership of, and jurisdiction over, otherwise indivisible waterworks. Cooperation in the development and conservation of international watercourses is based on sets of self-limitations to sovereignty (Solanes, 1992).

The above principles are best reflected by two abovementioned assemblages of rules and stipulations which are accepted by countries and jurists. These are the Helsinki rules, which were developed for more than 30 years by the "International Law Association, and the United Nations Conventions on the Law of the Non-Navigational Uses of International Water Courses" which were stipulated by the UN affiliated International Law Commission. This draft is now in the process of ratification by UN member states.

3. Treaties: evolution and practice

Treaties and Agreements on international river basins vary according to

- Parties to the agreement (bilateral/multilateral).
- Subject matter (data collection, allocation, planning, construction, etc.).
- Territorial extent (the whole basin or parts of it).
- Intensity of cooperation (from duty to inform to implementation of joint programs).

The depth of cooperation also affects the regime of ownership of the waterworks resulting from a treaty (Solanes, 1992, p. 119). Treaty regimes which have been established to regulate the joint utilization of water resources deal overwhelmingly with surface water, specifically rivers and lakes.

Navigation of rivers was one of the earliest topics to be addressed by international conventions and tends even today to be regulated independently of other uses of surface water.

There are three requisites for an international regime to be established in an international river basin:

- active support and long-term commitment on the part of top-level political representatives,
- mobilization of the available geological, meteorological, legal, social, engineering and other expertise,
- a domestic governmental structure capable of effective international cooperation and collaboration (Housen-Couriel, 1994, p. 2).

The various institutional arrangements and mechanisms as reflected in treaties, conventions and agreements are divided into three broad categories:

- (a) Agreements by riparian states stopping short of formal allocation;
- (b) Agreements allocating water between states;
- (c) Agreements for joint communal management of internationally shared waters.

Only a few treaties expressly acknowledge the existence of the above underlying customary rules (see for example the Mekong Basin Agreement of 1995). These principles were translated into regional agreements such as SADC (Southern Africa Development Community) Protocol of Shared Water Course Systems (1995) and the 1992 European Convention on the Protection and Use of Transboundary Watercourses and International Lakes (Savenije & van der Zaag, 2000, p. 23).

4. Part 2: international law and treaties: the practice

The treaties and conventions which will be examined here will be first tested as to the specific principles of international law which they advocate and also will be divided into three categories according to their level of cooperation, namely agreements stopping short of formal allocation, allocation agreements, and agreements for joint management of internationally shared waters.

4.1. Treaties and agreements stopping short of allocating water between riparian states

A great number of treaties and agreements are embraced by this category (Table 1). One of the earliest uses of international rivers was for navigation and the principle of freedom of navigation evolved early as an accepted legal principle for the management of international rivers. In earlier times rivers were considered “international” when “navigable”. Two principles were attached to international river boundaries: that they separated two or more states and that freedom of navigation was the general practice in these rivers. Some rivers had an international regime which regulated freedom of navigation in those rivers for a long time: the Danube since 1846, the Rhine 1839, and Lake Geneva 1816. Many of the conventions and treaties which deal with freedom of navigation are separated from the other treaties which may deal with other aspects of joint development of water resources of an international river basin. Examples are the Danube and Elbe which were regulated by the Treaty of Versailles (28.6.1919) for freedom of navigation, but

Table 1
Foundations for management of international water resources: treaties and agreements stopping short of allocating water^a

River basin	Legal regime ^b	Customary law ^c	Territorial extent and membership ^d	Functions ^e	Explicit or implicit expression ^f	Purposes and power of implementation ^g	External impacts on institution ^h	Conflict and conflict management ⁱ	Notes
Elbe	International Commission of the Elbe 1919–1936 based on the Treaty of Versailles	The Doctrine of Community—Freedom of Navigation	Czechoslovakia, Germany, Great Britain, France, Germany	Navigation, customs transit ports	None	National regulations for navigation had to be approved by the Commission which also had jurisdiction over special courts to deal with controversies	None	During World War II the whole Elbe was occupied by Germany	The Internationalized regime of the Elbe was not resumed after World War II. The Cold War and Iron Curtain prevented the resumption of the international regime. The Shipping in the Elbe was regulated and supervised by the two German states. Dealing with pollution was possible only after the fall of the Communist regimes in Eastern Europe
	International Commission for the Protection of the River 1990 (ICPE)	Limited sovereignty	Germany, Czech Republic and the EU	Clean the Elbe water for drinking, irrigation, and restoration of ecosystems		Recommendations to the environmental ministers of the member states which have to implement. Implementation is slow	EU is a full member in the ICPE		
Danube ^j	The internationalization of the Danube Basin Treaty of Versailles 1919–until 1939	Doctrine of communal—freedom of navigation	Freedom of navigation to all European countries	Transportation (freedom of navigation)	None	No data	None		Germany repudiated the international regime in the Danube in 1939

	1948 Belgrade Convention dissolution of the international regime	Exclusive control of each riparian country on its share of the river	Austria, Hungary, Bulgaria, Romania, Slovak Rep., Serbia, Montenegro, Russia, Ukraine	Transportation	Freedom of navigation is abolished	The Danube Commission was given quasi-legislative powers over navigation. NO SOVEREIGN POWERS		“Cold War” dissolution of the international regime. Freedom of navigation is secured by each riparian separately	East bloc basin states (USSR dominance in the basin). Support sovereign control of each state of its share in the river and free cooperation in the Danube Commission
	The environmental program for the Danube River Sofia, 1992 1994 Convention ^k	Limited territorial sovereignty	17 Co-basin states, European Commission, UNDP, UNEP World Bank	Incorporate all uses. Improving water quality by reducing pollution	Equitable water management None	Only monitoring powers. Recommendations are brought to the Ministerial level of member states	European Commission, UNDP, UNEP, World Bank, WWF are members as well as co-riparians EU	Upstream-downstream conflict over pollution of the river	No organization reflects European Community interest in elimination of all pollution from Europe’s international rivers
Rio de la Plata	La Plata Treaty 1973 (The La Plata Commission)	Freedom of navigation to all riparians of the river basin	Argentina and Uruguay	Border navigation and transport research ports, fishing pollution	Not to cause harm	Mostly coordination only; research projects. Implementation is by the parties themselves	None	The Rio de La Plata Commission serves as a forum for resolving disputes	

^a Sources for the table: Kliot, Shmueli, and Shamir (1997); Housen-Couriel (1994); Bingham, Wolf, and Wohlgenant (1994); Green Cross (2000).

^b “Legal regime” identifies the formal document or declaration which regulates organization in a basin.

^c “Customary law” refers to prevalence of one of the doctrines specified in the introduction.

^d Territorial extension classify institutions as to whether they cover the whole river basin or only parts of it and if there are members in the institution which are not riparians to the basin.

^e Functions include all the areas in which the institution is active and specific authority in certain issue.

^f Explicit expression of international law relates to specific mentioning of any international law stipulation as expressed by ILC or ILA Rules. “Implicit expression” refers to an indirect inference of these rules.

^g Power of implementation defines the specific powers of institutions such as: SUPERVISION, MONITORING, PLANNING, CONSTRUCTION, etc.

^h External impacts refer to international organizations or other state involvement in the institution establishment.

ⁱ Conflict relates to prevalence of direct conflict in connection to the established institution and whether the institution has a mechanism for conflict resolution.

^j Co-basin states of the Danube for 1998 are: Romania, Croatia, Serbia-Montenegro, Hungary, Austria, the Slovak Republic Germany, Bulgaria, Moldova, the Ukraine.

^k 1994 Convention on Cooperation for the Protection and Sustainable Use of the River Danube.

currently are being managed for the purpose of pollution control (Elbe) and for joint management and planning (the Danube).

The free navigation regime in the Danube was renewed by the Belgrade Convention of 1948. According to that convention, riparian states retain full control over those parts of the river which run through their territories but must uphold freedom of navigation. The Danube Commission is responsible for the implementation of the Convention which includes maintenance and development of navigational facilities, levying of tolls and long-term planning (Rauschnig, 1992; Nachtnebel, 2000).

In the case of the Rio de la Plata, one of the largest rivers in the world, the legal regime was established in 1969 with a wide authority, but practically it operates mainly in the area of navigation, namely clearing and maintenance of the riverbed in the four major rivers which together comprise the system of the huge river: the Paraguay, the Uruguay, the Parana and the La Plata itself. However, because the treaty has broad objectives defined in its statute, it could expand in the future. Navigation, on the other hand, is one of many functions fulfilled by the legal regimes of the Senegal and Niger which will be discussed as case studies for joint management of international river basins (see section C).

Another type of legal regime which deals with sole function was installed in the Elbe. The International Commission for the Protection of the River Elbe (ICPE) was founded to improve the water quality situation of that river. The structure of this organization is exceptional in that, in addition to the riparians to the basin, Germany and the Czech Republic, the European Union is also a partner and a signatory to the international treaty of the ICPE signed in 1990 (Schumann & Simon, 1994). The specific purposes of the ICPE are to enable the utilization of the Elbe River for drinking water supply and agricultural water use, to ensure the development of the natural ecosystem and to reduce the waste load transported via the Elbe River into the North Sea. Though the mandate of the ICPE is wide, it does not allocate water nor does it operate as a joint development organization.

In respect to the Danube, the 1985 Bucharest Declaration focused on regional cooperation in the field of pollution prevention, and in 1992, the Environmental Program for the Danube Basin (DREP) agreed to establish an operational and regional basis for strategic and integrated environmental management in the basin. The motivation for cooperation is the wish of central and eastern European countries to link or join the European Union, necessitating the adoption of European standards for environmental protection in general and water management in particular. The European Commission and UNDP/GEF (United Nations Development Program and Global Environmental Facility) also provide technical and financial assistance to help states reach these standards and to reinforce regional cooperation and a reduction in the transboundary effects of pollution in the Danube and wider Black Sea area (Green Cross, 2000, p. 85) (see Table 1).

It is interesting to note that the cooperation within the Danube was nicknamed “cooperation as salvation”, namely, that cooperative schemes are adopted when a problem has reached proportions beyond the control of any one state to overcome it (Green Cross, 2000, p. 35). Water pollution of shared water resources could reach a situation near to ecological catastrophe in other river basins.

A similar body is the 1950s International Commission for the Protection of the Rhine against Pollution (ICPR) in which Germany, France, Luxembourg, The Netherlands and Switzerland are members. The chemical pollution of the Rhine continued, and efforts to curb it did not succeed

until the 1986 disaster of Sandoz which caused a wave of publicity and public concern in all riparian states. A new action program was adopted, this time with a great success and the Rhine is in a process of rehabilitation. In many parts it has regained its ecological and biological capacity (Huisman, de Jong, & Wieriks, 2000, p. 89–92).

The above examples point to one of the shortcomings of narrowly defined legal regimes: their inability to extend their operation beyond their mandate. As the following cases will exemplify, almost all the river basins need institutions with wider scope and broader jurisdiction. Also reflected in Table 1 are trends and changes in the legal positions. Except for freedom of navigation which was adopted in early stages as an important principle (and it, too, was broken by Germany in the Second World War, and was restricted and regulated by the USSR during the Cold War) most states advocated for absolute sovereignty to do with water resources in their territory as they pleased. Only when pollution and flood control became a burden, were they willing to adopt a more restricted notion of sovereignty. This issue is even more prominent with other types of organizations. At least in the Danube River basin it led to the expansion of the cooperative framework beyond pollution control (see below).

4.2. Allocating water between states

Agreements allocating shared water resources, by volume or otherwise, have become a common expression of restricted sovereignty, sometimes coupled with a requirement that works likely to interfere with the rights of another state party to the agreement cannot be undertaken without the consent of the affected states (the Nile, Indus) (Eaton & Eaton, 1994; Dellapenna, 1993). “Cooperation as Allocation” is based on careful agreement on and adherence to water allocation and pollution level quotas, which can help towards the prevention of the worst kinds of over-exploitation and degradation of water resources. They do not, however, encourage the levels of public participation and basin-oriented institution building which characterize an ideal progressive transboundary cooperative framework (Green Cross, 2000, p. 33). Co-existence created by allocation agreements is an improvement on conflict, but it is still too limited as the four allocation case-studies in this paper (the Indus, Nile, the Jordan and the Ganges) show (see Table 2).

We shall start with the Farakka Dam Treaty which is based on a recent treaty and agreement reached by India and Bangladesh and which has very narrow scope. India and Bangladesh signed the Treaty on Sharing of the Ganges Waters at Farakka (12.12.1996) after a long and a bitter conflict (The Government of Bangladesh, 1996). The dispute on the Farakka barrage is an old one. It started in 1951 when India decided to construct the Farakka barrage in order to divert waters from the Ganges River to the Houghly River in order to maintain navigability of this river and to flush out the silt that was deposited in the Calcutta Port. The barrage began operating in 1975. The dispute concerns the quantity of Ganges water which India was ready to release from the barrage for Bangladesh’s usage which Bangladesh claimed was insufficient (Salman, Salman, & Uprety, 1999, pp. 304–307). Bangladesh even submitted a complaint against the Farakka to the UN General Assembly in 1976. The conflict between Bangladesh and India centered around the quantity of Ganges water to be released for Bangladesh utilization during the dry season and as such, the treaty stipulates the exact allocated amounts of water to be distributed between the two countries. Allocation agreements with seasonal stipulations are better than general allocation agreements, because disputes on supply of water quotas to downstream countries during the dry

Table 2
Foundations for management of international water resources: allocation agreements^a

River basin	Legal regime ^b	Customary law ^c	Territorial extent and membership ^d	Functions ^e	Explicit or implicit expression ^f	Purposes and power of implementation ^g	External impacts on institution ^h	Conflict and conflict management ⁱ	Notes
Nile ^j	The Nile Treaty 1929 replaced by the 1959 Treaty	Egypt claimed prior appropriation rights (absolute territorial integrity)	Egypt and Sudan (Great Britain for the Sudan)						
	Nile Treaty 1959	Prior appropriation of both parties was recognized. Also, Egypt and Sudan adhered to the Doctrine of absolute Riparian integrity against the upper riparians	Egypt and Sudan. No upper riparians included	The Permanent Joint Committee is responsible for implementation of the 1959 Treaty	Equity on water use of the Nile between Egypt and Sudan, “No harm” position against Ethiopia Priority of use	Construction of water projects. Data collection. Coordination of planning	World Bank withdrew its support. USSR provided technical and financial support	Permanent joint committee as forum for conflict resolution	The treaty reflects Egypt’s position as a regional power. Sudan is subordinate. No participation of Upper riparians. More recently, Egypt “allowed” Ethiopian small irrigation project
Indus	Indus Treat 1960	Pakistan claimed historical rights and “equitable apportionment.” India claimed prior use or preservation of status quo	India and Pakistan. Afghanistan and China which are upper riparians are not members	Coordinating supervisory body. Main function to ensure that parties develop their water shares exactly as stipulated	The Treaty calls for cooperation in development of the river but no joint planning took place. Exchange of data, early notification of plans, are within international law	Study and report. Treaty has stipulations for broader operation and technical services which were not realized	Important and crucial role played by the World Bank as a mediator and arbitrator financier of the partition projects. The final treaty was formulated and planned by the World Bank	The conflict between Muslims and Hindus led to the partition of the Indus, as a result of the dispute on how its water will be utilized and allocated. The dispute was solved by the involvement of a Third Party—the World Bank	The Indus treaty was an outcome of the partition of the Indian sub-continent. The partition of the Indus was obtained only after attempts at basin-wide development and planning failed. The Indus treaty is considered as a sub-optimal solution to the management of the Indus

Ganges	Treaty between Bangladesh and India on sharing the Ganges waters at Farakka 1996	India behaved according to the “Harmon Doctrine”. Bangladesh adopted a legal attitude advocating negotiation and mediation. Treaty advocates sharing of the water	India and Bangladesh limited scope of cooperation: only on Farakka. No agreement exists for the whole river basin	The joint committee stipulated that water extraction at Farakka will be according to the Treaty. Treaty lays formula for water sharing during dry season	Equity, fairness and no harm to either party are explicitly mentioned in the Treaty	Data collection, report to government. Implement the treaty deals with disputes	None	The conflict on sharing the Ganges water at Farakka continued for about 36 years and concerns lack of water for Bangladesh because India uses most of it. The committee is also a forum for conflict resolution.	The Farakka Dam was constructed without Pakistan’s consent and the dispute is shaped by India’s standing as a regional power. This is the reason for the flaws in implementing the treaty. The 1996 Treaty worked well during the dry seasons of 1998 and 1999
Jordan	Treaty of Peace 26.10.1994 (Article 6a, Annex II)	Israel upheld absolute territorial sovereignty over the Jordan after 1967, the state of Jordan before 1967 Until 1967 Israel supported absolute territorial integrity	Jordan and Israel only. Lebanon, Syria and the Palestinians were not included in the Peace Treaty	Joint water committee will supervise that the two parties extract water allocations as stipulated It is a forum for data exchange, research and technical advice	No harm. Equitable apportionment of the water resources of the Jordan, Yarmouk. Early notification of projects	Mainly coordinating body. Data exchange also included	None	The conflict on water resources and local “water wars” were frequent, in the 1950s and 1960s and were part of the Israeli Arab conflict. Conflicts in the water sector are referred to mechanism for conflict resolution established by the Peace Treaty	There is no separate Treaty for water resources. The stipulations are part of the peace treaty

^aSources for the table: Kliot, Shmueli, and Shamir (1997); Housen-Couriel (1994); Bingham, Wolf, and Wohlgenant (1994); Dellapenna (1999); Green Cross (2000).

^b“Legal regime” identifies the formal document or declaration which regulates organization in a basin.

^c“Customary law” refers to prevalence of one of the doctrines specified in the introduction.

^dTerritorial extension classifies institutions as to whether they cover the whole river basin or only parts of it and if there are members in the institution which are not riparians to the basin.

^eFunctions include all the areas in which the institution is active and specific authority in certain issue.

^fExplicit expression of international law relates to specific mentioning of any international law stipulation as expressed by ILC or ILA Rules. “Implicit expression” refers to an indirect inference of these rules.

^gPower of implementation defines the specific powers of institutions such as: SUPERVISION, MONITORING, PLANNING, CONSTRUCTION, etc.

^hExternal impacts refer to international organizations or other state involvement in the institution establishment.

ⁱConflict relates to prevalence of direct conflict in connection to the established institution and whether the institution has a mechanism for conflict resolution.

^jA more recent development in the Nile—the 1992 Nile River Basin Action Plan in which the 10 riparians are members with the purpose to promote cooperation and development in the basin. Based on this, the Nile Basin Initiative was launched in 1999, in order to require financial resources for development within the basin.

season are becoming frequent. Recent examples can be seen in the 12 countries of Southern Africa Development Community. Even in water-rich river basins such as the Mekong or Euphrates, low water flow during droughts may turn into a dispute between riparians with storage capacity. Examples are China and Thailand vs. Vietnam in the Mekong; Turkey against Syria and Iraq in the Euphrates. In 1974 the water shortage almost triggered a war between Iraq and Syria (Bilen & Uskay, 1991). The legal regime of the Mekong and the existing (partial) agreements in the Euphrates do not include any seasonal stipulations nor does the 1959 Nile Treaty between Egypt and the Sudan. The recent Farakka treaty does not allocate all the water resources of the Ganges but only the shares of India and Bangladesh at Farakka Dam according to seasons (Treaty between the Government of the Republic of India and the Republic of Bangladesh on the Sharing of the Ganges Waters at Farakka, 12 December 1996).

The Treaty stressed on principles of international law such as “equity, fairness and no harm to either party” (Article IX Treaty between Bangladesh and India, 1996), and it shows a desire of the partners for a more equitable use of the Farakka dam’s water but the treaty does not approach the major problem there, which is the growing competition on the available water in that river between India and Bangladesh.

The Nile’s water resources were divided between Egypt and the Sudan first in 1929 when the two countries were under British administration, and in a second agreement in 1959 when the two countries became independent states. The 1929 Agreement allocated 48 billion m³ of Nile water to Egypt and only 4 billion m³ to the Sudan. The 1959 Treaty improved Sudan’s allocation from 4 to 18.5 billion m³ whereas Egypt increased its allocation from 48 to 55.5 billion m³ (Kliot, 1994; Waterbury, 1979). As a part of that Agreement, the High Aswan Dam was constructed and Egypt paid compensation to the Sudan for the flooding of settled areas in the Sudan by Lake Nasser, which was created by the Dam. The 1959 Nile Treaty exemplified the importance of prior use or acquired rights in the use of international river basins. Egypt claims an absolute right (“no harm”) to the integrity of the river because of the priority of use (Ahmed, 1990; Dellapenna, 1999, p. 1319). But Egypt was ready to divide additional water from the Aswan more evenly or in a more equitable manner with the Sudan. However, the need of the upper riparians, particularly Ethiopia, were ignored in that Treaty, and Ethiopia, on a few occasions, expressed its objection to the Agreement. In 1957 it served notice that it would pursue unilateral development of the Nile water resources within its territory (Bingham et al., 1994, p. 76). The existing treaty, which provides priority to Egypt deprives Ethiopia and condemns it to remain impoverished (Dellapenna, 1999, p. 1319).

The Indus Treaty of 1960, which was signed between India and Pakistan, assigned the waters of the eastern tributaries of the Indus to India and the western tributaries to Pakistan. Again, other upper riparians were not included in this agreement. The Agreement was mediated by the World Bank which also assisted in funding the massive construction connected to the partition of the Indus (Baxter, 1967, Chap. 9; Lepawsky, 1963).

Article XI of the Indus Water Treaty states expressly that the parties did not intend to establish any general principle of law or any precedent but the practice and implementation of the Treaty, which points to some important principles of international law. India gave up its upper stream sovereignty and belief that it could utilize the resources of the upper tributaries however it wishes. The second principle of international law which was applied by the Indus Treaty is the principle of equitable apportionment of the water in that basin (Table 2).

It is important to note that the implementation of the Treaty by the Permanent Indus Commission (in which each of the two countries has its own commissioners), entails a very low level of cooperation mainly in the areas of exchange of hydrological data, and to ascertain and approve any works on the river (Rahim, 1990; Sharma, 1990). The Nile Agreement, in comparison, encouraged a more active cooperation between the two partners in matters such as sharing the burdens of construction, and determining allocations in the event of exceptional low flows. The Nile's Permanent Joint Technical Commission was assigned the authority for the planning and implementation of all hydrological works on the Upper Nile. Egypt and the Sudan practically adopted a common policy against the other co-riparians of the Nile (Kliot, 1994, p. 85). Finally, the recent Peace Treaty between Israel and the Hashemite Kingdom of Jordan also belongs to the category of water allocation agreements because an important chapter of that treaty deals solely with water allocation. According to Article 6 of the Peace Treaty, the parties agree mutually to recognize the rightful allocations of both of them in the Jordan and Yarmouk rivers and the Araba/Arava groundwater resources. Water allocation quantities from the abovementioned sources are specified according to seasons, for the use of Jordan and Israel (Annex II: *Water Related Matters. Treaty of Peace between Israel and Jordan*, 26 October 1994) (Israel, The Government of Israel, 1994).

It is important to stress that the Treaty of Peace between Israel and Jordan calls for intensive cooperation in water issues, including development of new water resources, projects of regional and international cooperation and even mentions the option of transboundary water transfers. Among the specific principles of international law which appear in the Treaty are avoidance of harming the water resources of the other Party, and there is the emphasis on principles of equity in the management and development of water resources. A Joint Water Committee was established as a part of that Agreement. In reality the Agreement is working successfully and Israel enlarged water transfers to Jordan which suffers from a chronic water shortage, especially in its capital city, Amman. But the Treaty does not advocate a joint management of the common water resources and does not include Lebanon, Syria and the Palestinian Authority, which are riparians to the Jordan Yarmouk (Table 2).

Comparative examination of the four allocation treaties shows a great variety in the political–conflictual situations which resulted from these agreements and also in their functions and powers. None of the above agreements cover the whole territorial extent of the respective basins and all exclude other riparians from it. That necessarily keeps the allocation agreements narrow in scope, and potentially a conflict may arise in the future when the other riparians could demand their share in the common resources.

The partition of the water is just one issue to be taken into account, and is insufficient on its own to establish a viable regime which reflects all water-related problems, including quality, quantity, distribution, and the environment. The needs of states change with population and economic growth, and allocation agreements can quickly become outdated and even restrictive to development. This approach to transboundary water runs contrary to the whole idea of water being a shared resource. Allocation agreements lack the basin-wide commitment to a shared set of priorities, principles and goals. But, entry into agreement, revealed, in all the river basins discussed an abandonment (even partial) of legal stances such as absolute territorial integrity and “Harmon Doctrine” in favor of more cooperative legal positions. The more recent allocation agreements (Farakka, Jordan) explicitly stress principles of international law such as equitable

water allocation and avoidance of harming the common water resources (Table 2). The institutions (joint committee or joint commission) which are responsible for carrying out these allocation agreements are mostly coordinating and supervisory bodies, which have to make sure that the parties will adhere to their water allocations. Only the Permanent Joint Committee in the Nile has wider authority in the planning and construction of water projects as well. Finally, in the formulation of the institution, external impact was crucial in the Indus basin, very influential in the Nile, but negligible in the Ganges and Jordan. In all the four institutions there are specific mechanisms for conflict-resolution in case disputes will arise in connection with allocation.

4.3. *Agreements for joint management of internationally shared waters*

Integrated management of transboundary watercourses which is based on water sharing principles, cooperation, protection of the environment and promotion of dispute settlement is voiced in the body of international law (1997 Convention, Helsinki Rules) and by academics (see Green Cross, 2000; Savenije, van der Zaag, & Wolf, 2000). Although full joint management remains rare, the practice may be moving in this direction. As an ideal form of institution for the management of water resources, key aspects of the structure of joint-management-multipurpose organizations should be presented in detail.

I. *Joint management* follows the doctrine of communality of property. Its major facets are as follows:

- Jointly developing and managing the water basin as a unit without regard to international borders;
- sharing of the benefits of that development and management according to some agreed-upon formula;
- a procedure for investigating and resolving the inevitable disputes constructively.

II. *Multipurpose projects* are constructed for water supply, flood control, irrigation, navigation and hydropower generation. Large dams are sometimes justified because of hydropower, which provides a high return and subsidizes other project purposes. Some of the best basin-wide multipurpose organizations can be found in developing regions. Most of these institutions also incorporate mechanisms for sharing the benefits and costs of the various projects and mechanisms for dispute resolution.

III. *Basin-wide planning*. The concept is interpreted as: the basin being the appropriate unit for development and management. Only coordinated planning of the river basin as one unit may be effective. One of the legal regimes which started with the fundamental role of water allocation and became a multipurpose organization which practiced joint management is the International Boundary and Water Commission of the USA and Mexico which jointly manages the Colorado and Rio Grande/Rio Bravo (IBWC/CILA) (see Table 3).

The IBWC/CILA was established in a series of treaties signed by the USA and Mexico since 1848. Some of the treaties dealt only with the boundary while others focused on water. The most important is the Treaty of February 3, 1944 for the Utilization of Waters of the Colorado and Tijuana Rivers and the Rio Grande, which distributed the waters of the international segment of the Rio Grande from Fort Quitman, Texas to the Gulf of Mexico, and the waters of the Colorado River. This Treaty further authorized the two countries to jointly construct, operate and maintain

Table 3
Foundations for management of international water resources: basin-wide development and planning^a

River basin	Legal regime ^b	Customary law ^c	Territorial extent and membership ^d	Functions ^e	Explicit or implicit expression ^f	Purposes and power of implementation ^g	External impacts on institution ^h	Conflict and conflict management ⁱ	Notes
Mekong	Mekong Committee 1957–1996	The Doctrine of Limited Territorial Sovereignty. China voted against the 1997 UN Convention	Thailand, Laos, Vietnam and Cambodia. China and Myanmar are excluded	Data collection, coordination of planning programs. Involvement in fish farming. Improvement of navigation, control of environmental pollution. No water allocations	Comprehensive development of Mekong. Equitable sharing of the Mekong	Originally comprehensive planning for the whole basin. In reality coordinating body	UN, UNDP, ECAFE, World Bank, Asian Development Bank, donor countries. Technical and financial support	No overt conflict yet. Environmental issues and separate development may lead to conflict (Energy; Thailand; rice farming; Vietnam	Continuous conflicts in southeast Asia hampered cooperation. Powerful China is not interested in cooperation in the Mekong management. Separate developments of the upper and lower basin
	Mekong River Commission 1995		The same but China and Myanmar have observer status	Joint planning and management for hydro-power, (great importance) flood control, fishing, irrigation, navigation, water supply	Sustainable basin wide management, equity	Data collecting, planning studies, training programs, coordination		Dams building threat to lower riparians; growing conflict between upper and lower riparians	Ministerial level was added to the Mekong commission in order to add to it political clout
Senegal	The Senegal River Basin Authority 1972 on (OMVS)	The Doctrine of communality of international water. The Doctrine of Limited Sovereignty	Mauritania, Mali, Senegal. Guinea withdrew	Navigation Promotion of irrigation and hydropower production. Construction and operation of projects	Equity. Prevention of harm, free navigation	Multi-purpose basin-wide comprehensive development and planning	Important effect of donor countries. Arab banks, EEC, USAID, OPEC, UNDP, World Bank	Disputes are solved by the uppermost level of the institution: Conference of heads of state 1988-Senegal-Mauritania	Organization of the Senegal began in colonial times 1934–52 for navigation and data collection. Organization of the river for navigation. Coordination, research continued until 1972—the establishment of OMUS

(Continued on next page)

Table 3 (continued)

River basin	Legal regime ^b	Customary law ^c	Territorial extent and	Functions ^e	Explicit or implicit	Purposes and power of	External impacts on	Conflict and conflict	Notes
Niger	The Niger River Commission 1964–1979 Niger Basin Authority 1980	The Doctrine of Limited Sovereignty	Seven of the 9 riparians were members in the Niger Commission. All 9 riparians are members in the Niger Authority	Navigation, cooperation and coordination of plans. Early notification of plans and projects. Conduct studies, prevention of pollution	Early notification of projects; prevention of harm	Cooperation for the study and execution of projects and coordination of all various plans	African Commission for Technical Cooperation, World Bank, UNDP, CIDA, USAID, FAO, Technical and financial support	The Commission was entrusted with the function of conflict resolution	Unlike the Senegal, the external involvement in that basin did not lead to a successful institution because of the too many riparians with opposing interests and also because of the institution failure in mobilization of foreign aid
Colorado and Rio Grande	International Boundary and Water Commission IBWC/CILA series of treaties established the regime 1906, 1944 are the most important	USA held off the Harmon Doctrine (absolute sovereignty) and changed its legal stance to one nearer to the Doctrine of Limited Sovereignty	United States and Mexico Organization covers the whole basin	Water allocation. Water quality: salinity and sewage. Groundwater resources	1906 convention explicitly mentioned equitable division. The 1944 Treaty stressed equitable distribution of the water	Management of water works, implementation monitoring and enforcement of agreements and resolution of conflicts. Practically it has basin wide comprehensive development approach	None	Conflicts on water allocation to USA and Mexico led to the conclusion of the 1906 and 1944 treaties. IBWC/CILA is also a forum for conflict resolution	This institution is unique because it deals with both border and water, and because it encompasses two rivers in the same institution. The institution began with one function of allocation but acquired more functions of pollution control and ground water management through a special mechanism of adopting specific minutes which add functions to the original 1944 treaty

Danube ⁱ	1994: Danube Convention	Limited territorial sovereignty	All the 17 riparians of the Danube are members. Yugoslavia has been excluded since 1991	Pollution hydro-power transportation multilateral basin-wide management	Equitable and sustainable water use is mentioned explicitly. Prevention of harm; implicitly	Integrated sustainable and equitable water management	EU an integrating force which supports cooperation of basin states particularly in water quality	Gabcikovo—International Court of Justice Upper-downstream conflict	The cooperation in the Danube basin is hampered by socioeconomic gaps and diversity of interests between the industrial upper riparians Germany and Austria and the less developed lower riparians. There is still no overall organization responsible for water resources management, development and utilization. Under the Danube convention such organization now is being developed (with all co-basin states members in it)
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^a Sources for the table: Kliot, Shmueli, and Shamir (1997); Housen-Couriel (1994); Bingham, Wolf, and Wohlgenant (1994); Green Cross (2000).

^b “Legal regime” identifies the formal document or declaration which regulates organization in a basin.

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^d Territorial extension classify institutions as to whether they cover the whole river basin or only parts of it and if there are members in the institution which are not riparians to the basin.

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^g Power of implementation defines the specific powers of institutions such as: SUPERVISION, MONITORING, PLANNING, CONSTRUCTION, etc.

^h External impacts refer to international organizations or other state involvement in the institution establishment.

ⁱ Conflict relates to prevalence of direct conflict in connection to the established institution and whether the institution has a mechanism for conflict resolution.

^j Co-basin states of the Danube for 1998 are: Romania, Croatia, Serbia-Montenegro, Hungary, Austria, the Slovak Republic Germany, Bulgaria, Moldova, the Ukraine.

on the main channel of the Rio Grande those dams required for the conservation, storage and regulation of the greatest quantity of the annual flow of the river to enable each country to make optimum use of its allotted waters (IBWC/CILA, 1996). The Treaty was a dramatic turning-point in the legal stance of the United States on its sovereign rights concerning water resources. Until that date the USA maintained, according to the Harmon Doctrine, that it had absolute right to use the water resources in its territory as it wished. The 1944 Treaty was accompanied by an agreement for the solution of the international problem of the salinity of the Lower Colorado river—IBWC Minute No. 242 dated August 30, 1973. In 1979, the two countries signed IBWC Minute No. 261 to solve their border sanitation problems.

In addition to water allocation of 234 million m³ of Colorado water to Mexico and of Rio Grande water, the IBWC is fulfilling the following:

- (a) *Flood control* in the lower Rio Grande and Tijuana River;
- (b) *Data exchange* and monitoring;
- (c) *Dam construction and operation* Anzal and Retamal on the Lower Rio Grande for flood control, Amistad Falcon on the Rio Grande for flood control, conservation, power generation and recreation. The Morelos dam is maintained on the Colorado.
- (d) *Drought* an international agreement in the form of IBWC Minute No. 293 was concluded in October 1995 to provide for a standby water loan to supply municipal needs of Mexican border communities along the Rio Grande.
- (e) Channel preservation and silt removal from the Colorado main channel.
- (f) *Salinity control* a bypass drain discharges saline water from the Rio Grande to the Gulf of Mexico and is supervised and operated by the IBWC. The Wellton-Mohawk bypass drain discharges saline water from the Colorado system.
- (g) *Groundwater resources* a binational report was prepared for reciprocal consultation on future studies of use and conservation of the transboundary water aquifers.
- (h) Finally, the two countries now deal with border sanitation and water quality matters based on Minute 261 which defines this type of problem. The IBWC operates and maintains the international wastewater treatment plant in Nogales, Nuevo Laredo, Tijuana—San Diego sanitation, and Calexico-Mexicali sanitation. Also, water quality monitoring (even of groundwater resources in Nogales Arizona and Nogales, Sonora is also carried out by the IBWC (IBWC Commission Report, 1998).

The USA and Mexican sections of the IBWC/CILA implement new policies or construction through the respective agencies or institutions within their own government, so that the principle of national sovereignty is not compromised. The decisions or recommendations of the two governments are recorded as minutes, which must be signed by both the Mexican and the American governments.

The various treaties stress important principles of international law. For example, the 1944 Treaty specified the equitable distribution of the water from the Lower Rio Grande and the Colorado. Equitable approach was adopted also to binational financing of water improvement projects.

Finally, the 1944 Treaty determined priorities for utilization of the shared waters as follows: (1) domestic and municipal use, (2) agricultural and stock-raising, (3) electric power, (4) other

industrial uses, (5) navigation, (6) fishing and hunting, (7) other beneficial uses (Housen-Couriel, 1994, p. 41) (see Table 3).

The Mekong River basin is another example of joint management and planning but with one major limitation—the Mekong Committee (1957) and its successor the Mekong Commission (1995) practice joint management only in the Lower Mekong Basin and the upper riparians, China and Myanmar, are not partners to these activities. This seriously hampered efforts to manage the river efficiently and equitably, for the benefit of all its riparians. The Mekong committee, which was established in 1957 by Cambodia, Laos, Thailand and Vietnam, was assisted, both technically and financially by the UN, UNDP, with aid from the USA, UK, Canada, France, and others (Savasdibutre, 1988). Its activities in the management of the river are of wide range: collection of basic data, flood control, assistance and planning of dams, fishing, navigation, and pollution control (Chomchai, 1986; Matics, 1995; Kirmani, 1990). The Mekong Commission, which was founded in 1995, had a more complex structure in which a political layer was superimposed on the two-tier Mekong Committee's structure, apparently to reinforce it. Also it was hoped that China and Myanmar, the two upstream riparians, would join the new body. China has completed the construction of the Man Wan Dam in Yunnan Province, and the Dachaoshan Dam is currently under construction (Jacobs, 1999). The Mekong Committee/Mekong River Commission has not fully implemented its initial vision of river basin development which included designs for several lower Mekong mainstream dams. The Committee's contributions include a flood forecasting and warning system, a network of hundreds of hydrological and meteorological stations, water balance studies, water quality monitoring, and salinity control structure for the Mekong delta (Jacobs, 1999).

The 1995 Agreement provides for the extension of the Commission to include China and Myanmar—the uppermost riparians, but does not include any mutually binding clauses concerning the use of the river's resources. The new commission has a dam building agenda which could potentially threaten the lower rice-growing regions, particularly Vietnam and Cambodia. The fact that China's water requirements are growing, in addition to the fact that it is not a member in the Mekong Commission and voted against the 1997 Convention, are all serious impediments to achieving sustainable cooperation in the Mekong Basin (Green Cross, 2000, p. 92).

The legal norms and customary law which emerge from the Mekong organizational framework are in line with the Harmon Doctrine of absolute sovereignty which is advocated by China, and the doctrine of limited territorial sovereignty supported by the Lower Mekong states. A specific principle of international law which was stressed by Mekong Committee was the equitable sharing of its resources (Chomchai, 1986, p. 5).

The Senegal River Authority (Organisation pour La Mise en valeur de Fleuve Sénégal or OMVS) which manages the Senegal river basin is a genuine active joint-management organization. The organization of the management of that river evolved under the French colonial rule and its main purpose was to regulate the river for navigation. Between 1934 and 1952 the structure in the Senegal called "MAS" collected data and proposed projects to harness the river. Since 1963 the Senegal has been managed by the OMVS in which Guinea, Mali, Mauritania and Senegal are members (Godana, 1985; OMVS, 1988). The OMVS was initiated and funded by 14 different donors—Arab Bank, African Development Fund, USAID, EEC, UNDP, the World

Bank and others. These agencies provided the technical aid and funding that secured the success of that organization (Le Marquand, 1986; Ibrahim, 1988). The influence of these foreign agencies is similar to the impact of such agencies in the development of the Indus Treaty and the Mekong Committee.

The OMVS, according to its convention, is a multipurpose organization with a comprehensive development policy which it has actually realized. The functions of the OMVS are navigation, promotion of irrigation and hydropower production and the authority to construct and operate joint projects (which it did). Unlike the Mekong basin, OMVS not only plans and formulates policies but also implements them. Its greatest success lay in its mobilization of \$700 million from the donors for its various projects. Also, greatly contributing to the implementation of OMVS projects is its structure, in which the political layer, represented by Government ministers, is the upper and decisive level in this organization. Another positive fact was that the political leaders of Senegal, Mali, and Mauritania (Guinea was not active in this body) were able to overcome their differences. The OMVS helped Senegal and Mauritania to negotiate the successful and conciliatory sharing of the resources of the Senegal after the 1988 conflict in which farmers and herders on both sides of the river fought over the same land and water resources (Green Cross, 2000, p. 84).

As for the customary law and legal norms there is no doubt that the OMVS convention epitomized the ideal of equitable and reasonable utilization of an international river basin as the Convention stipulated equal treatment for all users of the basin. It also stipulates that no projects likely to cause harm can be carried out without prior approval of the contracting states. The two dams constructed by the OMVS are owned jointly by the member states, as are the river seaports which OMVS has developed and maintained. However, as the case of the nearby river basin, the Niger, shows, a good organization is not always sufficient for successful functioning.

The cooperation in the Niger's basin has evolved since 1963 when seven out of the nine riparians signed the Act of Niamey. This agreement not only settled issues of navigation and transport but also the exploitation of the resources of the river basin for agricultural and industrial use. The structure of the Niger Basin Authority is similar to the one in the Senegal, and it also started to recruit NGO's and UN affiliated organs in order to obtain the financial support needed for its development plan. However, unlike the Senegal, it succeeded in amassing only \$30 million, plus substantial technical assistance, but this was not enough, and the organization's performance was poor (Rangeley, Thiam, Andersen, & Lyle, 1994).

The failure of the Niger Commission and its replacement, the Niger Authority, could be found in the composition of its seven member states. The structure was the same as in the Senegal basin: secretariat, technical committee of experts and the Council of Ministers. In 1980 this structure was transformed and an upper level of the Summit of Heads of State was added in order to improve the performance of that body but this step did not help. The main reason was the fact that only a few of the nine states really shared a common interest in the joint development of that basin (Rangeley et al., 1994; Ofosu-Amaah, 1990) (Table 3).

The final case study is the 1994 Danube Convention where the institution is still evolving, but it is planned as one in which basin-wide comprehensive planning and development will be practiced. The 1994 Convention (DPPC) is useful in that it established the essential administration and legal mechanisms for inter-regional cooperation and the definition of common goals for the

17 co-riparian countries. However, for the present, cooperation on the Danube River is largely confined to water quality monitoring and pollution control—and even this to a limited degree in some areas and Yugoslavia has been excluded from agreements since 1991 (Green Cross, 2000, p. 85).

Other examples of cooperation which follow principles of joint or integrated river basin management come from Asia and Africa. In 1996 India and Nepal signed a treaty for the integrated development of the Mahakali River. The Mahakali Treaty incorporated former agreements and provided for a new project—The Pancheshwar Multipurpose Project. The Treaty has provisions for water sharing projects for power generation, irrigation use, and flood control. The Agreement stipulates that the two countries will share equally the energy generated and share the cost in proportion to the benefits accruing to each (Green Cross, 2000, p. 45).

The Protocol on Shared Watercourse Systems of SADC which was signed in 1995 and ratified in 1998 refers to three international river basins: Zambezi, Limpopo and the Okavango. It calls for the establishment of River Basin Commissions in each basin, to collect and exchange data, monitor and research, and settle disputes. There is the intention to bring the Protocol in line with the UN 1997 Convention (Green Cross, 2000).

Comparative analysis of the above institutions for joint or integrated management of transboundary water resources points to some common features: both their territorial coverage and functional framework are broad (though not all-inclusive) and enable them to deal in an almost optimal manner with the shared water resources. In all the basins the customary law upheld is one of limited sovereignty. Their institutions explicitly reflect current accepted international laws, especially equitable utilization of water resources, prevention of harm, consultation and early notification, and consultation and comprehensive planning and development. Also prominent is the fact that in most of these institutions, external organizations and agencies played an important role in their success because they provided the necessary means for implementation (Mekong, Senegal). In the Niger, lack of funding partially explains its failing. Basin-wide comprehensive management is especially important in such cases when initial development of water resources is the case (Senegal, Niger) or when over-utilization of resources and their pollution (Mekong, Danube, Colorado and Rio Grande) necessitate the cooperation of all the basin-states. It is also interesting to note that joint-development is succeeding in both the developing and developed realms. Successful institutions often succeed or fail as a result of politics, especially the interests that the leaders of the respective partners show in cooperation. Organizations of international river basins which are perceived as serving a certain state's foreign policy aims will be supported by the respective governments and will succeed. However, cooperating in that sector is not easy, and the meager number of basin-wide joint development institutions testifies to that fact.

5. Conclusions

This paper presented three areas of research relevant to the institutions which manage or attempt to manage transborder water resources—legal foundations, structure and functions. In many parts of the world water scarcity, accompanied by rapid population growth, maldistribution

and over-utilization of those water resources transformed them into arenas of conflict. The institutions which govern international water resources reflect an evolution from the norms of customary law to their recent transformation as institutions which are governed by a more mandatory international law. The UN 1997 Convention may become a turning point in this respect. Though there is a long debate as to the nature of obligation associated with international law, most nations tend to uphold these norms, basically because it is in their interest to do it. Also, the practice of nations, in many cases, points to their adherence to some of the international law norms in which the most important ones are the duty of countries to cooperate, negotiate, consult each other, and notify each other before using shared water resources in a manner which may harm the use of these resources by co-riparians. Prohibition of water management practices likely to cause substantial injury to other states and the principle of equitable utilization of water resources are accepted today as guiding principles in managing common water resources. The survey of Wolf (1998) showed that states are more likely to find solutions to their water conflicts than to wage war over them.

These norms evolved in a lengthy process in which conflicts over the utilization of shared water resources were too frequent. As a matter of fact, some of the institutions discussed in this paper have evolved only after a long conflict and commit only a few of the riparians to these rivers—the Indus Treaty, the Treaty on the Farakka and the Jordan exemplify these cases. However, it should be remembered that institutions, preferably, basin-wide integrated development institutions, may prevent eventually acute conflicts as they regulate behavior in shared river basins. Institutions in which only a few of the riparians are involved (Nile, Mekong, Indus, Ganges, for example) may become useless in the future when non-member riparians demand their share in the common pool.

The case studies presented in this paper point to the danger of adopting institutions for only a portion of a river basin. Because of their hydrological nature, all parts of river basin have to be included in the institution because any activity in one part of it results in externalities or outcomes (positive or negative) in other parts of the basin. Treating the river basin as one unit may prevent harm to some riparians, and distribute benefits more equally among all of them. It is doubtful if narrowing the authority of these institutions to one function only (navigation, pollution, water allocation) is efficient and beneficial. Again, because of their nature, consumptive and non-consumptive uses of water resource affect each other. Therefore, dealing with one use and ignoring the other, greatly restricts the process of management. However, as joint management of water resources is always accompanied by restriction on sovereignty of state, many states are reluctant to enter into such obligations.

Though some aspects of river management are very old (navigation, hydropower) the negative effects of water utilization patterns, particularly their overuse for irrigation and pollution, however, become very severe in the last decade and adoption of efficient organization to treat these shared and vulnerable water resources is very urgent. River management institutions suffer mostly because they constitute a meeting-point between hydrology and politics—two incompatible areas. The former necessitates unity whereas the latter almost certainly means division and small particularized political sovereign cells. Perhaps the development of the institutions for management of shared water resources will follow the successful evolution of another institution—the Law of the Sea, which now serves as an inseparable part of the foreign policy and international behavior of states.

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