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BACHELOR THESIS

Political and development issue of transboundary water resources management

Štěpánka PECHÁČKOVÁ

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OLOMOUC, 2012

I declare in lieu of oath that I wrote this thesis myself. All information derived from the work of others has been acknowledged in the text and a list of references is given.

Olomouc, 2012 Signature

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Abstract

The aim of the thesis is to outline the issues of transboundary water resources management. It addresses the main stresses connected with transboundary water management and their relation to politics and development. There is a global water crisis going on and we are at risk of water conflicts. The thesis explores if shared waters can be rather a source of cooperation than of a conflict. It analyses the role of legal and institutional frameworks for water conflict prevention and resolution. The case study focuses on the area of the Indus River Basin and the dispute between India and Pakistan.

Keywords: water, transboundary water resources, international watercourses, development, international water law, institutions, water conflict, cooperation, the Indus River

Abstrakt

Cílem této práce je nastínit problematiku managementu přeshraničních vodních zdrojů. Zabývá se hlavními problémy managementu přeshraničních vodních zdrojů a jejich vztahem k politice a rozvoji. Situace vodních zdrojů je dnes velmi kritická. Čelíme riziku konfliktů o vodu. Práce se snaží zjistit, zda vodní zdroje mohou být spíše než zdrojem konfliktu výzvou ke spolupráci. Analyzuje, jako roli hrají právní a institucionální rámce v prevenci a řešení konfliktů o vodu. Případová studie se soustředí na spor mezi Indií a Pákistánem o povodí řeky Indus.

Klíčová slova: voda, přeshraniční vodní zdroje, mezinárodní vodní zdroje, rozvoj, mezinárodní vodní právo, instituce, konflikt o vodu, spolupráce, Indus

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List of abbreviations

CAS	Complex Adaptive System
ECOSOC	Economic and Social Council (of United Nations)
FAO	Food and Agriculture Organization
GMS	Greater Mekong Sub-region
GWP	Global Water Partnership
ICJ	International Court of Justice
IIL	International Institute of Law
ILA	International Law Association
ILC	International Law Commission
IWC	International Watercourse
IWLP	International Water Law Project
IWMI	International Water Management Institute
IWRM	Integrated Water Resources Management
IWT	Indus Water Treaty
J & K	Jammu and Kashmir
MRC	the Mekong River Commission
OECD	Organization for Economic Co-operation and Development
PCA	Permanent Court of Arbitration
PCCP	from Potential Conflict to Cooperation Potential
PIC	Permanent Indus Commission
QEC	Quadruple Economic Cooperation
SADC	South African Development Community
SIWI	Swedish International Water Management Institute
UN	United Nations
UN ESCAP	UN Economic and Social Commission for Asia and the Pacific
UNCED	United Nations Conference on Environment and Development
UNDP	United Nations Development Programme
UNEP	United Nations Environmental Programme
UNESCO	United Nations Educational, Scientific and Cultural Organization
USGS	United States Geological Survey
WHO	World Health Organization
WWAP	World Water Assessment Programme
WB	World Bank

1. Introduction

Water is a basis of life. Neither ecosystem, nor humankind could exist without it. No wonder that it has always been in the center of people's interests. Management of water resources roots deeply in the history of human civilization. Not only as the management in the sense of building water delivering systems but also in the sense of culture. Although water is so important for us it seems, we do not appreciate it enough. Great and still rising demand for water, its pollution and mismanagement along with the running climate change have made the world to face water scarcity. This global crisis brings about the increasing competition for scarce water resources and the risk of water conflicts.

Being part of all various processes and aspects in people's life, water connects us. Water is not a static resource though. It does not respect political or any other boundaries. Hydrological interdependence within countries is extended through international rivers, lakes and groundwater, linking different users in a one shared water system. Utilization of water resources in an upstream country has impact on the other downstream country. Management water resources itself is of complicated and conflictive nature. When the international boundaries are added, a conflict seems almost inevitable. The question is if water can be rather a cause of cooperation than of a conflict and how to manage water to be the former one.

One of the fundamental factors that can play role in the water conflict prevention and resolution is the sound and effective international legal framework and its institutional mechanisms. A lack of legal instruments and institutions exacerbates already a difficult situation in sharing freshwater resources. International water law has come from different sources, especially customary law, and developed various principles that govern the transboundary water management. The prevailing paradigm seems to slowly take a shift from the absolute sovereignty concept to creating a community of interests, from national water resources development to integrated, participatory river basin management.

The practice shows that the mere existence of the legal framework and its institutional mechanisms itself are not enough to guarantee the sustainable and peaceful management of transboundary waters. There have to be the will and the capacities to implement such management.

Transboundary water resources management is very complex area where plenty of interests compete and a lot of factors play role. There is much left to be researched and especially much to be done on the ground.

1.1. Aims and hypotheses

The aim of the thesis is to outline the issues of transboundary water resources management. It addresses the main stresses connected with transboundary water management and their relation to politics and development. It focuses on the area of the Indus River Basin and the dispute between India and Pakistan. The primary hypothesis that the paper tries to confirm are that:

a) There is a global water crisis going on and we are at risk of water conflicts.
b) Though, shared waters can be rather a source of cooperation than of a conflict.
c) The effective legal and institutional frameworks and their capacities are fundamental for water conflict prevention and resolution.

To identify contemporary situation of water resources management and an on-going global water crisis, we first need to define what water and water resources are and to characterize its properties. It is also vital to know the water's relationships with both the environment and the people. The latter is shown on the issues of water supply and demand, the water scarcity concept and the selected water-related indicators.

Before we link a water-related conflict to legal or institutional frameworks, we need to understand the existing system of international water law and its institutional mechanisms, including the most important international agreements in the field. After we analyze if the water can be source of a conflict or cooperation, we can identify the relationship between international law, institutions and a conflict over shared water resources, especially in the developing countries. Practical experience is shown in the case study that follows. It handles the contemporary state of transboundary water resources management in the dispute between India and Pakistan over the Indus River basin.

1. Water and water resources

Water is, whether a molecule or a compound, absolutely an essential condition for life as we know it. It has been an inseparable part of natural processes running on Earth and of the development of humanity. Water does not appear according to the laws and customs of the society but follows the laws of nature. On-going climate changes, ecological damage and the opposing needs of nature and humans can make water resource management a catalyst for conflict. When these factors encounter issues like transboundary waters, then conflict seems almost inevitable. Knowing water's characteristics and manifestations allows a better understanding how to manage water resources in a sustainable and peaceful manner.

2.1. Definition of (transboundary) water resources

A water resource is "any of the entire range of natural waters that occur on the Earth, regardless of their state (i.e., vapor, liquid, or solid) and that are of potential use to humans" (Britannica, 2012).

Transboundary water resources are then defined as surface or groundwater resources shaped by two or more countries (Kliot et al., 2001a, in Water Policy, 2001). Transboundary waters also "may be considered to be identical to ‚international watercourses', which have been defined in Article 2 of the *Convention on the Law of the Non-navigational Uses of International Watercourses* as follows:

'Watercourse' means a system of surface waters and groundwaters constituting by virtue of their physical relationship a unitary whole and normally flowing into a common terminus.

'International watercourse' means a watercourse, parts of which are situated in different States" (Jägerskog and Phillips, 2006).

However, the concept of water resources is multidimensional. It does not apply only to its physical criterion like hydrological or hydrogeological, but covers other qualitative, environmental and socio-economic dimensions (FAO, 2003). Thus, it is not easy to define comprehensively what a water resource is.

Jones (1996, p. 6) states that there are „three levels of water resource: (1) actual available resources, as currently used or 'developed'; (2) present potential resources, defined within the framework of available technology, … ; and (3) the future potential, which is to all practical purposes undefinable." The author also argues that water resources are

created by engineering – most of them are supplied through the centralized systems (Jones, 1996, p. 6).

Water resources also need to be understood within the context of the dynamics of the hydrological cycle. They are renewable and variable (WWAP, 2003, p. 8).

2.2. The world's transboundary water resources

The nations of the world are not only dependent on water but are interdependent through water, as a non-static resource. Hydrological interdependence within countries is extended by transboundary waters across national frontiers (see Table 2.1). Utilization of water resources in one country affects the other country (UNDP, 2006, p. 203 - 206).

Table 2.1: International river basins link many countries (UNDP, 2006, p. 206)

River Basin	Number of basin countries	Basin countries
Danube	19	Albania, Austria, Bosnia and Herzegovina, Bulgaria, Croatia, Czech Republic, Germany, Hungary, Italy, Macedonia, Moldova, Montenegro, Poland, Romania, Serbia, Slovakia, Slovenia, Switzerland, Ukraine
Congo	13 (+1)	Angola, Burundi, Cameroon, Central African Republic, Congo, Democratic Republic of the Congo, Gabon, Malawi, Rwanda, Sudan, Tanzania, Uganda, Zambia + South Sudan, after the partition of Sudan
Nile	11 (+1)	Burundi, Central African Republic, Democratic Republic of the Congo, Egypt, Eritrea, Ethiopia, Kenya, Rwanda, Sudan, Tanzania, Uganda + South Sudan, after the partition of Sudan
Niger	11	Algeria, Benin, Burkina Faso, Cameroon, Chad, Cote d'Ivoire, Guinea, Mali, Niger, Nigeria, Sierra Leone
Amazon	9	Bolivia, Brazil, Colombia, Ecuador, Guyana, Peru, Suriname, Venezuela and French Guiana
Rhine	9	Austria, Belgium, France, Germany, Italy, Liechtenstein, Luxembourg, Netherlands, Switzerland
Zambezi	9	Angola, Botswana, Democratic Republic of the Congo, Malawi, Mozambique, Namibia, Tanzania, Zambia, Zimbabwe
Lake Chad	8	Algeria, Cameroon, Central African Republic, Chad, Libya, Niger, Nigeria, Sudan
Aral Sea	8	Afghanistan, China, Kazakhstan, Kyrgyzstan, Pakistan, Tajikistan, Turkmenistan, Uzbekistan
Jordan	8	Egypt, Israel, Jordan, Lebanon, Occupied Palestinian Territories, Syria
Mekong	6	Cambodia, China, Lao People's Democratic Republic, Myanmar, Thailand, Viet Nam
Volta	6	Benin, Burkina Faso, Cote d'Ivoire, Ghana, Mali, Togo

Ganges-Brahmaputra-Meghna	6	Bangladesh, Bhutan, China, India, Myanmar, Nepal
Tigris-Euphrates	6	Iran, Iraq, Jordan, Saudi Arabia, Syria, Turkey
Tarim	5 (+1)	Afghanistan, China, Chinese control claimed by India, Kyrgyzstan, Pakistan, Tajikistan
Indus	5	Afghanistan, China, India, Nepal, Pakistan
Neman	5	Belarus, Latvia, Lithuania, Poland, Russia
Vistula	5	Belarus, Czech Republic, Poland, Slovakia, Ukraine
La Plata	5	Argentina, Bolivia, Brazil, Paraguay, Uruguay

There are 263 transboundary river basins. They represent about one half of earth's land surface and 40% of the world's population (see Figure 2.1). Approximately 300 shared aquifer systems lay under 15% of earth's land surface (Harlin and Morrison, 2009, p. 10).

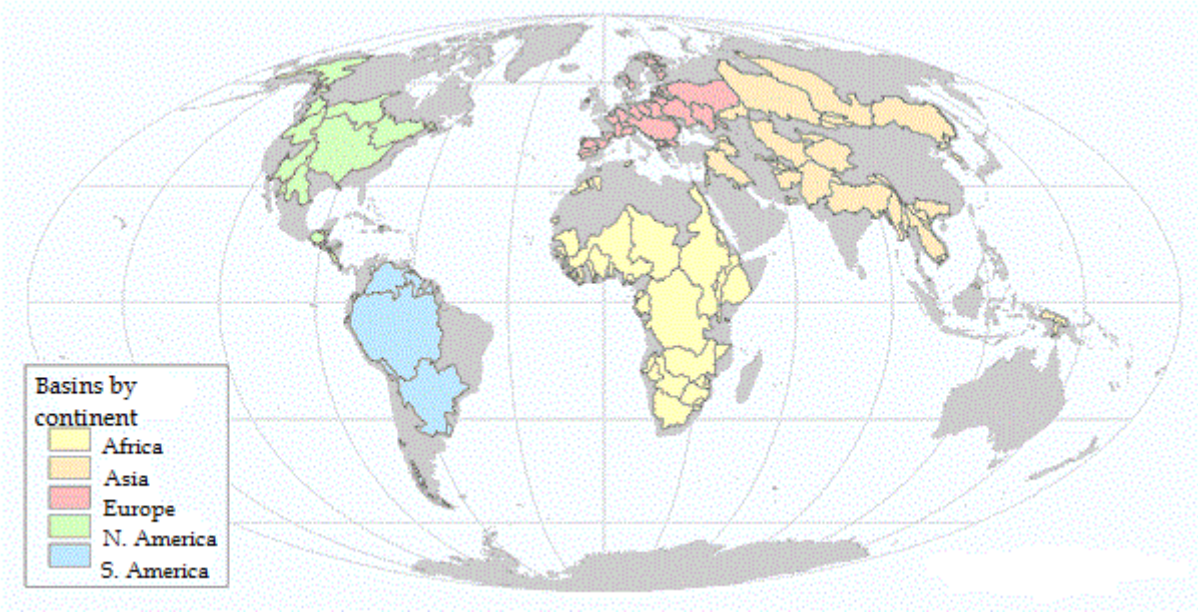


Figure 2.1: International river basins (Wolf et al., 1999)

The depth of the interdependence among countries is shown by the amount of countries which receive most of their water from outside their borders (UNDP, 2006, p. 203 – 206) or in so called *dependency ratio* (see Figure 2.2). It is „a good indicator of where tension and conflict over water-sharing and use can occur"(UNEP, 2008).

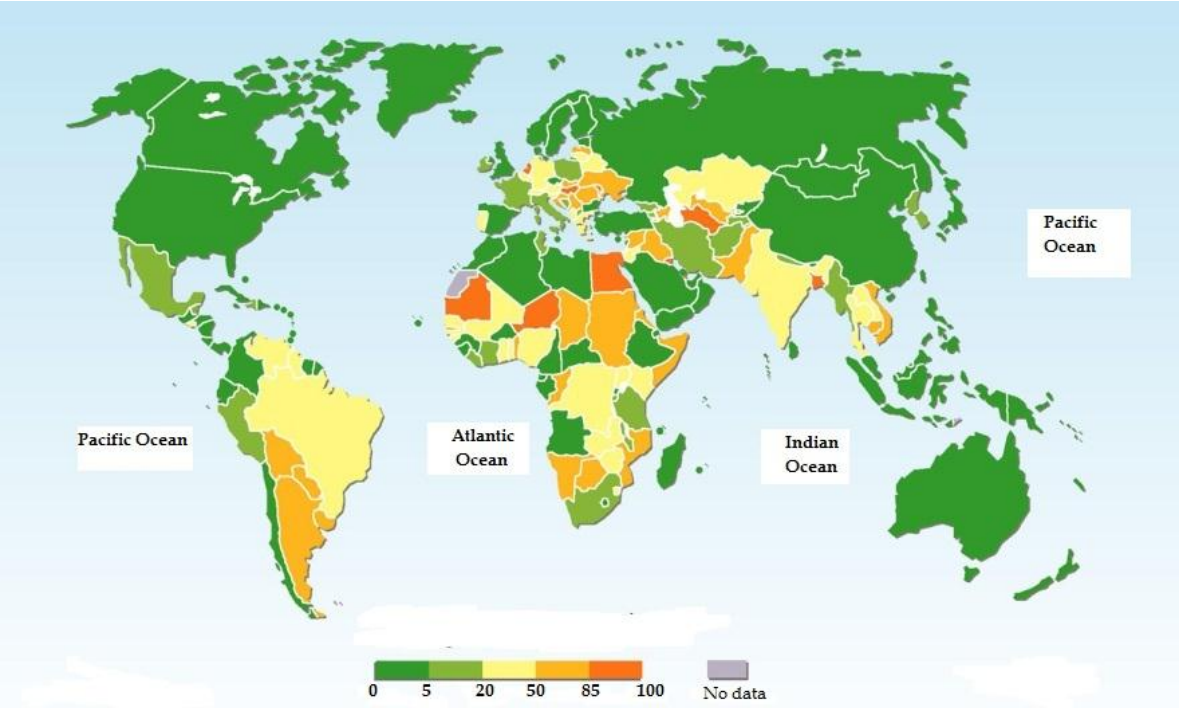


Figure 2.2: Percentage of total renewable water resources originating outside of the country, 1960 – 2007 (UNEP, 2008)

2.3. Water and the environment

The term water refers to two things: first, water as a chemical substance and second, water as a compound. It can be found in three forms – liquid, gas and solid. It acts in most planet's key processes. In geological and climatic processes, water co-shapes the Earth's surface or helps to create the greenhouse effect which enables conditions suitable for life on Earth (Pačes, 1982, p. 7 - 18). Due to its great chemical reactivity and solubility, water is also a medium for most biochemical reactions. "It is the most abundant component of any organism … It plays an essential role in the exchange of material between an organism and its environment" (Jones, 1996, p. 2). Among the hydrosphere, atmosphere, lithosphere and organisms there is a continual exchange of water which is called the Earth's natural metabolism (Pačes, 1982, p. 7 - 18).

Water is a fundamental component of the hydrosphere and is an irreplaceable part of all ecosystems (UNCED, 1992). Freshwater ecosystems are important as livelihoods; for water retention, for assimilating or diluting harmful substances and for maintaining biodiversity (UNDP et al., 2000).

The periodic circulation of water among oceans, land surfaces and the atmosphere creates a resource which is unlimited in global terms. This hydrological cycle is an ultimate recycling process and provides an entire supply of freshwater on Earth. It shares with solar radiation the role of a driving force in basic food production on land. As vapor, water creates the greenhouse effect and it is a major transporter of heat (Jones, 1996, p. 21).

The relationship between the water cycle and ecosystems has two interrelated implications for water management. First, to allocate water in a way so ecosystems can continue to deliver the level of benefits we need. Second, the ecosystems can be proactively managed in order to deliver what we need to meet water-related objectives, through ways such as conservation (WWAP, 2012, p. 27).

2.4. Water and people

People as living organisms need water or more precisely fresh water. Without water a person could survive only few days. Compared to other organisms that have depended on naturally provided water resources, people have been able to learn how to manage them. This ability has provided a suitable environment for the birth of civilization (Jones, 1996, p. 2). Water is central to the realization of human potential (UNDP, 2006). It is not only vital for body functions but also for social and human development.

2.4.1. *Water and human development*

As UNDP states (2011, p. 1), "human development is the expansion of people's freedoms and capabilities to lead lives that they value and have reason to value." It is about enlarging people's choices. The most essential choices are to have access to the resources needed for a decent standard of living, to lead a long and healthy life and to acquire knowledge (OECD, 2001). None of these can be possible without freshwater.

Water is the foundation for human development – for life in the household and for livelihoods through production (UNDP, 2006). Not only its quantity but also its quality matter. Health and human dignity are profoundly related to the quality of wa-

ter (UNDP, 2006). Clean water can improve health through better sanitation and hygiene (WWAP, 2009). However, over 1 billion people lack access to safe-drinking supplies and 2.6 billion people do not have adequate sanitation (WHO, 2002). Both poor quality and quantity of water can be the key factors in water related diseases. These are amongst the most common causes of illness and death (WWAP, 2003, p. 6). An estimated 3 million people die prematurely from water-related diseases every year in developing countries (WWAP 2009, p. 13). Furthermore, the issue of shared waters brings about the problem of pollution being carried from upstream to downstream countries, impacting human health and livelihoods (Harlin and Morrison, 2009, p. 10).

Water is also very closely related to poverty. No longer seen only as a lack of income, poverty is recognized to be a complex, multifaceted situation. The new approaches to poverty reduction include development of natural resources management such as water. One of the indicators of UNDP's Human Poverty Index is access to safe water (WWAP, 2003, p. 6). "Water contributes to poverty alleviation in many ways – through sanitation services, water supply, affordable food and enhanced resilience of poor communities faced with disease, climate shocks and environmental degradation"(WWAP, 2009, p. 83).

Water influences education. Access to schooling also is linked to improved access to safe drinking water and sanitation facilities in many settings (WWAP, 2009, p. 38). Future illiteracy and restricted choices menace girls who collect and carry water instead of going to school. The girls who can study often drop out because of inadequate water and sanitation in schools (UNDP, 2006, p. 22). Improved access to these, along with an increasing family income, enables households to pay school fees. Less absenteeism and better performance can be ensured by reducing occurrence of water- and sanitation-related diseases or by the simple separating of sanitation facilities (WWAP, 2009, p. 38).

The deprivation in water and sanitation preserves gender inequality and disempowers women. Millions of them experience the deprivation as a loss of dignity, a source of insecurity and time poverty. Although the women are responsible for the bulk of food production and for domestic water and sanitation, the men make most decisions affecting the communities (UNDP, 2006, p. 23). The well-planned water and sanitation schemes have been shown to be a good way of breaking this gender segregation, allowing women's empowerment (WWAP, 2003, p. 6).

Developments of the individual and of the society are interdependent. Individuals develop with the active support of the society and societies develop by the creative contributions of individuals (Macfarlane, 1999). The necessary behavioral changes can be adopted by individuals through communities. "Water is often an initial starting point for community initiatives, as the essential nature of the issues means they are widely understood. Many communities, once empowered in this way, continue to work together on subsequent initiatives"(WWAP, 2003, p. 6).

2.4.2. Water and economic development

Water and economy are indissolubly connected (Sanctuary and Tropp, 2005, p. 7). Proper water resources management boosts countries' economic growth. Improved economic integration between the riparian[1] countries can contribute to international trade and economic development (UN-Water, 2008, p. 3).

The costs of improving water supplies and – particularly - sanitation are much lower than its economic benefits (Sanctuary and Tropp, 2005, p. 4). Investment in management of water has been repaid also through livelihood security and reductions in health risks, vulnerability and ultimately poverty (WWAP, 2009, p. 81).

The major economic role of water lies in its relationship with agriculture (WWAP, 2003, p. 8). Water is needed in agriculture mainly for irrigation (Gleick, 2003) which safeguards one third of total food production (Clarke and King, 2004, p. 34). Every manufactured product uses water during a part of the production process. Industrial water use includes fabricating, processing, washing, diluting, cooling, or transporting a product (USGS, 2011). Access to markets as well as the generating of its own economy is created by water transportation in many countries. Power generation would also be impossible without water which is a cooling medium or a source of energy itself (WWAP, 2003, p. 8). Water affects the countries' economy both on microeconomic and macroeconomic levels.

Another economic role water has is as 'virtual water.' It is water used in a production process of an agricultural or industrial product, contained in the product (Allan, 1998, p. 545 - 46). When these commodities enter the market, trade in virtual water happens (de Fraiture et al., 2004: 1). The 'hidden flows' of water can be found in such trade. This is important in relation to the policies and strategies used in managing interna-

[1] A riparian state is a state in whose territory part of an international watercourse is situated (Dinar et al., 2007: 55).

tional water resources, especially in analyzing the real state of food security and of access to shared water resources between the riparian countries (Jäkerskog and Phillips, 2006, p. 18). Water-scarce countries could save water by importing water-intensive product, while water-rich countries could profit from their export (Zimmer and Renault, 2003). Though trade has water-saving potential, its impact might not be as important as it seems at the first sight (de Fraiture et al., 2004).

The economy is based on the individuals who produce goods and services – these individuals must have water for their living. Illness, malnourishment and treatment of water-related diseases have an enormous economic toll (World Savvy, 2009). Inadequate access to water and water supplies are the sources of time poverty. The time, energy and resources spent on collecting and carrying water, seeking privacy for defecation or looking after someone who has a water-related illness could very often be used on productive economic activity (WWAP, 2003, p. 8).

It is the poor who suffer most from these constraints. They have the lowest access to water and are most dependable on it. They are the ones who are most vulnerable to changing social and environmental conditions (WWAP, 2009, p. 84). As Human Development Report states (UNDP, 2006) access to water mirrors the distribution of wealth in many developing countries. It is not only income that matters though. It is policy that shapes the conversion of income into human development (WWAP, 2009, p. 84).

The principal drivers of growth and change come from outside the domain of water managers (WWAP, 2009, p. 81). "A country's overall development strategy and macroeconomic policies - including fiscal, monetary and trade policies - directly and indirectly affect demand and investment in water-related activities" (Sanctuary and Tropp, 2005, p. 7).

2.4.3. Water supply

The total amount of water presented in the hydrosphere is more or less constant (Pačes, 1982, p. 30). Currently, it is estimated to be approximately 1,386 billion km^3 (Shiklomanov, 1998, p. 4). Waters usable for humans which are freshwaters create only 2.5% of this sum. Of the 2.5% total amount, 1.3% is surface waters, 69% is found in glaciers and ice caps and 30% in groundwater (see Figure 2.3). Both surface waters and groundwater are often shared.

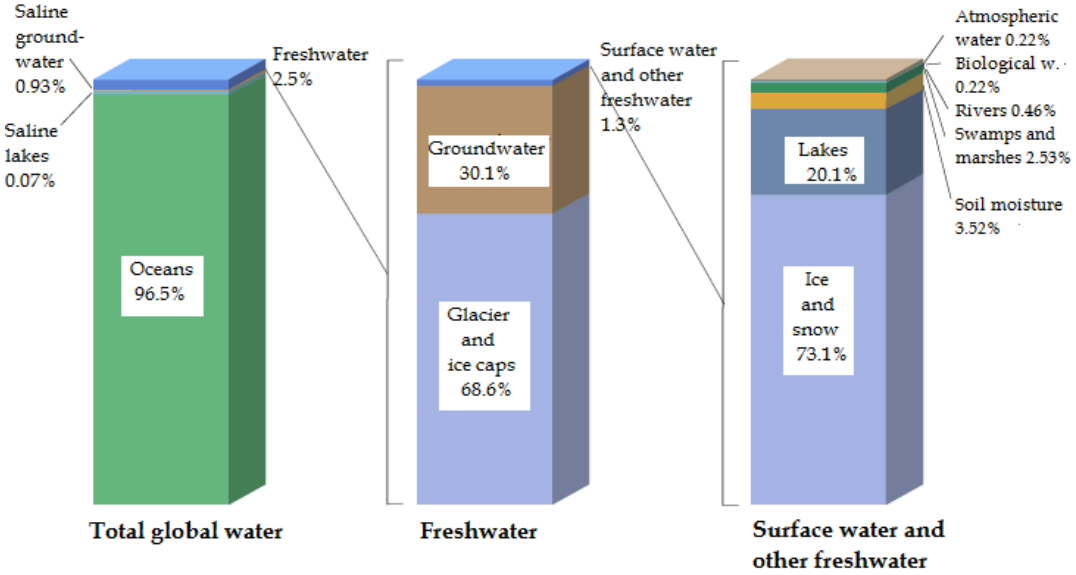


Figure 2.3: Distribution of Earth's water (USGS, 2011b)

Water resources can be used by people only in limited quantity (Netopil, 1981, p. 15). The most readily available for use are the waters of the rivers, lakes and other reservoirs (Shiklomanov, 1998, p. 4). According to ECOSOC (1997) less than 1% of global freshwaters is promptly accessible for direct human use.[2]

Water supply is not only limited by the amount of global freshwater resources, but also by its unequal distribution on the Earth. The hydrological cycle and climate conditions restrict how much freshwater is on the continents (Falkenmark, 2000, p. 75). The main source of water for people is runoff that comes from the water cycle's precipitation. There are wide variations in seasonal and annual precipitations in the different regions of the world (WWAP, 2003, p. 8). While the warmest areas like the Amazon's basin has annually more than 2,000mm of rainfall, some of the subtropical regions receive only about 200mm a year (Vysoudil, 1991, p. 18). Renewable water resources are variable in both space and time (WWAP, 2003, p. 8). Their quantity also varies during and between the years. "Even in parts of the world with large river flows, there can be a great amount of variability in terms of when and where the water is available" (ECOSOC, p. 1997). About 60 to 70% of the total runoff is the result of floods (Shiklomanov, 1998, p. 10). Moreover, a significant part of the world's accessible run-off occurs in areas far from human settlements, and it is very expensive to transport water over long distances (ECOSOC, 1997).

[2] „This is the water found in lakes, rivers, reservoirs and those underground sources that are shallow enough to be tapped at an affordable cost." (ECOSOC, 1997)

Another major factor in the availability of water is the rate of evapotranspiration. It is the loss of water from land to the atmosphere by evaporation from the soil and water surfaces, and transpiration from plants (ECOSOC, 1997).

As water is a renewable resource, its supply is ultimately confined by the average rate of renewal. Although it seems due to the hydrological cycle that supply of freshwater are limitless, it is only in global terms (Jones, 1996, p. 21). In local and regional terms, the amount of freshwater is constraint and uneven in time (Pimentel et al., 1998, p. 97). The average renewal rates are also different according to the form of water. Mountain glaciers and deep groundwater are renewed fully in about 1,500 years while rivers renew in 16 days. Then, the two kinds of water supplies can be defined: (1) static storage component and (2) renewable waters. The total amount of renewable water resources is estimated on the basis of average annual runoff (Shiklomanov, 1998, p. 6).

The size of the population is also a very important factor. It determines how much water is potentially available per person (see Figure 2.4) (ECOSOC, 1997). Today, it is difficult for a lot of developing countries to supply the minimum annual per capita water requirement of 1,700m^3 of drinking water necessary for active and healthy life for their people (WWAP, 2003, p. 11).

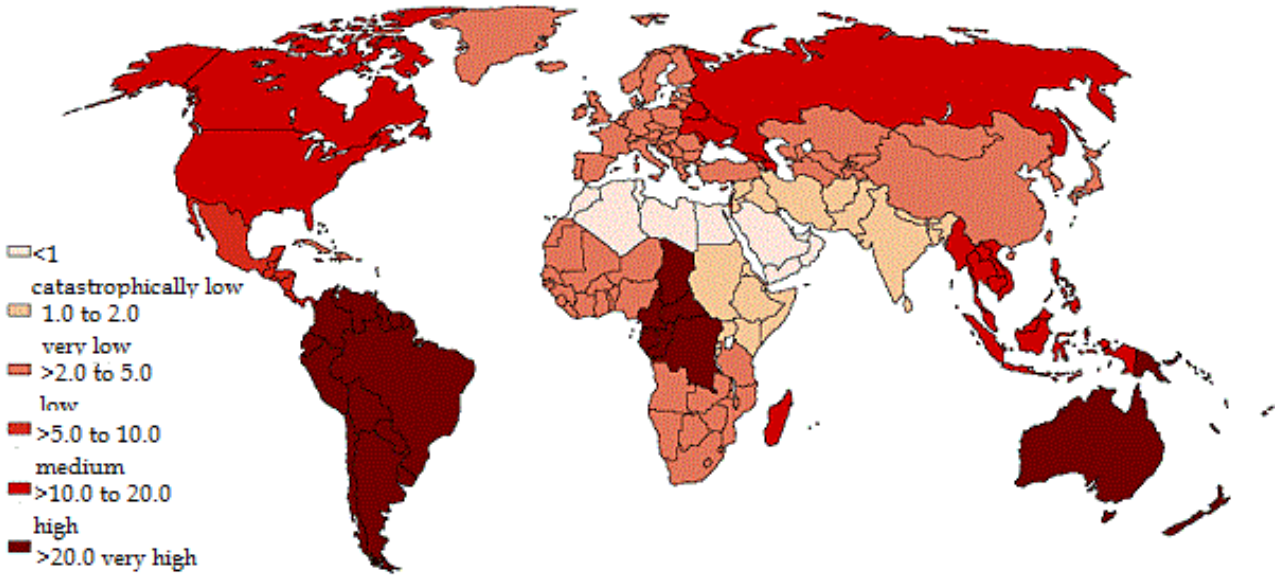


Figure 2.4: Water availability by sub-region in 2000 (1 000 m^3 per capita / year) (UNEP, 2002)

2.4.4. Needs for water

There is a difference between *demand* for water and *need* for water. *Demand* for water is an economic concept, meaning the amount of water requested or required by a user. It may have no relationship with the minimum amount of water actually *needed* to satisfy a particular requirement, i.e. *need* for water (Gleick, 2003, p. 278).

As Gleick (in Water International, 1996) points out, the amount of required water varies with an activity it is needed for and with climatic conditions, lifestyle, culture, tradition, diet, technology and wealth. An absolute minimum water requirement for humans can be defined only for maintaining human survival. The other minimum amounts for sanitation, hygiene, cooking and the kitchen range according to the level of economic development, use of technologies and the societal preferences (see Table 2.2).

Besides their basic needs, people seek water for goods and services, such as food production or transportation, and beyond – for recreation or for luxury goods (Gleick, 2003, p. 277). These can be called *wants* for water and are also dependent on the level of economic development and social customs.

2.4.5. Demands for water

Demand for water is rising. There are number of factors which drive the increase. Jones (1996, p. 8) names four fundamental ones: growing population, urbanization and the demands for greater production from agriculture, industry and wasteful practices.

World Water Development Report (WWAP, 2009, p. 25 - 75) describes the *external* factors that determine the evolution of the water system as 'water drivers.' They create pressure which influences the water use patterns (see Table 2.3 in Appendix 1). They are demographic, economic and social ones. The demographic drivers include population growth, age distribution, urbanization and the growth of informal human settlements and migration. The economic drivers are globalization, the global food and fuel crises and international trade, in particular virtual water trade. The social drivers consist of poverty, education, cultures, value systems, lifestyles and consumption patterns. There are many others pressures impacting water demand that could be considered such as technological innovation or climate change. They all result in a continuously increasing demand for water resources (WWAP, 2009, p. 28).

Table 2.2: Recommended basic water requirements for human needs (Gleick, 1996)[3]

Purpose	Minimum (liters per person per day)	Range (liters per person per day)
Drinking water	5	2 to 5
Sanitation services	20	0 to over 75
Bathing	15	5 to 70
Cooking and Kitchen	10	10 to 50
Total Recommended Basic Water Requirement	50	

2.4.6. Water use

The terms in the water literature are often confused. The common term *water use* can mean many different things, referring at times to consumptive use and at times to withdrawals of water. The amount of water removed from a source and used for human needs is usually called *withdrawal*. Some of it can be re-used, some of it can be used consumptively. Water *consumption*, or irrecoverable loss, typically refers to water withdrawn from a source and made unavailable for reuse in the same basin, such as through losses to evaporation or contamination (Gleick, 2003, p. 278). There is also *gross water use* which includes also recirculated water (Gleick, 1996, p. 84).

Our knowledge of water use is as poor as the knowledge of water resources. Information is largely incomplete and sometimes even missing. Data for water use are most sought after but often the least reliable (WWAP, 2009, p. 97). The estimated total global freshwater use is about 4,000 km^3 a year. Another 6,400 km^3 of rainwater is directly used in agriculture (WWAP, 2009, p. 97).[4]

"Water is used for many different purposes throughout our economies and natural ecosystems" (Gleick, 2003, p. 280). The most important user of water is nature – an estimated 70,000 km^3 of water is evaporated each year from forests, uncultivated vegeta-

[3] The calculations exclude water required to grow food. Drinking water minimum refers to a minimum to sustain life in moderate climate and with average activity level. The sanitation services minimum's upper end of the range represents extremely inefficient toilets. In water-scarce regions, sanitation services with no water use are available, but rarely embraced socially. The upper values of the minimum for bathing, cooking and kitchen represent social preferences for moderately industrialized countries. Some water-rich regions might exceed these amounts in water use. The lowest values are minimum uses in developing countries (Gleick, 1996, p. 88).

[4] This is only a partial picture of water use in sectors as there are many unaccounted-for uses. Little is known about water use in informal urban settlements or informal irrigation systems. There are also numerous on-stream uses (such as fishing or navigation). Such uses cannot be measured in volume terms, and they are therefore not reflected in statistics on water use (WWAP, 2009, p. 100).

tion and wetlands (WWAP, 2009, p. 97).[5] The biggest consumer of water is agriculture (see Figure 2.5), mainly for irrigation (Gleick, 2003). The consumptive uses in agriculture, industry and the domestic sector put the greatest pressure on natural systems, both in quantity and quality of water (WWAP, 2009, p. 98).

Water use varies across the sectors as well as the countries. It ranges from 646 km^3 a year in India to less than 0.03km^3 in some tropical African countries. The annual water withdrawals converted into per capita indicator range from 20 m^3 in Uganda to more than 5,000 m^3 in Turkmenistan (see Figure 2.6). Generally, the developing countries use most of their water for agriculture, while in Europe and North America withdrawals are related mostly to industry and energy (WWAP, 2009, p. 99 – 100).

Water withdrawals are predicted to increase by 50% by 2025 in developing countries, and 18% in developed countries (WWAP, 2006). Since designing and building water infrastructure take years and cost a lot, water planners need to take a relatively long view. The prediction studies that have been done often overestimate future water demand (Gleick, 2003, p. 293). Insufficient or inaccurate information and studies on water resources consequently influence their management and countries' policies.

[5] "Evaporation from human-made reservoirs is difficult to estimate but is considerable in arid areas and is estimated to be about 200 km^3 a year" (WWAP, 2009, p. 97).

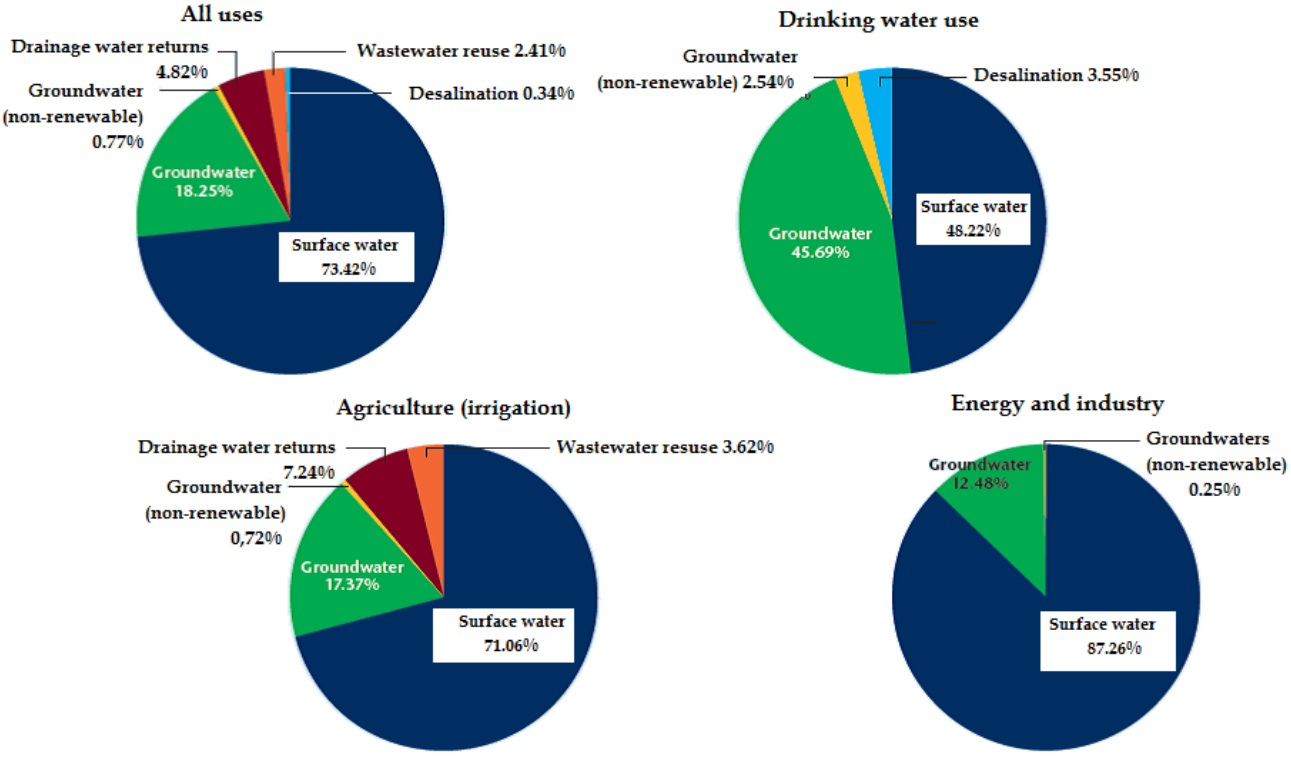


Figure 2.5: Sources of water use globally and for major sectors, 2000 (WWAP, 2009)

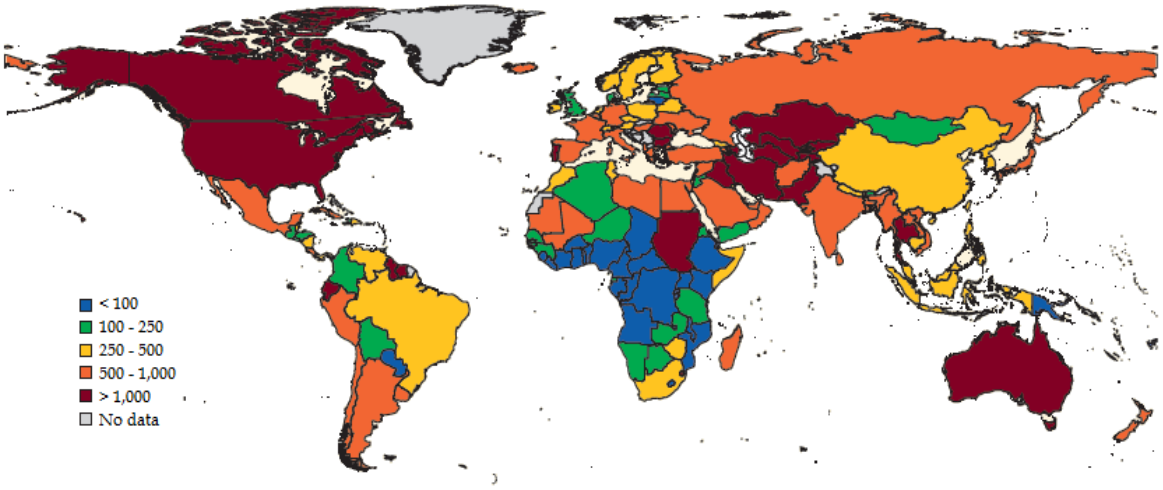


Figure 2.6: Annual water withdrawals per person by country, 2000, m³/year (WWAP, 2009, p. 99)

2.4.7. Water scarcity

The term water scarcity does not only mean there is not enough water for what we normally require. It is a multidimensional, relative concept. Its defining and understanding are difficult to make, but important for policy-making purposes (Rijsbermann, 2004; Winpenny). FAO and UN-Water (2007, p. 4) define water scarcity "as the point at which the aggregate impact of all users impinges on the supply or quality of water under prevailing institutional arrangements to the extent that the demand by all sectors, including the environment, cannot be satisfied fully." It may be a social construct - a product of affluence, expectations and customary behavior - or the consequence of changed supply patterns, stemming from climate change for instance.

It is difficult to determine whether water is truly scarce in the physical sense at a global scale (a supply problem) or whether it is available but should be used better (a demand problem) (Rijsbermann, 2004, p. 1). There can be *physical scarcity* and *economic scarcity*. *Economic scarcity* is caused by a lack of economic investment in water, e.g. a lack of infrastructure, or a lack of human capacity to satisfy water demand (Molden, 2007, p. 11; FAO, UN-Water, 2007, p. 4; WWAP, 2009, p. 167).

It is better to understand water scarcity at the local or regional level, within a river basin or sub-basin, rather than at the global level. There are both water-scarce and water-abundant areas in many countries, especially larger ones such as Brazil. Then there are naturally arid countries but with regular supply of perennial rivers flowing from wetter areas upstream, such as Egypt (FAO and UN-Water, 2007, p. 6).

The term *water scarcity* is commonly interchanged with the terms *water shortage* and *water stress*. Winpenny (W-2) explains that these terms differ:

A) *water shortage* is "a dearth, or absolute shortage; low levels of water supply relative to minimum levels necessary for basic needs."

B) *water stress* means "the symptoms of water scarcity or shortage, e.g. growing conflict between users and competition for water, declining standards of reliability and service, harvest failures and food insecurity."

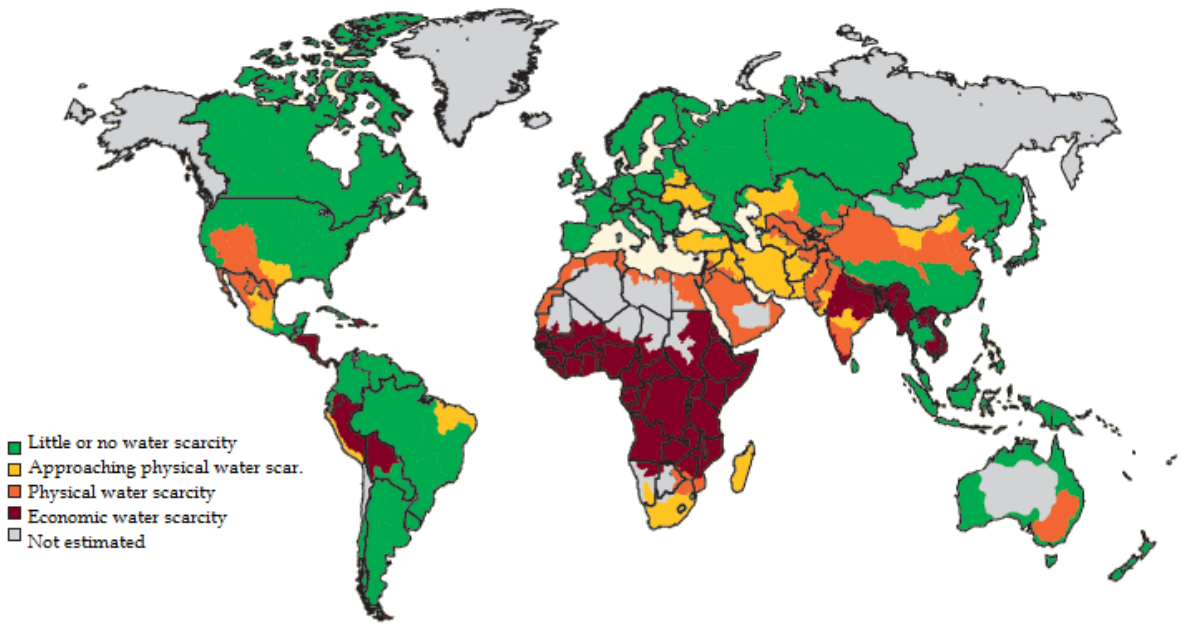
There are many indicators determining water scarcity. The most widely used one is *The Falkenmark Water Stress Indicator*. It proposes 1,700m^3 of renewable water resources per capita per year as the threshold. The areas who cannot sustain the amount are said to

be under *water stress*. When supply declines below 1,000m³ an area experiences *water scarcity*, and below 500m³ it faces *absolute scarcity* (Rijsbermann, 2004, p. 2).

The Comprehensive Assessment of Water Management in Agriculture (Molden, 2007) reveals that one in three people today face water shortages. Around 1.2 billion people live in an area with physical scarcity and 500 million are approaching the situation. Another 1.6 billion live in economic water scarcity.

Growing population, insufficient human and institutional capacity, inadequate investments and poor governance are the factors lying behind water scarcity. They are likely to multiply and become more complex in the near future (Molden, 2007, p. 10). Water scarcity increase competition for water and induces conflict not only between users, but also between countries and regions sharing water resources (FAO, UN-Water, 2007; Molden, 2007, p. 2).

Figure 2.7: Increasing water scarcity, 2000 (WWAP, 2009, p. 128)



3. The international (legal) framework for transboundary water management

Effective policies and legal frameworks are necessary for governance and protection of water resources (WWAP, 2009, p. 49). When there is a lack of adequate legal instruments, it exacerbates already a difficult situation. Chaos tends to dominate and power plays an excessive role, leading to an inequitable allocation of water (FAO, Un-Water, 2007, p.12).

3.1. International water law as a part of international law

International law is a normative system. It governs the relationships between sovereign countries; their rights and duties vis-à-vis each other to ensure peaceful relations (Vinogradov, 2003, p. 9; Dinar et al., 2007, p. 55). International law is a decentralized system, unlike domestic law. There is no clear division of executive, legislative and judicial power. There is neither an international legislature, per se, nor a court with compulsory jurisdiction, or authority, over countries (Dinar et al., 2007, p. 55 – 56). The consequences are a lack of normative clarity and enforceability, allowing countries to sometimes disregard the restrictions imposed by international law and to promote only their own interests.

The international watercourse law has always been connected to the development of the international law system. It determines a country's entitlement[6] to the benefits of the use of an international watercourse and establishes certain requirements for a country's behavior while developing the resource (Vinogradov, 2003, p. 2). It suffers from the same flaws as all international law – a lack of clarity and enforceability. There is a difference between universal acceptance, understanding of the governing principles of international water law and its understanding by a country and practical application (McIntyre, 2010, p. 61). The main sources of international (water) law are treaties and customary international law.[7] The other "sources" of law that influenced it contain general principles of law, judicial decisions, resolutions and recommendations of international organizations (Vinogradov, 2003, p. 12).

[6] Entitlement is a legal right to use the waters of a transboundary watercourse located in the territory of a riparian state (Vinogradov et al., 2003, p. 2).

[7] Customary international law comprises the unwritten rules of international law formed through the practice of countries that is engaged in out of a sense of legal obligation (Dinar et al., 2007, p. 55).

3.2. Sources of international water law

3.2.1. Customary international law

Customary international law is the primary source of several central obligations that are on countries in terms of transboundary water resources. First, the concept of "*equitable and reasonable" utilization* (see Chapter 4.3.3). Second, the responsibility *to avoid causing any significant harm* to the other riparian or the *"no harm"* rule (Vinogradov et al., 2003, p. 12; Dinar et al., 2007, p. 65). Third, *notification and consultation obligation regarding planned measures* – a country planning a new project that may affect other country's use of an international watercourse must provide timely advance notice of those plans to the other countries (UN Convention, 1997).

There have been attempts to codify the formulations. The first one dates back to 1911 when the Institute of International Law (IIL)[8] adopted *the Madrid Declaration on International Regulations regarding the Use of International Watercourses* (Vinogradov et al., 2003, p. 12). The IIL and other significant organizations have continued to produce drafts reflecting rules of the developing international custom in water law. These efforts include the IIL's 1961 *Salzburg* and 1979 *Athens Resolutions*, the International Law Association's (ILA)[9] 1966 *Helsinki Rules on the Uses of the Waters of International Rivers* and the 1994 International Law Commission's (ILC)[10] *Draft Articles on the Law of the Non-navigational Uses of International Watercourses* (Dinar et al., 2007, p. 63 – 64; Vinogradov et al., 2003, p. 12 – 13).

The ILL's three documents mainly emphasized the equality of the riparian countries' rights to utilize transboundary waters but under certain limitations imposed by international law. The 1966 Helsinki Rules were a more sustained and detailed attempt to develop systematically "a code of conduct." It was a comprehensive set of rules that codified and developed the law governing utilization of international watercourses (Vinogradov et al., 2003, p. 12 – 13).

Dinar et al. (2007, p. 64) remarks, "a mere review of the dates of these instruments shows the increasing frequency with which the subject has been treated by expert

[8] "A highly respected group of experts in the field of international law" (Dinar et al., 2007, p. 64)

[9] The ILA was founded in Brussels in 1873. Its objectives are "the study, clarification and development of international law, both public and private, and the furtherance of international understanding and respect for international law". It has consultative status as an international non-governmental organisation (ILA, 2008).

[10] The ILC was founded by the UN General Assembly. Its objective is „the promotion of the progressive development of international law and its codification" (UN, 1998 – 2012).

groups and…the international community. This growing attention in turn reflects the expanding importance of the law governing **shared freshwater resources** and the need to develop and clarify it to prevent disputes and promote cooperation."

3.2.2. Judicial decisions

International judicial decisions were particularly important for the evolution and clarification of the customary rules of international water law. The international tribunals were repeatedly asked to settle disputes over transboundary waters (Vinogradov et al., 2003, p. 13). The Permanent Court of International Justice and its successor ICJ, have dealt with these disputes. Some of the most important cases include the Meuse river dispute between Belgium and the Netherlands in 1920s or the Danube river dispute or the Gabčíkovo–Nagymaros case between the former Czechoslovakia and Hungary over a series of dams and barrages on the Danube which crosses the two countries' territories (Vinogradov et al., 2003, p. 13-14; IWLP, 2011).

A number of international arbitral decisions have also contributed to the evolution of international water law. The arbitrations consist of cases such as a dispute between France and Spain over the use of Lake Lanoux waters (Vinogradov et al., 2003, p. 13; McIntyre, 2010, p. 62), the San Juan River dispute between Costa Rica and Nicaragua and the Zarumilla River dispute between Ecuador and Peru over the demarcation of their respective common boundaries (Vinogradov et al., 2003, p. 13).

National judicial decisions can serve as models for the international conflicts resolutions or to identify applicable general law principles, although it is not a source of international law as such. This especially regards the decisions of the supreme courts in disputes within federal states. The US Supreme Court is one of the courts that have importantly influenced the articulation of some of the fundamental rules of water law (Vinogradov et al., 2003, p. 13; McIntyre, 2010, p. 59 – 64).

3.2.3. Treaties

International treaties have been a fundamental tool in cooperation between riparian countries as well as the main source for international water law.

They vary according to (see Chapter 4.5):

a) Parties to the agreement (bilateral/multilateral) (Vinogradov et al., p. 13 - 15; Dinar et al., 2007, p. 159- 160; Kliot and Shmueli, 2001b, p. 308)
b) Subject matter (data collection, allocation, planning, construction)

c) Territorial extent (the whole basin or parts of it)
d) Intensity of cooperation (from duty to inform to implementation of joint programs) (Kliot and Shmueli, 2001b, p. 308).

The freshwater treaties can be also classified as either *framework agreements* or *specific watercourse agreements*. The *framework agreements* "provide a general structure for states to follow in concluding treaties concerning specific watercourses." The example of such agreement is the 1966 Helsinki Rules. The *specific watercourse agreements* are the ones relating to a particular international watercourse (Dinar et al., 2007, p. 160).

Over 3,600 water-related treaties have been signed since AD 805 to 1984 (Hamner and Wolf, 1998). More than 400 of them concern shared freshwater resources (Dinar et al., 2007, p. 159). One of the most fundamental and the only global treaty in the field is the 1997 *UN Convention on the Law of the Non-Navigational Uses of International Watercourses* (the 1997 UN IWC Convention). It applies to uses of international watercourses and of their waters for purposes other than navigation. It also applies to measures of protection, preservation and management related to the uses of the IWC. It has not been in force yet because not enough countries have ratified it (Vinogradov et al., 2003, p. 14 - 15). The other essential treaty is *the 1966 Helsinki Rules.* It was the starting point for a lot of activities towards transboundary watercourses. In 2004, it was updated as *Berlin Rules on Water Resources* (Vollmer et al., 2009, p. 4).

The other important treaties include:

- The 1969 Treaty on the River Plata.
- The 1992 UN Economic Commission for Europe Convention on the Protection and Use of Transboundary Watercourses and International Lakes, concluded in Helsinki
- The 1992 Agreement on Cooperation in the Area of Joint Management, Utilization and Protection of Interstate Water Resources [in Central Asia].
- The 1994 Convention on Cooperation for the Protection and Sustainable Use of the Danube.
- The 1995 Agreement on Cooperation for the Sustainable Development of the Mekong River Basin.
- The 1998 Convention on the Protection of the Rhine.
- The 1995 Protocol on Shared Watercourse Systems in the Southern African Development Community (SADC)

- Revised Protocol on the Shared Watercourses in the SADC.

The majority of them deal with navigational questions (McIntyre, 2011; Biswas, 2008, p. 12; Hamner and Wolf, 1998). The treaties on non-navigational uses of international freshwater resources were not negotiated before 1814 (Hamner and Wolf, 1998).

The authors Hamner and Wolf (1998) analyzed over 145 treaties from The Transboundary Freshwater Dispute Database.[11] The authors argue that the preference for bilateral agreements may be due to the negotiation's paradigm that with the more parties involved, the more difficult it is to negotiate.

The primary focus of the treaties is on hydropower and water supplies – 57 of 145 (39%). The others address water for consumption (37%), flood control (9%), industrial uses, navigation and pollution. Although hydroelectric generation brings development and provide a cheap source of electricity to spur developing economies, it might be the decline of "the age of dams." There is not enough money for such demanding projects, not enough convenient places and there are serious environmental concerns.

About a half of the treaties have a provision for monitoring. Sharing information generally brings good will and can build confidence between co-riparians. However, some countries classify river flows as secrets or use the lack of mutually acceptable data as a stalling technique in their negotiations.

Only a few treaties allocate water – clearly defined allocations create only 37% of the agreements. The authors observed four key trends in treaties which specify water resources allocation:

a) Shift in position from rights-based approach to needs-based approach, i.e. from hydrological, geographical rights to factors such as irrigable land area or population.
b) The needs of the downstream countries, in disputes between an upstream and a downstream country, are more often delineated.
c) Economic benefits are not explicitly used in allocating water, although they helped to define some of the terms such as 'beneficial" uses
d) The uniqueness of each basin is repeatedly suggested in the treaty texts. The unique treaty elements devised by negotiators exemplify that.

[11] They analysed only those international watercourse agreements adopted after 1870 which deal with water per se, excluding those which deal only with boundaries, navigation or fishing rights (Hamner and Wolf, 1998).

The process does not end with adopting a treaty. Ratifying it means binding to carry out the actions agreed in a treaty. Implementation requires the existence of proper institutions, the compatibility of national laws with an agreement and popular participation, ensured by political and financial measures. A policy framework is also needed (WWAP, 2009, p. 49 – 60).

3.3. Groundwater in international law

Groundwater makes a great part of accessible freshwater resources that people use. Additionally, aquifers[12] provide ready availability of water for local users and an optimum storage place (Postel, 1999, p. 31). New technologies and the exponential growth in the demand for water of the last several decades have made groundwater a critical transnational resource (Dellapenna, 2001, p. 274). Despite the significance of its availability and the necessity of its management, it has not received such considerable attention as (international) surface waters. The management of international groundwater is in its infancy, both in general terms and terms of laws and institutional approaches (Salman, 1999; Dinar et al, 2007, p. 33; WWAP; 2003, p. 316).

There have been very little customary laws established and no legally binding law for sharing groundwater (Salman 1999; Dellapenna, 2001, p. 274 - 275; Matsumoto, 2002). Matsumoto (2002) reviewed more than 400 existing transboundary freshwater treaties: only 62 of them mentioned groundwater. Of these, the majority used ambiguous language and did not mention specific frameworks for groundwater resource management, such as allocations, management principles, and surface and groundwater interactions. Only nine treaties addressed a specific groundwater resource provision. The treaties also lack the concrete institutional arrangements for transboundary groundwater management. Although the UN IWC Convention's definition of international watercourses covers groundwater, it excludes "confined" groundwater, i.e. not related to an IWC (Vinogradov et al., 2003, p. 17). In 1989, Bellagio Draft Treaty attempted to provide legal framework for groundwater management (Hamner and Wolf, 1998). Nowadays, we can see a slow shift of attention to the transboundary groundwater issues. There are *the 2008 UN Resolution on the Law of Transboundary Aquifers* and *Resolution VIII.40, Guidelines for rendering the use of groundwater compatible with the conservation*

[12] Aquifer is "a subsurface water-bearing geologic formation from which significant quantities of water may be extracted" (Hayton and Utton, 1989, p. 678).

of wetlands, adopted by 8th meeting of the Conference of the Contracting Parties to the Convention on Wetlands (IWLP, 2011).

Groundwater management might be so underdeveloped because of the nature of the resource. Groundwater is often deep and uneven in geographical distribution, thus very problematic and expensive to be measured and classified. Another obstacle is its transboundary character. It may be difficult for countries to realize that they are not absolutely sovereign over the groundwater located within their territory but shared with another country in some way (Salman, 1999; Matsumoto, 2002). Groundwater needs prudent and specific management. It cannot be treated under the same (legal) regulations as surface waters - they are closely interlinked but different (Dellapenna, 2001, p. 274 – 275; Matsumoto, 2002; Dinar et al., 2007, p. 33 - 34).

3.4. Principles

Uses of international rivers and lakes for other than navigation pose not only legal complicated questions. The fundamental problem is in determining where one country's rights to shared water resources end and the other country's rights begin (Amer, 1997, p. 382). In other words, find a position between a country's utilization of international watercourses and the concept of territorial sovereignty as recognized and protected under general international law. There have been various principles invoked under general international law, governing the use of IWC (McIntyre, 2010, p. 60).

3.4.1. The theory of absolute territorial sovereignty

According to the theory, the country may use the river water which lies within its territory as necessary without regard for any other riparian country. It is called the "Harmon doctrine" after the US Attorney-General who first articulated the principle in 1895 (Amer, 1997, p. 382; McIntyre, 2010, p. 61). The theory has little support among commentators, in judicial, arbitral or country practice. Even though some countries like India or Chile referred to it, they have acted differently in their actual practices (McIntyre, 2011, p. 61). Such theory "has no place in today's interdependent, water-scarce world" (McCaffrey, 2001, p. 114).

3.4.2. The theory of absolute territorial integrity

It is the antithesis to the Harmon doctrine. It states that "the lower riparians have an absolute right to have the uninterrupted flow of the river from the territory of the upper riparian." A country may not use international waters in a way which would

alter any of its qualities or quantities in another riparian country (Amer, 1997, p. 382). The principle gives a downstream country a right of veto in any upstream country's action involving an international river or a lake. It is based upon sovereignty but it appears to have a basis in the equality of countries. Its roots lie in the riparian rights doctrines which had traditionally existed in national legal systems (McIntyre, 2010, p. 63). The theory was applied to resolve disputes between the members of a federal country (Amer, 1997, p. 382).

It would appear to be recognized in the moderate formulation in 1911 Madrid Declaration by ILL. "The states have always had serious reservations about this approach," even though some downstream countries invoke the approach (McIntyre, 2010, p. 63). This theory as well as the theory of absolute territorial sovereignty were invoked as "tools for advocacy" rather than as legal principles to assist in the resolution of a concrete dispute (McCaffrey, 2001, p. 129 - 130).

As Amer (1997, p. 382) says, between the Harmon doctrine and the theory of absolute territorial integrity "there are other concepts which are more pragmatic and which take into account the great importance of irrigation works and the generation of electricity for economic development."

3.4.3. The theory of limited territorial sovereignty

The theory is also called the principle of "equitable utilization" in the context of international watercourses. It is a compromise between the two previous theories. It entitles each co-basin country to an equitable and reasonable use of waters flowing through its territory (McIntyre, 2010, p. 64). Sovereignty is in this case relative and qualified. The co-riparians have reciprocal rights and duties (Caponera, 1992, p. 213).

The theory consists of the concept of a reasonable and equitable utilization. To determine the concept all relevant factors must be identified, considered together and a conclusion reached on the basis of the whole. The factors include the threshold of allowable harm, environmental needs, human needs and others (Vinogradov et al., 2003, p. 2 - 3). The concept is very vague to permit flexibility. The application always depends on the particular circumstances of each case.

It is the prevailing theory in international water law today. It originates in widespread country practice, international treaty law and decisions of municipal and other courts (McIntyre, 2010, p. 64 - 65). McCaffrey (2001, p. 145) reports, "no known international

decision supports a contrary rule." It has received consistent support in the case law of international tribunal such as in the Gabčikovo-Nagymaros case at the ICJ. It has also been recognized as an established principle of customary international law in all recent significant codifications of the area: the 1966 ILA's Helsinki Rules, the 1978 UNEP's Principles on Shared Water Resources and the 1997 UN IWC Convention.

3.4.4. The theory of common management / community of interests

The theory ignores national boundaries. The entire basin is regarded as an integrated whole and managed as an economic and geographic unit (McIntyre, 2010, p. 61; Amer, 1997, p. 383). A physical unity creates a legal unity leading to the formation of a community of interests (Caponera, 1992, p. 213).

To ensure such management, "the international machinery" has been established (see Chapter 4.5). Examples of common management institutional structures include the Danube commission or the Amazonian Cooperation Council and many more.

The theory is an *approach* to manage water problems rather than a *normative principle* of international law. In spite of being advocated by a lot of commentators, the approach "is not to be likely evolved into a requirement of general or customary international law." However, it is widely endorsed by the international codification bodies, including IIL or ILC. The Article 9 of *the 1992 UNECE's Convention on Protection and Use of Transboundary Watercourses and International Lakes* requires parties to "enter into bilateral or multilateral or other arrangements" (McIntyre, 2010, p. 59 – 71).

3.4.5. Integrated Water Resources Management (IWRM)

The common management approach, the interdependence of water and all areas of human society, interrelation of decisions at the international, national and local level were reflected in emerging of so called Integrated Water Resources Management (IWRM).

The Global Water Partnership (GWP, 2012) defines IWRM as *"a process which promotes the coordinated development and management of water, land and related resources to maximize the resultant economic and social welfare in an equitable manner without compromising the sustainability of vital ecosystems."* It fundamentally addresses the management of water demand as well as supply, considering integration in terms of the both natural and human systems (Cosgrove, 2003, p. 80 – 81).

It is the approach that international community seems to have adopted. In 2002, the World Summit on Sustainable Development in Johannesburg set for all countries the goal to develop IWRM. The Sixteenth Session of the Commission on Sustainable Development endorsed IWRM as a framework and an essential tool for effectively managing resources (WWAP, 2009, p. 242). The paradigm shift is taking place from national water resources development to integrated, participatory river basin management (Mostert, 2003a).

4. Water conflict or cooperation: The role of international institutions

4.1. Water: a cause for a conflict or cooperation?

There have been two views of the future of water resources, especially the international ones. The first says that there are going to be wars over scarce water resources, the second claims that the option of cooperation will prevail. Transboundary water resources can be a source both of a conflict or cooperation. Which direction an international watercourses-related issue will take depends on plenty of factors.

4.1.1. Definitions

The term "water conflict" is used very broadly and often not understood clearly as it is frequently interchanged with the term "dispute." The precise difference between the terms is not agreed and consistent even among international lawyers and in the international treaty practice. Not proper definition can have serious legal implications – in some cases the status of a dispute needs to be established before any means of dispute settlement can begin. The law dictionaries typically define the term "dispute" as a "conflict or controversy; a conflict of claims or rights" (Vinogradov et al., 2003, p. 25 – 26). [13] This paper uses the terms conflict and dispute interchangeably, referring to any

[13] We can distinct "justiciable" and "non-justiciable" conflicts, i.e. these which can be solved by principles and rules of international law and those that are unsuitable for adjudication. This does not mean that "non-justiciable" disputes cannot be solved by other means of peaceful settlement, including involvement of a third party. Visegradov et al. (2003, p. 26) also notice that not all the conflicts involved can be called "water disputes," for instance the conflicts where water is the "object." "It is doubtful whether intentional or inadvertent destruction of water supply facilities, dykes, or other water infrastructure during an armed conflict will make this conflict 'water related'." The same can be said about disputes over boundary rivers which do not regard the question of water utilization.

conflict of interests or views between two (or more) riparians over shared water resources.[14]

The intensity of water conflicts ranges broadly – from minor disagreements through serious tensions to open disputes and even armed conflicts. It is obvious that there is always going to be a certain degree of conflict. The main task is to manage the conflict, prevent the escalation, and promote mutually beneficial cooperation (Visegradov et al., 2003).

Cooperation's meanings can differ. It could mean that the parties' forces are joined in order to reach common goals. These are not obligatory for cooperation though. To prevent escalation, the compromise or a package deal formulated by the cooperating partners can be enough (Mostert, 2003b, p. 8 – 9).

4.1.2. The potential for conflict

A water-related conflict can arise not only between the countries, but also within a country. This paper, however, deals only with the international conflicts and disputes over transboundary water resources.

Water can play different roles in a conflict. It can be an *object* of a conflict when countries argue about scarce resources or water pollution. It can be also an *instrument* in a conflict. The example is when two countries are in conflict on some other issue but the (upstream) one extorts the other (downstream) country with manipulating of shared water resources. Water can be also a *catalyst* for international conflicts. A country's national instability can be evoked by inner water scarcity, leading to increase of international instability (Mostert, 2003b, p. 8 – 9).[15]

The potential for conflict arises from the various sources of a conflict. There is no single cause of a water-related conflict. Different authors state different causes, although sometimes only slightly different. UN ESCAP (2003) indicates five basic sources of conflict:

a) Relationship conflicts - poor communication, misperceptions, dueling egos, power struggle and other;

[14] This concept of a conflict corresponds with the definition the PCCP programme uses.

[15] Water scarcity and conflict are closely linked according to some part of international community. The increasing scarcity of freshwater resources might lead to national and international conflict. Any change of subnational, national or regional water regimes and property rights has inevitably an impact on the availability of water for different uses and competition over water among different user groups - which may lead to a conflict (Molen and Hildering, 2005).

b) Data conflicts - a lack of important information, contradictory information, misinformation or different 'frames';
c) Values conflicts - disagreement about what is right or wrong, just or unjust;
d) Structural conflicts - resulting from a situation that is set up in a way that conflict is built in, like unreasonable time or physical constraints or unequal power or authority;
e) Interest conflicts - substantive, procedural or psychological issues.

Mostert (2003b, p. 9) sees the potential for a water conflict through these three possible sources or aspects of conflict: conflicting goals (interests and/or fundamental values); bad relations and different perceptions of the relevant facts.

Gleick (1993) stresses that international water resources can serve as military and political goals or as instruments of war.

Vinogradov et al. (2003, p. 22) state, "Usually, problems arise where there is insufficient water to meet existing or new needs. A "conflict-of-uses" situation often arises where the quantity or quality of the water is such that competing demands of watercourse states clash with each other." The "conflict-of-uses scenarios include conflicts between existing uses; conflicts between existing and new uses (planned measures); those over future uses and a conflict as a result of emergency situations (Vinogradov et al., 2003, p. 22 – 25).

Wolf et al. (2003) have created a database of all reported events of either conflict or cooperation between nations over water resources during the last 50 years.[16] The analysis of indicators indicated that parameters commonly used to identify conflict, like climate, water stress and population, are only weakly linked to dispute.

The study suggest that *the institutional capacity* within a basin is as important, if not more so, than the physical aspects of a system. "The likelihood and intensity of dispute rises as the rate of change within a basin exceeds the institutional capacity to absorb that change."

The most significant indicators therefore could be extremely rapid changes in the institutional environment or in the physical river basin. The changes happen mostly in "in-

[16] The database contains the river basin, the involved countries, the scaled intensity of each event, the issue type and a summary of the event. A GIS was developed to be able to assess the historical setting in which each event of conflict/cooperation took place. It contains approximately 100 layers of biophysical, socio-economic and geopolitical spatial data.

ternationalized" basins - where "institutions were developed under a single jurisdiction, but are altered or shattered as the jurisdiction suddenly becomes divided among two or more countries or when major projects are planned in hostile and/or institutionless basins."

Landovsky (2006) assessed the institutional arrangements in transboundary river basins within the Complex Adaptive System (CAS) theory framework.[17] He concluded the institutions need to be *resilient* to change to ensure *sustainable* management of transboundary water resources, i.e. they are able to cope with *uncertainties* that ongoing global changes like climate change can bring and that are connected with assessment of sustainability.[18] The institutions are thus viable, not vulnerable.

4.1.3. The potential for cooperation

The same study also revealed that most of interactions between riparians were mild and cooperative. Water acts both as an irritant and a unifier. Nations cooperate in a wide variety of issues, while argue mostly over water quantity and infrastructure (Wolf et al., 2003).

The historic evidence tends to favor water as a catalyst for cooperation as shown by Hamner and Wolf (1998) in The Transboundary Freshwater Dispute Database. "Organized political bodies have signed 3,600 water-related treaties since AD 805 versus only seven minor international water-related skirmishes (each of which included other non-water issues). The only water-related war between states on record occurred about 4,500 years ago."

Wolf et al. (2003) conclude that international relations over freshwater resources are "overwhelmingly co-operative." Also Toset et al. (2000) reach a similar conclusion. Although the results of their study indicate that the low availability of water in both countries in the dyad is significantly related to disputes, they conclude that there is not sufficient evidence to claim that sharing a river provides a major source of armed conflict.

[17] The CAS theory or "complexity" theory "seeks to understand how order emerges in complex, non-linear systems such as galaxies, ecologies, markets, social systems and neural networks. Complexity scientists suggest that living systems migrate to a state of dynamic stability they call the ‚edge of chaos.' " Systems "on the edge" are "free enough to change, but stable enough to stay recognizable (Cleveland, 2005)

[18] Landovsky (2006, p. 6) uses definition of sustainable as something, a transboundary water institution for example, that is in steady state, i.e. that it performs according to a given set of rules.

4.2. International institutions and its mechanisms in conflict prevention and resolution

To implement joint management of transboundary watercourses and to ensure their sustainable and effective development, respective institutions and capacities for them are needed (WWAP, 2003; WWAP, 2009; Vinogradov et al., 2003; McIntyre, 2010; Landovsky, 2006, p. 3).

Many international codification bodies have recognized the essential role of institutions. In 1970s, the ILA's rules concerning *Administration of International Water Resources* and the Stockholm Conference's Recommendation 51 of *the Action Plan for the Human Environment* called for creation of international water administration. Also under the 1997 UN IWC Convention countries are encouraged to do so (McIntyre, 2010, p. 59 - 71; Vinogradov et al., 2003, p. 57 - 71).

The concept of institution is used with a variety of different meanings, sometimes not in a reference to the term "organization", sometimes almost synonymously to it. There are formal institutions, with written rules and policies, and informal ones, including cultural heritage and values or set of rules (Vollmer et al., 2009, p. 4; Landovsky, 2006, p. 3).

This paper works with the concept of a formal institution, as an organization, particularly at the international level: "bodies or organizations often shaped in the form of international commissions and committees, founded by formal and legal agreements such treaties for the management of transboundary water resources."

International watercourse joint bodies and commissions are the essential parts of many modern agreements relating to shared watercourses. They serve both as "permanent institutional mechanisms of interstate cooperation and, specifically, as important tools of identification of competing interests, thus preventing disputes over shared waters" (Vinogradov et al., 2003: 51).

Landovsky (2006, p. 4) points out, "water institutions are always a result of interactions between riparian states." According to Housen-Couriel (1994, p. 2), there are three requisites for an international institution to be established in a transboundary water resource:

a) Active support and long term commitment on the part of top level political leaders and representatives establishing such institution

b) Mobilization of the available expertise

c) A domestic governmental structure capable of effective international cooperation

After reaching the decision for establishing of an institution or a legal regime, key aspects have to be also decided:

a) Level of centralization /decentralization of the management institutions, especially according to a country's size (large countries need more decentralized structure).

b) Basin-wide planning – the institution should cover the whole basin

c) Multipurpose versus single purpose projects

d) Financing of institutions (Kliot et al., 2001b, p. 307 - 309).

The authors Kliot et al. (2001a) have examined the management systems of 12 transboundary river basins[19], represented by the legal regime of the studied rivers. They divided the various institutional arrangements and mechanisms, reflected in the governing treaties, into three "broad categories:" agreements by riparian countries stopping short of formal allocation; agreements allocating water between countries; agreements for joint communal management of internationally shared waters. They also tested the agreements as to the specific principles of international law which they advocate (see Appendix 2).

International river basins are systems of interactions and competing interests. "Water management is, by definition, conflict management. All water management is multiobjective and based on navigating competing interests." (Wolf, 2006).

"Although customary law does not require watercourse states to establish joint commissions, state practice demonstrates that the majority of international agreements, bilateral or multilateral, provide for such institutional mechanisms as means of treaty implementation and dispute prevention" (Vinogradov et al., 2003, p. 57).

"There is little immediate prospect of finding a way to give legitimacy to processes for decision making and management at the planetary level." The former *Subcommittee on Water Resources of the United Nations Agency Coordinating Committee* proved ineffective,

[19] The international river basins examined were: the Mekong, Indus, Ganges-Brahmaputra, the Nile, Jordan, Danube, Elbe, Rio Grande and Colorado, Rio de la Plata, Senegal and Niger.

being without no policy making power. In 2002 it was restructured as *UN-Water* that seems to address the previous weaknesses. Using their *World Water Assessment Programme*, it produces every three years the *World Water Development Report* (Cosgrove, 2003, p. 81).

„International organization in water management is as fragmented as its domestic counterpart. There are at least as many international agencies involved in the water and environment sectors as there are at the national level" (Cosgrove, 2003, p. 81). They range from the Meeting of the Parties, through the establishment of joint commissions (IJC in the 1909 Canada–United States Boundary Waters Treaty), to the establishment of specialized dispute settlement tribunals (e.g. the Tribunal set up in the 1995 SADC regime) (Vinogradov et al., 2003: 57). Recent estimates state over 100 international river commissions have been established (McCaffrey, 2001, p. 159).

The international community recognized the importance of proper conflict management over transboundary water resources. UNESCO developed the program called *From Potential for Conflict to Cooperation Potential* (PCCP) to "address the challenge of sharing water resources primarily from the point of view of governments, and to develop decision-making and conflict prevention tools for the future" (Cosgrove, 2003, p. 3). The institutions and its mechanisms play very important role in the PCCP cycle, as evidenced in the majority of country practice involving transboundary waters (Vinogradov et al., 2003, p. 20).

The PCCP cycle presents how potential conflicts over water are transformed into cooperation potential (see Figure 4.1). It has four identifiable phases (from a legal perspective): 1) The legal context (the rules of international law that apply to the conflict and its resolution); 2) From conflict to cooperation (the means used to transform the conflict into a cooperative agreement); 3) The agreement (the new legal framework); 4) Implementation (how the new agreement is implemented and how changing circumstances and potential new conflicts are being dealt with) (Vinogradov et. al., 2003, p. 2).

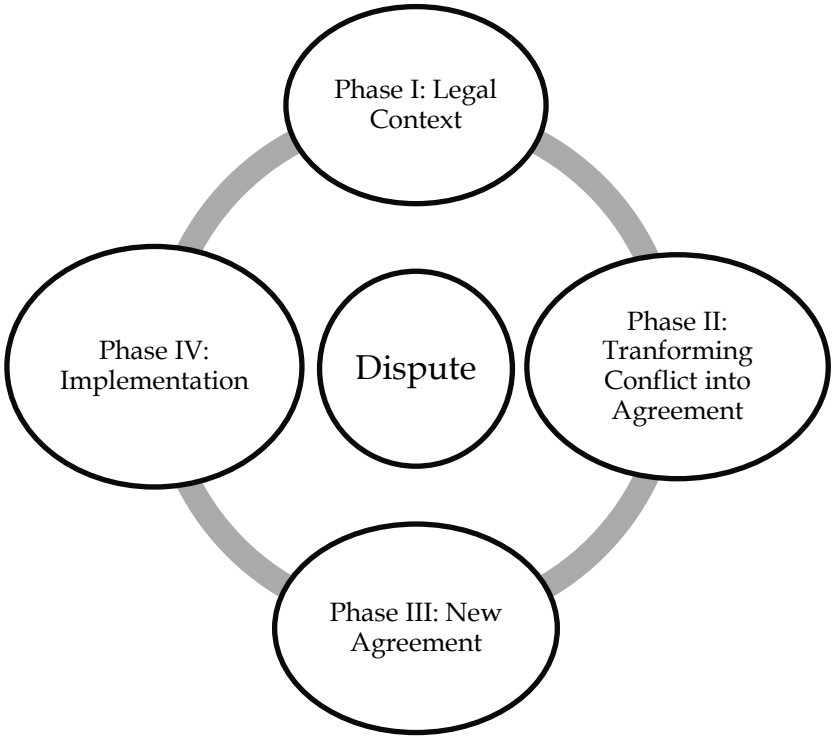


Figure 4.1: The PCCP cycle (UNESCO, 2005: 2)

A broad variety of institutional solutions can be and has been developed to prevent conflicts and stimulate co-operation (Newater, 2005). International law offers a series of means to resolve international disputes, both diplomatic - negotiations, consultation, good offices, mediation, fact-finding, inquiry, conciliation, and the use of joint bodies and institutions - and legal - arbitration and adjudication (Cosgrove, 2003, p. 25).

There is a distinction between the basin institutions in developed countries, such as the commissions for the Rhine and the Danube, and in the developing world, such as the Mekong Commission. The latter are more development-oriented, often focusing on evolving or managing infrastructure, such as dams for hydropower production or irrigation. The former are more protection-oriented, aiming on pollution control and nature issues (Mostert, 2003b).

In Africa, the management of main international river basins, through multilateral institutions, is stressed. The SADC adopted *the 1995 Protocol on Shared Watercourse Systems*, later replaced by *the 2000 SADC Revised Watercourses Protocol* (Vinogradov et al., 2003, p. 59, UNDP-GEF, 2011, p. 234). The watercourse protocol's primary goal is "to foster closer cooperation and to develop sustained and coordinated management of the shared watercourses" in the region (UNDP-GEF, 2011, p. 234). It created more numerous and powerful institutional mechanisms responsible for treaty implementation. The most senior body, *the Committee of Water Ministers*, should among other functions assist in a potential conflict resolution. Otherwise, the SADC Tribunal is supposed to settle the disputes (Vinogradov et al., 2003, p. 59).

Another example of a relatively successfully evolving multilateral institutional framework is a mechanism established on the Zambezi River system.[20] It consists of the *Zambezi Intergovernmental Monitoring and Coordinating Committee* and *Zambezi River Basin Coordinating Unit*. The first is an intergovernmental body, responsible for coordination and provision of operational and policy guidance. The second primarily implements the Action Plan. As it is both a river basin institution and a SADC unit, there is very close cooperation with relevant SADC institutions (Vinogradov et al., 2003, p. 59).

Other multilateral institutions were created for particular African river basins and watercourses like the Niger, Senegal, Okavango Rivers, Lake Victoria or Lake Chad (Vinogradov et al., p. 59; UNDP – GEF, 2011).

In Asia, one of the examples of the long-term disputes but also cooperation in transboundary water resources management is the Indus River case (see Chapter 7). Other is the Mekong River case.

The Mekong River Commission (MRC) governs the allocation and utilization of the Mekong River waters by four countries – Thailand, Cambodia, Vietnam, and Laos. It was established under the 1995 Agreement [21] (UNDP-GEF, 2011, p. 262; Vinogradov et al., 2003, p. 60 – 61). The MRC is composed of three permanent bodies: *the Council, the Joint Committee* and *the Secretariat*. Both the Council and the Joint Committee are empowered to dispute resolution (Vinogradov et al., 2003, p. 60 – 61; UNDP-GEF, 2011, p. 262 -

[20] The system was adopted and concluded by the five Zambezi basin states under *the 1987 Agreement on the Action Plan for the Environmentally Sound Management of the Common Zambezi River System* (Vinogradov et al., 2003).

[21] *The Agreement on the Cooperation for Sustainable Development of the Mekong River Basin* (UNDP – GEF, 2011).

263). The relationships among riparians on the Mekong River are very complex and competitive though. The agreement was "the result of more than 40 years of regional and supra-regional efforts to manage the resources of the Mekong River Delta." However, China and Myanmar, the upper Mekong river countries, have not signed the agreement (UNDP – GEF, 2011, p. 262 – 263). There are also other two river basin institutions - *Greater Mekong Sub-region* (GMS) and *Quadruple Economic Cooperation* (QEC)[22] – and international organizations such as UNDP involved (Landovsky, 2006, p. 4).

4.3. Challenges and risks

To recognize the challenges faced by international water institutions as a part of joint water resources management implementation, we need to understand the complexity of it. Landovsky (2006, p. 3 - 5) describes the three main characteristics of the management.

First, "transboundary water management depends on relations between riparians or stakeholders." The inter-connections between riparians and other relevant stakeholders are not simple or linear. The watershed cannot be understood only as "a sum of its components." The countries' attitude toward transboundary issue is a result of intricate political processes, as the countries form very complex systems.

Second, the relation between causes and effects in transboundary issues are non-linear. A small change in a watershed may cause a large effect or no effect at all, like the Thai the Khong Chi Moon project' water diversion can result in salinization of the Mekong delta which jeopardizes the Vietnamese rice production. The magnitude of these effects is almost unpredictable. History, in general, shows that many "inputs" created non-proportional "outputs", e.g. assassination of the successor to the Habsburg Throne started the First World War.

Third characteristic is prevailing uncertainty. When the uncertainty level is high, the academic and policy-making communities incline to search for panaceas (Rosenau, 1996. In: Landovsky, 2006, p. 5).

Vinogradov et al. (2003, p. 62) notice:

[22] MRC has four lower Mekong countries and QEC includes four upper Mekong countries, while Thailand and Laos are members of all three organizations at the same time. All six riparians are members of GMS (Landovsky, 2006, p. 4).

"There is no single model or approach to cooperation that would be appropriate for all or even most situations. This diversity is a major strength and is a consequence of the large variety of political and physical settings, various origins and mandates of the institutions, and the current and emerging problems they are required to address."

No matter which approach is chosen or what decision is agreed upon in an international context, all need to be implemented at the national, regional and local level. The decisions stand and fall with the capacities and the willingness to put them into practice at all levels involved (NeWater, 2005, p. 15; Vollmer et al. 2009, p. 4). The efficiency is therefore dependent on the legitimacy in the eyes of a number of different actors in the participating countries, like municipalities, stakeholders and citizens. The balance between different objectives needs to be found – politics in other issue areas can come into conflict with water management aims (NeWater, 2005, p. 15).

Kliot et al. (2001b) states other obstacles that stand in implementing joint management, which is "ideal for shared water resources but it's hard to achieve", are: questions of sovereignty, ownership of waterworks, jurisdiction, financing, scope of cooperation and others.

No water-related activities, including developing legal framework or establishing river basin organizations, can be developed and carry out without money. Even if all the necessary policies and laws are in place, lack of funding will stop necessary actions (WWAP, 2009, p. 56 – 67; UN-Water, 2008, p. 10; Harlin and Morrisson, 2009, p. 15).

Not all of joint watercourse bodies were able to successfully fulfil their functions, mostly because of inadequacy of available financial and other resources. The experience shows that their financial capacity must be guaranteed by the cooperating parties to undertake activities in a sustainable manner (Vinogradov et al., 2003, p. 60). "Often institutions' success or failure will solely depend on their ability to obtain international funding" (Kliot et al., 2001b, p. 309). The experience of the Nile Basin Initiative is the instance of how the involvement and substantial international financial support (e.g. of the World Bank) is important (Vinogradov et al., 2003, p. 60).

There are many other external factors that affect management of the water environment. The areas of law, not directly addressing the water issues but influencing it, include land use planning, environmental assessment, nature conservation and environmental law. Public health laws impact the supply of water and sanitation. So does land tenure reform. Individuals are not willing to invest in sanitation where there is no

security of tenure, nor will water companies pose pipes to such land. Legal provisions on freedom of information and access to justice, human rights and other constitutional measures are also important parts of a governance framework (WWAP, 2009, p. 49 – 60).

As Vinogradov et al. (2005, p. 62) state: "Although there is no blueprint for a successful legal framework for cooperation, well-drafted and unambiguous legal instruments are essential in creating effective and sustainable institutional frameworks." Changes within a basin can lead to a conflict in the absence of institutions. Though, "institutional capacity together with shared interests and human creativity seem to ameliorate water's conflict-inducing characteristics." The international community has a choice – between traditional unilateral actions leading to a crisis or getting ahead of the crisis curve through crisis prevention, preventive diplomacy and institutional capacity building (WWAP, 2003, p. 314). In other words, the choice lies between choosing water to be a cause for conflict or cooperation.

5. Case study: The Indus River basin

The Indus River basin, one of the most densely populated and agriculturally productive regions in the world, has experienced many profound changes in the last 60 years (Thatte, 2008, p. 165) The Indus River basin has always been essential in the evolution of Indo-Pakistani relations. It has been vital for the countries' actual existence. It delivers indispensable water for irrigation in not only textile industry that drives the countries' economies but also in agriculture, providing food for the constantly growing population (Wheeler, 2011). The needs of the two nations have clashed and a dispute has arisen.

5.1. The Indus River System

The Indus and its upper tributaries dominate the north-western part of the Indian subcontinent. The Indus springs from Himalaya, near Lake Manasarovar at Mt. Kailash, and flows into the Arabian Sea, going through Tibet, India and Pakistan; including Pakistan occupied Kashmir (see Table 7.1). Its flow is fed by Himalayan glacier waters in Tibet, Karakoram and Zanskar ranges (Sridhar, 2005). One of them is the Siachen glacier that is an object of an armed conflict between India and Pakistan.

Table 7.2: Features of the Indus watershed (Wolf and Newton, 2008)

	Watershed features					
Name	**Riparian countries** (with % of national available water being utilized)	**Riparian relations** (with dates of most recent agreements)	**Average annual flow** (km^3/year)	**Size** (km^2)	**Climate**	**Special features**
Indus	Afghanistan (47.7), China (19.3), Chinese control, claimed by India (n/a), India (57.1), Indian control, claimed by China (n/a), Nepal (n/a), Pakistan (53.8)	Cool (1960 Indus Water Treaty between India and Pakistan)	238	1,138,800	Dry to humid sub-tropical	Scheduled as case to be "back-modeled"

The tributaries (see Figure 7.1.) concerned in the Indo-Pakistani dispute are "eastern rivers" – the Ravi, Beas and Sutlej – and "western rivers" – the Jhelum and Chenab. Indus itself is referred as "western river" (Wolf and Newton, 2008).[23]

Ravi rises in the Indian state of Himachal Pradesh. There is Thien Dam (Ranjit Sagar Dam) at the tri-section of Punjab, Himachal Pradesh and Jammu and Kashmir (J & K). It supplies irrigation in North-western Punjab. Beas also rises in Himachal Pradesh. There is Pandoh Dam on it, diverting water to Sutlej. Sutlej is the longest one of the tributaries and originates near Mt. Kailash along with the Indus. There three important headworks – one of them is Husseiniwala headworks whose closure in May, 1948 "triggered the water crisis that prompted the IWT". There is huge Bhakra Dam on the river. Jhelum is fed by the Kishenganga River and other tributaries, flowing through major cities such as Srinagar. Chenab springs from Kulu and Kangra districts of Himachal Pradesh. After leaving J & K, it enters Pakistan that built the Marala barrage across the river. The original infrastructure built by the British to harness and distribute the waters of these tributaries has been augmented with construction of dams since independence by both India and Pakistan (see Figure 7.2) (Sridhar, 2005).

[23] Other tributaries include the Swat, Kurram, Gomal, Kohat, Zoab and Kabul (Sridhar, 2005).

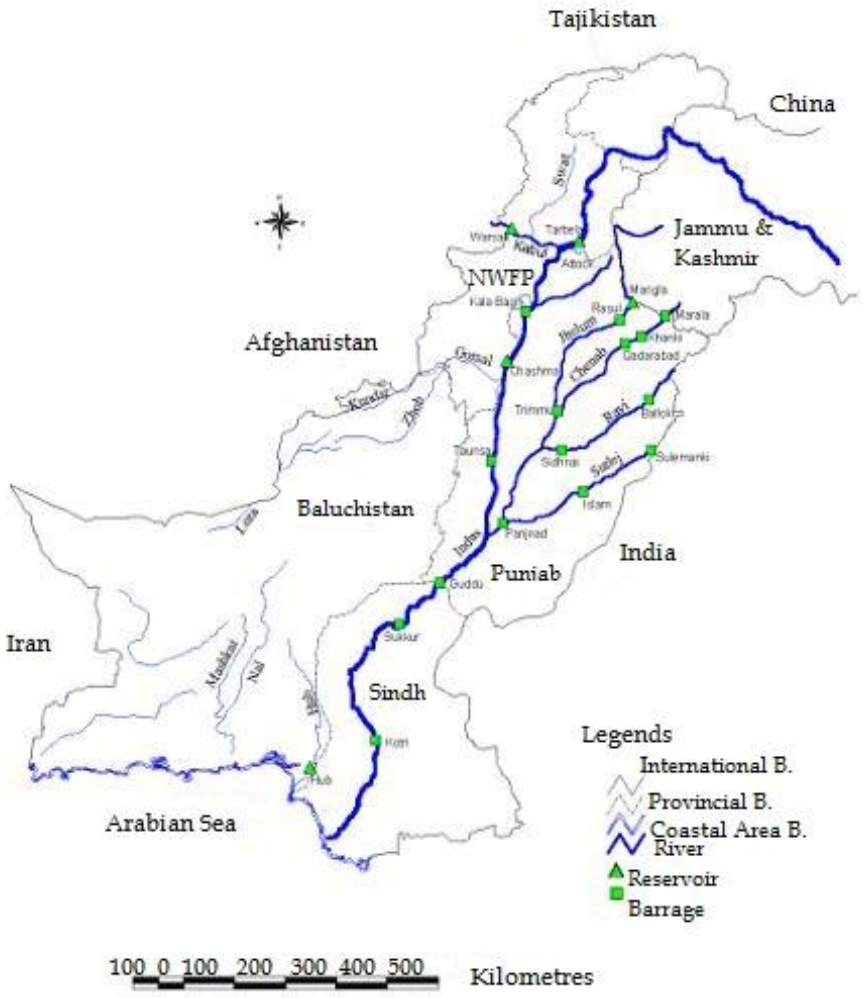


Figure 7.1: The Indus River Basin (Sridhar, 2005)

Figure 7.2: Major tributaries and dams on the Indus River (Sridhar, 2005)

5.1. History of the conflict

5.1.1. Pre-independence time

Irrigation in the Indus River basin dates back centuries. The British colonial rule picked up on prior work of the Mughals and developed it further. By the late 1940s the irrigation works along the river were the most extensive in the world (Wolf and Newton, 2008; Varis et al., 2008). The British rule represented one political authority and any water conflict could be resolved by executive order. Later, when the water management was put under provincial jurisdiction, the disputes appeared (Wolf and Newton, 2008). There were differences between provinces of Bahawalpur, Bikaner, Punjab and Sindh. The disputes were attempted to solve through different independent commissions (Salman and Uprety, 2002, p. 38 – 42). The Indus Commission, appointed in 1941 to resolve the dispute between Punjab and Sindh over water allocation and building dams on the Sutlej River, did not succeed. Bothe provinces found its findings inacceptable and referred the dispute to London.

When India and Pakistan became independent in 1947, the conflict became international (Wolf and Newton, 2008; Salman and Uprety, 2002, p. 38 – 42). The political boundaries divided the Indus basin, making India an upstream country and Pakistan a downstream one. The partition was completed in only 73 days, and did not deal with the water management issues. The Indian province East Punjab, having the two important irrigation headworks of the Ravi and Sutlej rivers on its territory, was able to cut off vital water supplies for the West Punjab province in Pakistan[24] (Salman and Uprety, 2002, p. 38 - 42). Further complicating the issue, the violent conflict between India and Pakistan over the region of Kashmir broke out (Sridhar, 2005). Heightened political tensions, population displacements and unresolved territorial issues served to exacerbate the water dispute (Wolf and Newton, 2008).

5.1.2. Post-independence time

"To remedy the legal vacuum created by the partition" (Salman and Uprety, 2002, p. 42), the chief engineers of Pakistan and India signed a "Standstill Agreement" in 1947, which froze water allocations at two points on the river until March 31, 1948, allowing discharges from headworks in India to continue to flow into Pakistan (Wolf and Newton, 2008; Salman and Uprety, 2002, p. 42).

[24] East Punjab and West Punjab were allocated respectively to India and Pakistan in 1947. The partition divided the Punjab into Indian Punjab and Pakistani Punjab (Gill, 2010).

After expiration of the "Standstill Agreement" and in the absence of a new agreement, on April 1st 1948 India discontinued the delivery of water to the Dipalpur Canal and the main branches of the Upper Bari Daab Canal (Wolf and Newton, 2008; Salman and Uprety, 2002, p. 42). It is not clear why India acted so. Wolf and Newton (2008) states, that there might have been several motives:

"The first is legalistic-that of an upper riparian establishing its sovereign water rights. Others include an Indian maneuver to pressure Pakistan on the volatile Kashmir issue, to demonstrate Pakistan's dependence on India in the hope of forcing reconciliation, or to retaliate against a Pakistani levy of an export duty on raw jute leaving East Bengal. Another interpretation is that the action was taken by the provincial government of East Punjab, without the approval of the central government."

In the 1950s both countries tried to negotiate a settlement but failed until the World Bank was involved and the 1960 Indus Water Treaty (IWC) was signed.

5.2. The Indus Water Treaty

5.2.1. Negotiations

Pakistan The resumption of water delivery to Pakistan from India was discussed at an Inter-Dominican Conference held in Delhi in May 1948. India agreed the resumption but wanted Pakistan to recognize Indian rights over shared waters, particularly over "eastern rivers." India also claimed that by agreeing to pay for water under the Stand-still Agreement of 1947, Pakistan did approve them. Pakistan countered that they had the rights of prior appropriation and the payments were only to cover operation and maintenance costs (Wolf and Newton, 2008; Salman and Uprety, 2002, p. 43).

The new "Delhi Agreement" was signed. Both parties recognized "the necessity to resolve the issue in the spirit of goodwill and friendship" and East Punjab assured West Punjab that it would not suddenly withdraw the supply of water without allowing Pakistani party to develop alternate resources. The agreement "could not stay intact for long" though and the issue on its interpretation made the dispute to continue (Salman and Uprety, 2002, p. 43 - 44). Pakistan wanted "equitable apportionment of all common waters" (Wolf and Newton, 2008). In 1950, Pakistan formally denounced the agreement and suggested that the issue should be submitted to the ICJ or the UN Security Council. India, however, rejected third-party involvement, insisting on the Delhi Agreement (Salman and Uprety, 2002, p. 44).

The stalemate lasted until the visit of David Lilienthal, former Chairman of the Tennessee Valley Authority and of the United States Atomic Energy Commission. He wrote the series of articles, recommending the joint management of the Indus basin[25] and funding of the World Bank (WB).

5.2.2. The role of an international organizations

The then president Eugene Black of the WB followed the Lilienthal's recommendations and offered the parties good offices. Both countries accepted it (Salman and Uprety, 2002, p. 45; Cosgrove, 2003, p. 38).

Good offices are one of the examples of a conflict resolution. "A third party offering good offices to the conflicting states acts as a 'go-between' in order to persuade them to enter into negotiations." The role of the WB, however, "gradually extended to a more dynamic, and in many respects decisive, involvement in the resolution of the dispute" (Cosgrove, 2003, p. 38). Biswas (2008, p. 9- 10) describes the dispute as „the most noteworthy and successful case where an international organization played a very critical role as a catalyst and a facilitator to get the co-basin countries to agree to a treaty." The Bank was a proper and impartial "honest broker." It facilitated the agreement with an offer of financing new water development projects on the assumption that the parties will reach a settlement, which proved as a very attractive incentive for both parties concerned (Cosgrove, 2003, p. 39). When negotiations were likely to reach a stalemate due to clashing requirements of both parties, the WB issued its own proposal.[26] It abandoned the strategy of an ideal goal of integrated development in favor of one of separation (see Table 7.2). The latter seemed to be too elusive at then stage of political relations (Wolf and Newton, 2008).

[25] This example shows that the joint management model is not something new to international law. It has been used e.g. in the petroleum sector (Joseph, 2011).

[26] This active strategy was attempted with the riparians of the Jordan River watershed in conjunction with the multilateral working group on water (Wolf and Newton, 2008).

Table 7.2: Water allocations from Indus negotiations, MAF / year (Wolf and Newton, 2008)[27]

Plan	India	Pakistan
Initial Indian	29	90
Initial Pakistani	15.5	102.5
Revised Indian	All of the eastern rivers and 7% of the western rivers	None of the eastern rivers and 93% of the western rivers
Revised Pakistani	30% of the eastern rivers and none of the western rivers	70% of the eastern rivers and all of the western rivers
World Bank Proposal	Entire flow of the eastern rivers	Entire flow of the western rivers

Water was divided from other controversies between India and Pakistan. This allowed negotiations to continue. Water problems were to be viewed as "functional" rather than political (Wolf and Newton, 2008).

The WB's role in the dispute provides a good example of how the lines among good offices, mediation and conciliation are sometimes blurred (Cosgrove, 2003, p. 39). The Black's and the WB's leadership and involvement after the series of meetings and negotiations lead to adoption of the Indus Water Treaty on September 19, 1960 in Karachi (Biswas, 1992).

[27] All the negotiations were in English units. MAF is million acre-feet. 1 MAF = 1233.48 million cubic meters. The Indian proposal allocated 29 MAF per year to India and 90 MAF to Pakistan, totalling 119 MAF. The Pakistani proposal, in contrast, allocated India 15.5 MAF and Pakistan 102.5 MAF, for a total of 118 MAF (Wolf and Newton, 2008).

5.2.3. The IWT Regime

The IWT consists of Preamble, twelve articles describing the rights and obligations of both countries and various Annexure, as follows (Shridhar, 2005):

Table 7.3: Articles and Annexure of the IWT

Article I	Definitions
Article II	Provisions Regarding Eastern Rivers
Article III	Provisions Regarding Western Rivers
Article IV	Provisions Regarding Eastern Rivers and Western Rivers
Article V	Financial Provisions
Article VI	Exchange of Data
Article VII	Future Cooperation
Article VIII	Permanent Indus Commission
Article IX	Settlement of Differences and Disputes
Article X	Emergency Provisions
Article XI	General Provisions
Article XII	Final Provisions
Annexure A	Exchange of notes between Government of India and Government of Pakistan
Annexure B	Agricultural Use by Pakistan from Certain Tributaries of the Ravi
Annexure C	Agricultural Use by India from the Western Rivers
Annexure D	Generation of Hydroelectric Power by India on the Western Rivers
Annexure E	Storage of Waters by India on the Western Rivers
Annexure F	Neutral expert
Annexure G	Court of Arbitration
Annexure H	Transitional Arrangements

The main points of the treaty included (Alam, 2002):

a) an agreement that Pakistan would receive unrestricted use of the western rivers, allowed to flow unhampered by India, with minor exceptions;
b) provisions for three dams, eight link canals, three barrages, and 2,500 tube wells to be built in Pakistan;
c) a ten-year transition period until March 31, 1970, during which Pakistan will get water supplies according to a detailed schedule;

d) a schedule for India to provide its fixed financial contribution of $62 million, in ten annual installments during the transition period;
e) additional provisions for data exchange and future cooperation.

A Permanent Indus Commission (PIC) was constituted, headed by two Commissioners, one from each country. The Commissioners meet annually, by turns in India and Pakistan (Sridhar, 2005). It is authorized to implement the IWT. It examines and resolves any question that may arise between the parties relating to the IWT and submits an annual report to the two governments (Wolf and Newton, 2008).

The IWT sets out the procedures for settlement of disputes and differences. Sridhar (2005) gives "an abridged version of the dispute settlement process:

A. Any question that might be a breach of IWT shall be first examined by the PIC.

B. A difference is deemed to have arisen if the PIC could not reach an agreement.

C. The difference shall be dealt with by a neutral expert who may opine if it is a dispute or not. If not, he shall resolve it. Such a neutral expert shall be a highly qualified engineer and appointed by the two Governments in consultation, or failing which, by the Bank. Such a neutral expert can deal with any of the questions mentioned in Part-I of Annexure-F. The expert's decision is final and binding.

D. In case of a dispute, the Commissioners report to their respective Governments which shall then strive to resolve the dispute.

E. A Court of Arbitration shall be setup to resolve the dispute, if no decision is reached by the above process.

F. Such a Court will consist of seven members, two from each party and three including a Chairman from a panel to be chosen by the two Governments. If no consensus on names can be arrived at, the IWT has given a list of persons from whom to choose…"

The IWT also articulated a mechanism to exchange regularly flow-data of rivers, canals and streams (Sridhar, 2005). The treaty provides the obligation of timely notification (Wolf and Newton, 2008).

5.3. Post-1960 time

Despite the IWT's provision for "future cooperation," no projects have been submitted under the provision since 1960 (Wolf and Newton, 2008).

Kliot et al. (2001b, p. 321 – 322) point out that the PIC "simply monitors and inspects each of the member states…" and that "data exchange is the single and most important

function" of the PIC. Jurisdiction of the PIC is over the whole basin, but only inspection and monitoring is carried out in the basin as a whole. Utilization of the transboundary water resources is separated and "there is no basin-wide joint management of the Indus." The IWT "offered geo-physical partition of the river system itself, "conceivable only in the unique circumstance of the Indus basin (Wirsing and Jasparro, 2006, p. 3).

Though, the PIC is considered a successful institution. It lasted for more than 50 years and was able to handle the conflicts which surfaced during its functioning (Kliot et al., 2001b; Biswas, 2008; Wirsing and Jasparro, 2006; Pandya and Michel, 2009, p. 27 - 28). The first controversy resolved after the IWT was over the building of the Salal Dam - through bilateral negotiations between the two governments (Sridhar, 2005).

Other disputes which are left to resolve are over the Indian hydroelectric projects include the Wuller Barrage on the Jhelum, the Baglihar dam on the Chenab in Kashmir. Renewed attempts to settle the conflicts began to take place in July 2004 (Wolf and Newton, 2008). The latest issue is the controversy over the Kishenganga Hydroelectric Project. The differences between India's and Pakistan's "interpretation and application of provisions" of the IWT have made Pakistan to deliver the issue to the Permanent Court of Arbitration in 2010. The dispute has not been resolved yet (PCA, 2009).

Nowadays there have been voices, calling for revising the IWT. There is a body of opinion considering the division of waters under the IWT unfair (Pandya and Michel, 2009, p. 27 – 28). The treaty was criticized by experts "for its inflexibility to adjust to changes in water levels" and to adapt to new issues like increasing water demand (staff report, us senate committee, 2011). Both India and Pakistan are facing the possibility of water scarcity caused by greatly growing population and mismanagement of the inner water resources (Wirsing and Jasparro, 2006; Weigold, 2012). Complicated trust-less relationship between India and Pakistan seems to preclude any possibility of the integrated water management and leaves the future of the Indus River basin opened.

6. Conclusion

Water, or more precisely freshwater, is fundamental for both people and the environment. It has not been crucial only for birth of life but also for birth of civilization. Human, social and economic development would not be possible without it. Despite the essentiality of freshwater, there are billions of people today who lack access to safe-drinking supplies, do not have adequate sanitation and die prematurely from water-related diseases. Supply of freshwater as well as water availability are not endless and even as it may seem at the first sight. Ever rising water demand, poor governance and management, pollution and other factors such as climate change make world to face global water crisis. Water is becoming a scarce resource. Around 1.2 billion people live in an area with physical scarcity and 500 million are approaching the situation. Another 1.6 billion live in economic water scarcity. Water scarcity increases competition between its different users and the risk of conflicts.

Water is a renewable and variable resource. Water's dynamic nature respects no boundaries and makes its management not an easy issue. Transboundary water resources, or international watercourses, make the management even harder, connecting the users from different riparian countries to one shared water system. At the international level, water resources are managed mainly through tools of international water law. International water law determines a country's entitlement to the benefits of the use of an international watercourse and establishes certain requirements for a country's behavior while developing the resource. It roots from various sources as well as general international law - such as judicial decisions or customary law. It also suffers from the same flaws – a lack of clarity and enforceability. Customary law particularly contributed with principles that have founded international water law. The most significant principles are territorial sovereignty and equitable and reasonable utilization of water resources.

Today's paradigm is taking shift to integrated water resources management that perceives a river basin as a whole unit and postulates joint cooperation. It is a slow process though. There is no global treaty or authority governing the use of international watercourses. More attention is also needed on transboundary aquifers.

The question is if water can be a source of cooperation rather than of a conflict. The historical evidence shows that water has been more the former than the latter. Over

3,600 water-related treaties have been established since 805 AD until 1984 while only seven minor skirmishes over water, which included other non-water issues, happened. Several authors found that the interaction between countries was more cooperative than conflictive. The process does not end with ratifying a treaty. There have to be necessary mechanisms and capacities to implement it effectively.

It is obvious that there is always going to be certain degree of conflict. The task is to manage the conflict, prevent the escalation, and promote mutually beneficial cooperation. Institutions serve as an important mechanism for joint management implementation, dispute prevention and resolution. It has been shown that usual indicators used to identify a conflict are only weakly connected to a dispute. The likelihood and intensity of dispute rises as the rate of change within a basin exceeds the institutional capacity to absorb that change. To assure sustainable and peaceful management of transboundary water resources, institutions need to be resilient to a change that today's world and the nature of water brings.

The Indus River Basin dispute between India and Pakistan shows that even though there has been an international recognition of joint management of shared resources, it cannot be always achieved. To implement a theory in practice, capacities and will are required and these are often missing. However, the importance of transboundary water resources stays the same and so does the necessity of studying them.

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Appendix 1

Table 2.3: Water drivers' impact on water use patterns (WWAP, 2009: 79)

Users	Demographic growth	Economic growth	Social change	Technological innovation	Policies, law and finance	Climate change
Agriculture	Rising demand for food and subsequent pressure on land and water resources	Rising demand for meat, fish and high-value agricultural products	Environmentally sensitive behavioral changes can lead to more vegetarian diets	Greater agricultural water productivity	Agriculture and trade policy dictates crop yields and water requirements	Shifts in crop patterns, greater reliance on irrigation in places, generally greater crop evapotranspiration
Energy	Rising demand and pressure to develop more energy sources	Rising demand and pressure to develop more energy sources, sometimes 'dirty' resources (tar sands)	Awareness can lower demand Consumption lifestyles can increase demand	Greater efficiency (production and supply) Development of new or 'dirty' sources	Energy policy (and price speculation) dictates supply sources (hydro and renewables, fossil, nuclear)	Change in production patterns, with different water demands (quantity and quality implications)
Health	Urbanization and potential for increased disease transmission	Greater access to medical services, safe water and sanitation	Education increases good health possibilities	Increasing quality of health care Unexpected negative impacts (pesticides)	Health care and education policy (e.g., universal coverage, subsidies)	Shifting limits and timing of vector-borne diseases Greater vulnerability of the poor
Industry	Increased demand for basic goods and services	Positive feedback Loop Greater resources needs and environmental degradation	Rising living standards change demands for consumer products	Can increase or decrease environmental impacts (both in some cases)	Can promote or impose standards	Increased uncertainty and risk Can prompt Energy and water efficiency
Environment	Increased competition for land and resources	Can increase natural resource use and pollution	Awareness can lower impact Consumption lifestyles can increase impact	Can increase or decrease impacts – sometimes both	Can impose protection measures	Threatens ecological balances Leads to shifting habitats

Poverty focus	Growth of informal human settlements	Can aid in poverty reduction Increased need for natural resources to fuel economic growth	Increasing expectations for poor communities	Low-cost technologies are increasingly accessible	Can impose equity rules on allocation and pricing policies May hinder efficient provision of needed services	Will affect the poor the most Impacts will affect developing countries more than developed countries

Appendix 2

Table 4.2: Foundations for management of international water resources: treaties and agreements stopping short of allocating water (Kliot and Shmueli et al., 2001)[28]

River Basin	Legal regime	Customary law	Territorial extent and membership	Functions	Explicit or implicit expression	Purposes and power of implementation	External impacts on institution	Conflict and conflict management
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

[28] For the objective of the thesis, the data given are only for the river basins located in the developing countries or infringing into them (Colorado and Rio Grande Rivers).
Definitions:

- ''Legal regime'' identifies the formal document or declaration which regulates organization in a basin.
- ''Customary law'' refers to prevalence of one of the doctrines specified in the introduction.
- 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.
- Functions include all the areas in which the institution is active and specific authority in certain issue.
- 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.
- Power of implementation defines the specific powers of institutions such as: SUPERVISION, MONITORING, PLANNING, CONSTRUCTION, etc.
- External impacts refer to international organizations or other state involvement in the institution establishment.
- Conflict relates to prevalence of direct conflict in connection to the established institution and whether the institution has a mechanism for conflict resolution.

Table 4.3: Foundations for management of international water resources: treaties and agreements stopping short of allocating water (Kliot and Shmueli et al., 2001)

River Basin	Legal regime	Customary law	Territorial extent and member-ship	Functions	Explicit or implicit expression	Purposes and power of implementation	External impacts on institution	Conflict and conflict management
Nile	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)	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
	Nile Treaty 1959[29]	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	World Bank withdrew its support. USSR provided technical and financial support	Permanent joint committee as forum for conflict resolution
Indus	Indus Treaty 1960	Pakistan claimed historical rights and ''equitable apportionment.''	India and Pakistan.	Coordinating supervisory body.	The Treaty calls for cooperation in development of the river but no joint planning took place.	Study and report.	Important and crucial role played by the WB as a mediator and arbitrator financier of the	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

[29] 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.

		India claimed prior use or preservation of status quo	Afghanistan and China, which are upper riparians, are not members	Main function to ensure that parties develop their water shares exactly as stipulated	Exchange of data, early notification of plans, are within international law Equitable division of water is provided	Treaty has stipulations for broader cooperation and technical services which were not realized	partition projects. The final treaty was formulated and planned by the WB	and allocated. The dispute was solved by the involvement of a Third Party-the WB
Ganges	Treaty between Bangladesh and India on sharing the Ganges waters at Farakka 1996[30]	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.
Jordan	Treaty of Peace 26.10.1994 (Article 6a, Annex II)[31]	Israel upheld absolute territorial sovereignty over the Jordan after 1967, the state of Jordan before 1967	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	No harm. Equitable apportionment of the water resources of the Jordan, Yarmouk.	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.

[30] 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.

[31] There is no separate treaty for water resources. The stipulations are part of the Peace treaty

		Until 1967 Israel supported absolute territorial integrity	It is a forum for data exchange, research and technical advice	Early notification of projects			Conflicts in the water sector are referred to mechanism for conflict resolution established by the Peace Treaty

Table 3.4: Foundations for management of international water resources: basin-wide development and planning (Kliot and Shmueli et al., 2001

River Basin	Legal regime	Customary law	Territorial extent and membership	Functions	Explicit or implicit expression	Purposes and power of implementation	External impacts on institution	Conflict and conflict management
Mekong	Mekong Committee 1957– 1996[32]	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

[32] 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[33]		The same but China and Myanmar have observer status	Joint planning and management for hydropower, (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
Senegal	The Senegal River Basin Authority 1972 on (OMVS)[34]	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
Niger	The Niger River Commission 1964–1979 Niger Basin Authority 1980[35]	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

[33] Ministerial level was added to the Mekong commission in order to add to it political clout

[34] Organization of the Senegal began in colonial times 1934–52 for navigation and data collection. Coordination, research continued until 1972 the establishment of OMUS.

[35] Unlike the Senegal, the external involvement in that basin did not lead to a successful institution (too many riparians with opposing interests, failure in mobilization of foreign aid).

Colorado and Rio Grande	International Boundary and Water Commission IBWC/CILA series of treaties:1906, 1944 are the most important[36]	USA held off the Harmon Doctrine (absolute sovereignty) and changed its legal stance to one nearer to the Doctrine of Limited Sovereignty	The US, 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

[36] This institution is unique because it deals with both border and water, and because it encompasses two rivers in the same institution.