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Water Sharing in the Indus River Basin: Application of Integrated Water Resources Management

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Abstract:

Rise in population growth needs high demand of limited water to meet the challenges of high food requirements and it creates an environment of conflicts. The extent of conflicts varies from regional tensions to violence and it depends on the importance of water resources and relationships between the parties. In case of international rivers, the conflict over share water resources is quite common. However, shared rivers are not always prone to conflict; it could provide an opportunity to bring the riparian countries to the negotiation table and make them involve in more cooperative process. The guidelines has provided in integrated water resource management framework help the policy makers and states to manage their water issues in more effective and efficient way.

Indus river water is mostly shared between Pakistan and India. This river system is a source of life for billions of people in both countries. An Indus water treaty 1960 agreement was signed between both countries for sharing the water resources. But, due to increase in population growth and uncertainty in river water and acute water shortage, there is a dispute among India and Pakistan. As both countries are trying hard to get high access of water by constructing hydropower and navigational projects. This case study analyzes the nature of disputes. Attempts are made to provide relevant information by using several secondary sources. After analyzing the problematic situation, recommendations are made. The three main issues of Indus water disputes are: limitations in IWT, lack of trust and cooperation and high politics. There is a need to revise the Indus Water Treaty according to the IWRM principles in order to promote cooperation between India and Pakistan and to achieve an improved desirable situation. In the presence of high political will and commitment, the IWRM framework of enabling environment, institutional arrangement and managing instrument are the best tool for the successful application of IWRM at basin level.

Key words: *IWRM, IWT, Indus, Pakistan, India, Conflict management,*

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ABBREVATIONS

EPA:- Environmental Protection Agency

GWP:- Global Water Partnership

GWP-TAC:- Global Water Partnership Technical Advisory Committee

ICA: International Court of Arbitration

IR:- International Rivers

IWRM:- Integrated Water Resource Management

IWT:- Indus Water Treaty

KHEP:- Kishanganga Hydroelectric Project

PIC:- Permanent Indus Commission

UNESCO:- United Nations of Educational, Scientific and Cultural Organization

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1. Introduction

1.1 Water Management Need:

Water is the basic need for sustaining life on earth and also central to agriculture and industry. Access to good quality water is the right of all users. The socio and economic development activities of nations related to good quality and ample water supply. Fresh water is a very limited and vulnerable resource. While one third of the earth's surface is covered by oceans and seas, only 2.5 % fresh water is available. Major portion of water is in solid form on glaciers and therefore as such unable to be used (Abbas 2004)**.** So, water as a resource is under severe stress across the world. Due to climate change, large scale industrializations, economic developments and population growth, water stress is emerging as a real threat. Recent estimates reveals that globally 20 % increase in water scarcity will be due to climate change**,** As the population size is increasing, the demand of water is also increasing in each sector (agriculture, industry, domestic) and is greatly affecting the readily available water. Rise in population growth is one of the major concerns of the world. It has its impact on each and every sector especially in the third world countries that already suffer from water, food and health problems. All over the world, about 1.1 billion people lack access to good quality water and 2.4 billion people to improved sanitation (UNESCO-WWAP 2003). Most of the increase in population probably would occur by the year 2025 and it is estimated that by the middle of 21st century between 45 - 65 percent people will suffer the condition of water scarcity (UNESCO-WWAP 2003). According to UNEP (1994:4), two out of three persons will suffer water scarcity by the year of 2025, if the present patterns of increasing consumption insist (Brochmann et al., 2006). As world growing population is consuming more water and climate change reducing the water availability in many regions, there is a need to manage the water cautiously to meet the challenges of water demand and supply.

1.2 Water Conflicts in General:

Conflict is a real fact of life. People in a society living together and there is an interaction between them. When this interaction for a common resource does not fulfill the satisfaction of all

the stakeholders then conflict eruption takes place. Conflict is a social interaction during which the actors trust to interaction decreases. Actors have a conflict, taken notice the action of each other and give meaning to those actions. Distrust is the reason of conflict either other characteristics i.e. difference in goals, desires and interest divergence. Lack of trust builds the communication gaps which contribute in the conflict escalation. This lack of trust may be due to the misunderstanding and misperception (Hallgren unpublished).

Environmental conflicts are the most complicated form of conflict because many parties are showing their interest. Conflict emergence depends on the interdependence of the parties and incompatibility among their goals and desires. Complexity of conflict increases when it adversely affects the people fundamental values and Disagreement mostly occurs on scare resource (Daniel, 2001). So, conflict mostly emerges and escalates when different parties feel resentments due to the action of others.

Fresh water consumption is increasing with higher demand of food and electricity and ample supply of water is critical for human survival. So, one of the reasons of conflicts over fresh water resources is because of more and more demand while the supply side looks more and more insecure. Development of water resources contribute to the social welfare and economic productivity. In all over the world trends of building new dams, reservoirs and barrages are more common at present time. This activity may cause eruption of conflict either within the state or among the states that share the same water sources (Swain, 2004).

This conflicting situation is more complex and complicated in case of international river basins, as it create political tensions among the countries. Because, when conflict eruptions occur, it not only sweeps away decades of development efforts but also effects the economic, social and political situations of that particular region (Bannon et al., 2003). Water conflicts mostly occur where transboundary water management has become necessary. So, due to water shortage in a world, an issue of water war is common.

Water scarcity is a major source of water conflict all over the world because of increase in global water demands (Zawarhi, 2009). This increase in water demand lead to competition among the water users. So, water may be act as a catalyst to breed conflict. The conflict over scarce water

resources is unavoidable. This conflict might be at local national and international level. Many specialists believe that intensified water scarcity will bring the peoples to fight over their resources. Water as a renewable resource will be a major source of conflict in 21st century. Many scholars surmise that water conflict may lead to water war in 21st century. According to Dixing cited by Allouche (2005) "The renewable resource most likely to stimulate interstate war is river water". Disputes between states over water bring about regional tensions delay economic development and activate the risks of causing more conflicts (Marquet, 2011). Competition for both quantity and quality over share water at local level may often cause international conflict (Trolldalen, 1992). Water conflicts may develop due to poor international relations, real controversies or distrusts (Mostert, 2003).

1.3 Water Cooperation:

Water is not only the source of conflict. It has also been a productive way for developing cooperation and preventing conflict. The message of Kofi Annan on world water week cited by Wolf, 2007 are:

"Water problems of our word need not only be a cause of tensions. They can also be a catalyst for cooperation, if we work together a secure and sustainable futures can be ours"

Kofi Annan, February 2002.

Cooperative events cover a broad spectrum including water quantity, quality, hydropower development and joint management (Wolf et al., 2005). Role played by politics for cooperative development posses much Importance. Where there is a will there is a way, cooperation may develop if riparian's countries wish to maintain good associations (Mostert, 2003).

Positive political relations, higher level of economic developments, agreements on water management and institutional capacity are the key factors that promote cooperation (Editorial, 2006). Political will and cooperation are the most important preconditions for fruitful cooperation in all aspect of water sharing (Un-Water, 2008).

Cooperation over shared water resources is one of the most important things for sustainable social, political, environmental and economic development of world. It can bring the stakeholders together by building trust and confidence among them and can serve as an avenue

for negotiation. There are more examples that international disputes do get resolved due to the active involvement of water institutes. As in case of Pakistan and India, both countries were in a state of war three times and they have fought two wars after water treaty, but have adhered to water sharing management even at the time of war. Due to the intelligent role played by water related institutes, the war clouds had shed off.

2. Research Design

Research results in advancement and better understanding of the knowledge and leads humanity towards finding solutions to problematic situations. Indus river basin historically is a problematic situation between India and Pakistan. Indus is a source of life for millions of people in South Asia region. Indus basin system not only interacts with its ecosystem but also with the human activity in the region; hence it is very dynamic. These complexities naturally cause the situations of mistrust among river sharing states and often cause the conflicts. To identify and understand nature of water conflict between India and Pakistan following research methodology is used.

2.1 Methodology:

Qualitative research consists of methods and techniques which cannot be quantified; lack of quantification may be due to the small sample or unique occurrences. It is more related to the phenomenon in perspective. It has many types, i-e observations and interviewing, content analysis. Content analysis is an indirect technique of study that uses systematic methodology for categorizing text based on explicit rules of coding **(**Stemler, 2001**).** Responses or impressions are searched with the analysis of the statements made (books, blogs, articles). Case study is also one of the types of qualitative research methods. Case study method is helpful to explain the situation, to explore the problem and to describe the objectives. Case study research through reports and reviews of past studies, allows the exploration and understanding of complex issues. It can be consider as a strong research method when a holistic, in-depth investigation is required. Case study method can be used to explain the real problematic situation that may not be captured by survey or experimental research (Zainal, 2007).

This study is based on the theoretical review of Indus water issue between India and Pakistan. To analyze and explore the problematic situation secondary source of data has used. Secondary analysis is a useful approach to investigate my research question. Secondary sources of data (reports, articles, websites, books, newspapers) are used in this desktop study to understand and analyze the water issues amongst Indus basin riparian countries.

2.2 Limitations:

As, both India and Pakistan have a hostile political relations. So, because of political instability the officials from both sides not interested to share important information in order to avoid any

problematic disturbances. That's why it was difficult to conduct field work to get accurate relevant information. Although, one of the major limitation of this research is nonparticipation but efforts has been made to get relevant information and perceptions of all major states stakeholders. Due to the shortage of time, political instability between India and Pakistan and limited contact with Indus River basin organizations, the part of study to be undertaken based on the secondary resource analysis.

2.3 Aim of study:

Water is the essential part of life and its scarcity is ever increasing. Intuitively this dilemma putting strains on the water distribution mechanisms. Therefore there is a dire need to manage the existing resources efficiently without any/less conflict of interest. It is also logical to revisit different mechanisms of water distribution in order to find the potential and existing conflicts and use the state of the arts of conflicts management guidelines, like IWRM principles to overcome the existing and future water conflicts both at national and international level.

Indus river basin is a classical example of water based conflict, where water dearth is causing the conflict like situation nationally and internationally. Indus water treaty that signed in 1960s was successful to manage conflict internationally. As, time is passing the water availability is also minimizing. It resulted in high levels of severity of conflict and this treaty does not seem promising any more. Now it is high time and obvious to propose the mechanisms that are best suitable for not only current water shortage circumstances but can also cope with the future water scarcity and management problems.

The well known IWRM principles are the best choice of framework that can enable such a revisit and reformed the treaty. The notion of IWRM begins with the term of water resource management. IWRM emerged around 1980 in response to high pressure on water resource because of high competition among various users. IWRM is a holistic and Participatory approach that involves the participation of all stakeholders for sustainable water and related land resources. IWRM framework develops a mechanism that helps the countries for sustainable development of water resources by considering the social, environmental and economical interests.

2.3.1 Research question:

How IWRM is going to address the water sharing issues or challenges of Indus River between riparian states?

2.3.2 Objectives:

The objectives of my study are:

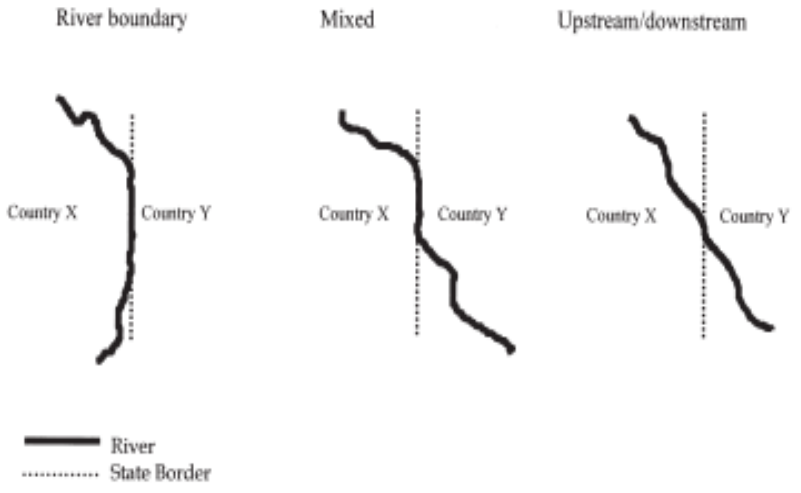
- To analyze of Indus water treaty,
- To analyze Future developments and roles of riparian countries,
- To identify of the nature of problems,

3. Research Analysis

3.1 International river Basins:

Water for ecosystem and sustaining life is like the blood for body and rivers role like blood vessels. Rivers provide water for drinking, for energy, for food production, for transportation and play a vital role in the development of human civilization. Rivers are the symbols of life. Rivers are the central features of ecology of this planet and play an important role in sustaining ecosystem and sculpting landscapes. River basins have always been central features of the economic environment. River Basin is the area that contributes hydrologically including both surface warter and ground water to a first order stream, which in turn is defined by its outlet to the ocean, or to a terminal lake or inland sea (UN-Water, 2008). Sometimes rivers flowing from its origin to end, crosses many political boundaries and these basins are defined as an international (Wolf, 2007). Rivers may run along the boundaries refer as a river boundary type. For example Cango, which separate the former French and Belgian colonies. They may also run from one country to another country refer as upstream/ downstream types as Nile river crosses from Sudan into Egypt.

Fig1: Types of international rivers:



Source: (Allouche, 2005)

In a 1978 United Nation study listed 214 internal rivers (Wolf et al., 1999). Now, there are 263 international rivers, because of the internationalizations of national basins through political changes such as the breakup of Balkan states and Soviet Union as well as better mapping sources and technologies. These rivers cross multitude of natural and political boundaries. The table below describes increased numbers of rivers from 1978 to present in different continents.

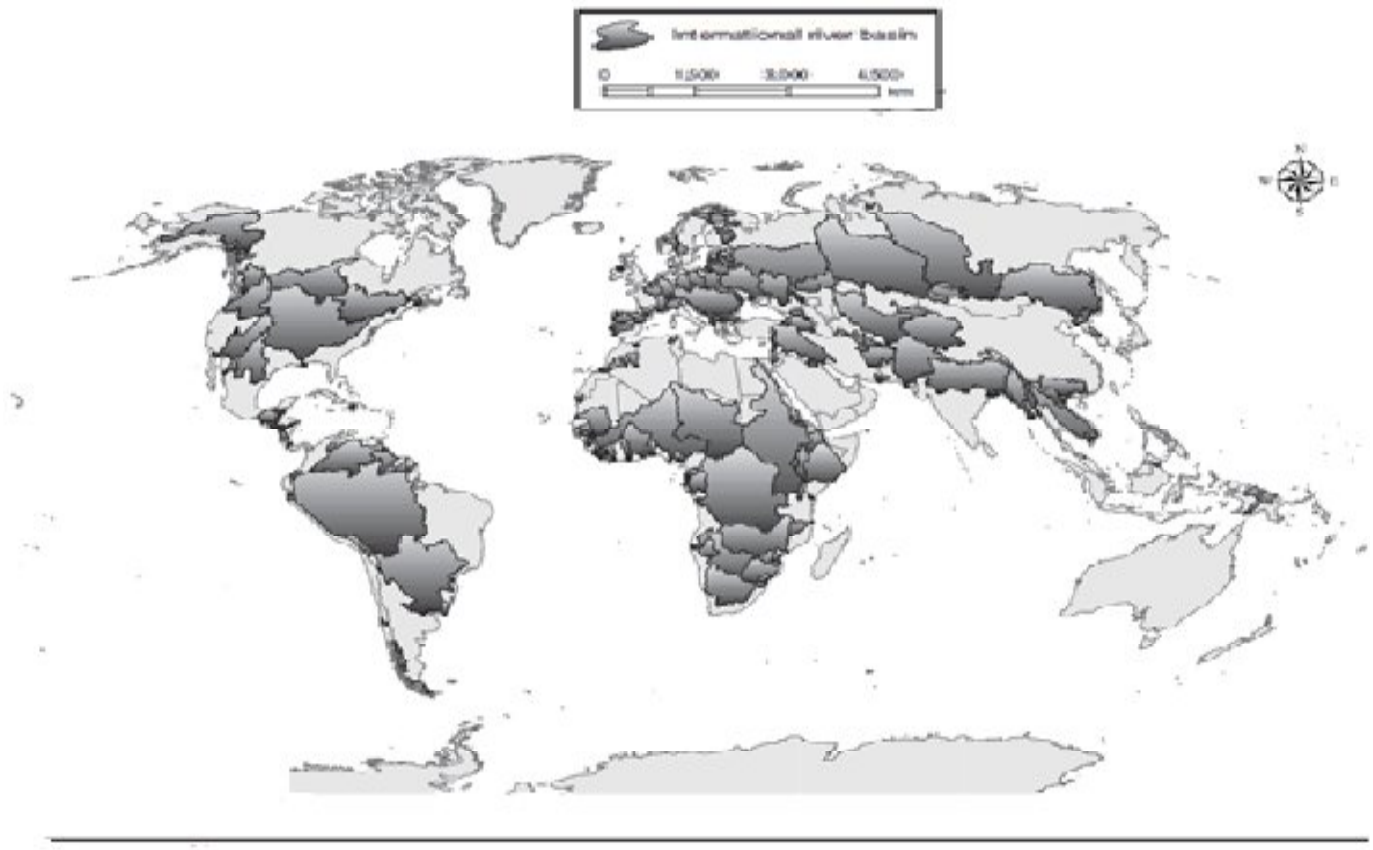
Table 1: Worlds international Rivers Distribution

Continent	**Present**	**1978 Register**
Africa	59	57
Asia	57	40
Europe	69	48
North America	40	33
South America	38	36
Total	263	214

Source: (GWP,2009 and Wolf et al., 1999)

These rivers approximately cover an area of 45 percent of the earth surface, roughly host 40 percent of the world's population and account about 60 percent of the global river flow. (Wolf et al., 2005).

Fig:2 Map of international river basins of world



Source: (Wolf, 2007)

Out of total, one hundred forty five nations include territory within international basins. Twenty one nations lie in their entirety within international basins and a total of thirty three countries

have greater than 95 percent of their territory within these basins (Wolf, 2007). Roughly one third of these basins are shared by more than two states. Nineteen basins are shared between nine and eleven countries and one basin has seventeen riparian's nations. The following table describes the international basins shared by different number of countries.

Table 2: International River Basins of the World (Wolf et al., 1999)

Number of countires (Number of International basins)	**International basins**
17 (1)	Danube.
11 (2)	Congo and Niger.
10 (1)	Nile.
9 (2)	Rhine and Zambezi.
8 (2)	Amazon and Lake Chad.
6 (8)	Aral Sea, Ganges-Brahmaputra-Meghna, Jordan, Kura-Araks, Mekong, Tarim, Tigris and Euphrates (Shatt al Arab), and Volta.
5 (3)	La Plata, Neman, and Vistula (Wista
4 (17)	Amur, Daugava, Elbe, Indus, Komoe, Lake Turkana, Limpopo, Lotagipi Swamp, Narva, Oder (Odra), Ogooue, Okavango, Orange, Po, Pu-Lun-T'o, Senegal, and Struma

3 (49)	Asi (Orontes), Awash, Cavally, Cestos, Chiloango, Dnieper, Dniester, Drin, Ebro, Essequibo, Gambia, Garonne, Gash, Geba, Har Us Nur, Hari (Harirud), Helmand, Hondo, Ili (Kunes He), Incomati, Irrawaddy, Juba-Shibeli, Kemi, Lake Prespa, Lake Titicaca-Poopo System, Lempa, Maputo, Maritsa, Maroni, Moa, Neretva, Ntem, Ob, Oueme, Pasvik, Red (Song Hong), Rhone, Ruvuma, Salween, Schelde, Seine, St. John, Sulak, Torne (Tornealven), Tumen, Umbeluzi, Vardar, Volga, and Zapaleri.
2 (176)	Akpa, Alesek, Amacuro, An Nahr Al Kabirm, Artibonite, Astara Chay, Atrak, Atui, Aviles, Aysen, Baker, Bangau, Bann, Baraka, Barima, Barta, Beilun, Belize, Benito, Bia, Bidasoa, Buzi, Ca (Song-Koi), Cancoso (Lauca), Candelaria, Castletown, Catatumbo, Changuinola, Chico (Carmen Silva), Chilkat, Chira, Chiriqui, Choluteca, Chuy, Coatan Achute, Coco (Segovia), Colorado, Columbia, Comau, Corubal, Coruh, Courantyne (Corantijn), Cross, Cullen, Daoura, Dasht, Don, Douro (Duero), Dra, Elancik, Erne, Etosha/Cuvelai, Fane, Fenney, Firth, Flurry, Fly, Foyle, Fraser, Gallegos-Chico, Gauja, Goascoran, Golok, Great Scarcies, Grijalva, Guadiana, Guir, Han, Hsi (Bei Jiang), Isonzo, Jacobs, Jurado, Kaladan, Karnafauli, Klaralven, Kogilnik, Kowl-E-Namaksar, Krka, Kunene, Lagoon Mirim, Lake Fagnano, Lake Natron, Lake Ubsa-Nur, Lava (Pregel), Lielupe, Lima, Little Scarcies, Loffa, Ma, Mana-Morro, Massacre, Mataje, Mbe, Medjerda, Mino, Mira, Mississippi, Mius, Mono, Motaqua, Murgab, Naatamo, Nahr El Kebir, Negro, Nelson-Saskatchewan, Nestos, Nyanga, Olanga, Oral (Ural), Orinoco, Oued Bon Naima, Oulu, Oyupock (Oiapoque), Pakchan, Palena, Pandaruan, Parnu, Pascua, Patia, Paz, Pedernales, Prohladnaja, Puelo, Rezvaya, Rio Grande (North America), Rio Grande (South America), Roia, Rudkhaneh-ye (BahuKalat), Sabi, Saigon (Song Nha Be), Salaca, Samur, San Juan, San Martin, Sarata, Sarstun, Sassandra, Sembakung, Seno Union (Serrano), Sepik, Sixaola, Song Vam Co Dong, St. Croix, St. John, St. Lawrence, St. Paul, Stikine, Suchiate, Sujfun, Tafna, Tagus (Tejo), Taku, Tami, Tana, Tano, Terek, Tijuana, Tjeroeka/Wanggoe, Tuloma, Tumbes-Poyango, Umba, Utamboni, Valdivia, Velaka, Venta, Vijose, Vuoksa, Wadi Al Izziyah, Whiting, Yalu, Yaqui, Yelcho, Yenisey (Jenisej), Yser, Yukon, and Zarumilla.

Source: (Wolf et al., 1999)

3.2 Conflict over International Rivers:

International rivers as common water resource are more prone to conflict because they cross the political boundaries randomly and create some sort of tensions among the societies (Sadof et al., 2002).These tensions not only affect their relationships but also become the obstacles in nations economic development. Among the three different types of river systems, upstream/ downstream are more disposed to conflict. There is no doubt that disputes among nations also exists in other two types. But the intensity of the conflict is very low as compare to upstream downstream river system. All water related disputes ascribe to three issues, water quantity, water quality water timing (Wolf et al., 2005).

Water is a scare finite resource and competition for limited quantity is one of the clear reasons of the water related disputes. Competing claims over scarce resource always creates tensions among the nations. An absolute conflict exists, when there is not enough water to meet the legitimate needs of riparian states. This situation becomes worse when adversarial states are highly dependent on water and they face a water deficit (Zawahri, 2009). The possibility of conflict increases in such cases when construction of dams on the upper course of river, not only to serves energy needs but also irrigational works and badly effect the livelihood of lower riparian's. For example in Mekong river basins, construction of Pak Mon dam by Thailand, more than 25000 people were affected by drastic reduction in upstream fisheries and other livelihood problems.

Another, strife issue is water quality. Rivers are not only act as the reservoir for the supply of fresh water but also a medium for disposing of waste water and industrial rubbish. The water with high concentrations of pollutants that resulted from waste water, pesticides leeching, excessive salt and suspended solids is not suitable for drinking, industrial and some time also for agricultural purposes. Low quality water can become a source of conflict between those who affected by it and who cause it. Conflicts arise due to pollution, not always leads to violence and military actions but it can be a reason of tensions between states.

Water flow timing is one of the reasons that breed conflict. Flow timing is also important in many ways and it depends on riparian's relations and requirement. Upstream country might release water during winter while downstream needs it during summer time for irrigation. Conflict over water distribution could be one of the reasons in the case when it seriously hampered the lower lying regions. In contrast to conflict over water quality, which can result in tensions between nations, water distribution conflict can lead to violence or military threats. It mostly emerges due to the construction of dam or extensive irrigational networks which reduce water availability. These detrimental actions of upper riparian badly affect the lower riparian. The river system of Euphrates and Ganges are characterized by drastic reduction of flow in the lower basin because of extensive use of resource by upper riparian.

Table 3: International environmental conflict over river Systems:

River Systems	Countries involved	Reasons of conflict
Nile	Egypt, Ethiopia, Sudan	Water flow
Euphrates, Tigris	Iraq , Syria, Turkey	Dam, Water flow
Mekong	Thailand, Vietnam, Laos, Kampuchea	Water flow
Yarmouk	Jordan, Syria	Water flow
Jordan, Litany	Israel, Lebanon	Water flow
Danube	Germany, Hungary, Czechoslovakia	Dam, Water flow
Ganges	Bangladesh, India	Siltation, Flooding
Indus	Pakistan, India	Timing, Irrigation, Dam
Rio, Grande, Colorado	United state, Mexico	Salinisation, Water flow agrochemical pollution
Great Lakes	Canada, United state	Water Diversion
Parana	Argentina, Brazil	Dam, Flooding

Lauca	Bolivia, Chile	Dam, Salinisation
Rhine	Germany, France, Netherland, Switzerland	Industrial pollution
Elbe	Germany, Czechoslovakia	Industrial pollution
Szamos	Hungary, Romania	Industrial pollution

Source: (Trolldalen, 1992)

The table given above mentioned different cause of conflict at different international rivers. Among all these the root cause of conflict emergence is water scarcity and shortage. Water shortage is directly relates to high demand of water by high population. Although water scarcity is an important reason of breeding conflict but many authors claim that politics over water is the reason of conflict within the state and among the states. It is not the lack of water that leads to conflict bur the poor way the resource is governed and managed (Carious et al., 2004). Conflict over water is the result of a failure of politics to negotiate settlements over the shared use of water (Marquet, 2011). Conflict over water can be a catalyst for war, or a force for peace, but the politics as a proxy for the full bundle of relationships and associated tensions that arise between states will determine either conflict or cooperation is chosen (Sadof et al., 2002).

Cooperation on shared water management not only helpful in reducing tensions but also provide a common stand point, that is important in developing regional stability, prosperity and maintaining a good relationship at all levels. Political will and commitment are the most important preconditions for fruitful cooperation in all aspects of water sharing (Un-Water, 2008). Cooperation on share water resources is one aspect of good water governance and will become increasingly important in future (Vollmer et al., 2009). Promoting cooperation is a long term and resource intensive process. Such process includes developing institutions and collaborated structures, building capacity in the multi-sector use of water and trust among the riparian states.

3.3Integrated Water Resource Management (IWRM):

Water problems are more common in current century. It will continue to grow and become more severe and affect other sectors like energy, agriculture, environment, health and industry. Water management is necessary for the development of all these sectors. That's why, water can no longer be viewed as a single resource without considering the other water related development sectors. So, there is a dire need to focus on multi-sectors approach instead of traditional sector-based approach. Integrated water resource management is considered as one of the best and basic approach for managing water resources. IWRM assist the countries to make an effort in order to deal with complicated and crucial water issues in a cost effective and sustainable way by considering the social, economic and environmental interests.

The notion of IWRM begins with the term of water resource management. IWRM emerged around 1980's in response to high pressure on water resources because of high competition among various users. IWRM has evolved in different ways in different countries as a function of culture and geography. In defining the IWRM, GWP notes that "A process which promotes the coordinated development and management of water, land and related resources in order to maximize the resultant economic, social and welfare in an equitable manner without compromising the sustainability of vital ecosystem". (GWP-TAC, 2000).

There are several principles and guideline related to IWRM and each have their appropriate applications of which the Dublin principles are specifically useful. The four Dublin principle of IWRM are

1. Fresh water is a finite and vulnerable resource and is essential to sustain life, development and environment.
2. There must be a participatory approach for water resource management and development. There should be an involvement of planner, policy makers and users at all levels.
3. Roles of women are very important and they play a central role in managing and safeguarding of water.
4. Water has an economic value in all competing uses and should be recognized as an economic good.

IWRM as a holistic approach consider all water function on equal term within the frame work of integrated water system. This approach, not only take into account the scientific and technical aspects but also consider the natural, social, environmental and political aspects. IWRM as a holistic approach and participatory approach entails all stakeholder engagement. IWRM aims to bring all the stakeholders at a table to negotiate their perspective, use their knowledge and need of water to employ the efficient fair and durable solutions. IWRM being a holistic approach needs to increase communications between different public and private stakeholder groups by considering contributions and perspectives of all users, planners and policy makers (Jeffrey et al., 2004). Participation of all stakeholders at decision making process is a fundamental need in order to achieve durable and acceptable solutions.

IWRM is based on the three key objectives: economic efficiency, equity and environmental sustainability. Economic efficiency focus on the finite, vulnerable and limited water resources must be use with a maximum possible efficiency. Equity can be describes as allocation that takes into account all relevant factors and circumstances in order to drive the maximum benefits for all with minimum resultant harms. Sound management of water resources is essential for sustainable development. Environmental sustainability demands ecosystem protections and maintenance of long term viability for present and future generations. GWP describe three important complementary elements to achieve these key objectives. These complementary elements include:

- Enabling environment: The enabling environment includes general framework of national policies, legislations, regulations and information of stakeholders.
- Institutional role: Includes creation of organizational frameworks and capacity buildings to put policies into practices.
- Management instrument: includes operational instruments for effective regulations, Monitoring and sharing of information.

Fig 3: General Framework of IWRM

Source: (www.gwp.org)

3.4 International river basin management and IWRM:

International river basins are inherent to multiple challenges that need to be solved by water sector managers. Water is essential for human life and it is the most politicized natural resource. When different states (whether they are in the upstream or downstream) share the river basins they have their own interests that can be conflicting within them. To manage this resource a number of settings has been involved. These include agreements between countries, national legislations to the local councils and informal group of stakeholders at the level of basin or sub-basin areas and also at the national and international levels. Conventions or agreements between states are negotiated and ratified at international level. Whereas, policies are formulated at national level and implemented at basin and sub-basin level.

On the basis of these facts, the IWRM principles highlight the need to coordinate the actions between these different sectors at different levels. IWRM based coordinated efforts are best to be implement when key policies makers from all riparian states are involve. Therefore, to solve the conflicts, the main stakeholders including the high level authorities, from both sides must be convinced that the cooperation is necessary to minimize/solve the conflicts. Also, their strong will is also required for taking further mutual actions and to trigger the continuous cooperation process that will be beneficial for everyone.

The IWRM approach is necessary for maximizing water utilization benefits and for sustainable development. But before implementing IWRM an enabling environment must be created by supporting laws and legislations. These laws and legislations are required to be developed at both national and interstate levels. Both parties involved in the conflict need to make sure continuous finances in order to keep whole process running. This continuous flow of finances is achieved by making institutional arrangements at national and interstate level. On the other hand basin organizations need to be set up at basin and sub-basin (local) level by including the key stakeholders involved in the conflict for sake of the improved implementation of process. Effective mechanisms of management and supports must be provided by top authorities for the water management sectors to involved countries. According to Swain (2004), problem understanding is essential for the negotiators to find solutions and for the conflict management. Therefore, relevant and sufficient information about the complex issues should be provided, encompassing all diverse domains existing in the basin from all countries involved in a conflict.

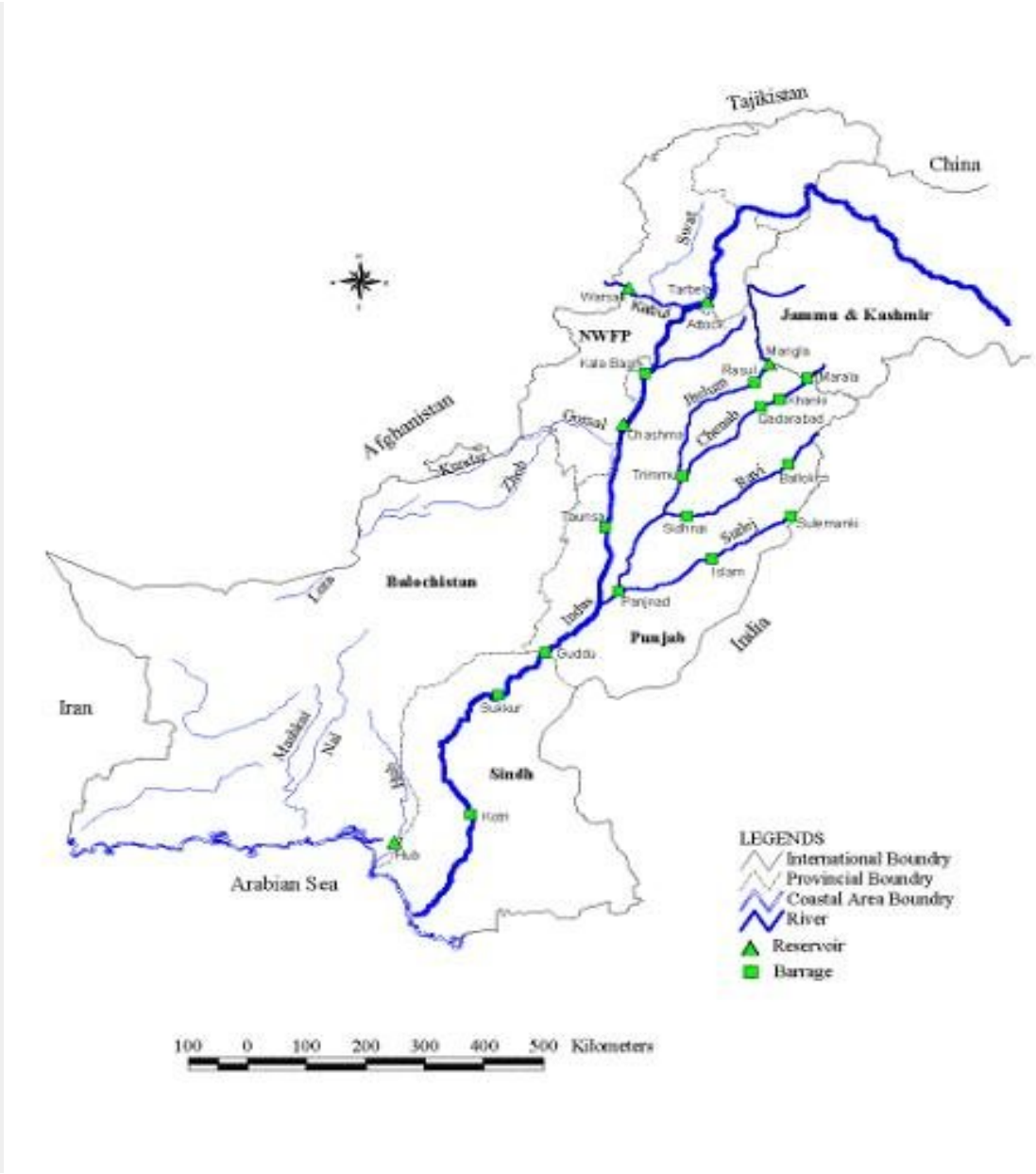
4. Case Study

4.1 Indus River Basin:

The Indus river basin is one of the largest basins in Asia covering an area of 1,165,000 km^2 (Swain,2004). The river flows through four countries in south Asia including, China in north-east, India in east, Afghanistan in north-west and Khyber Pakhtunkhwa and majority of plains of the Punjab and Sindh in Pakistan (Rehman et al., 2005). The Indus river basin comprise of Indus river, its two western tributaries the Kabul and Kurram rivers and five eastern tributaries the Jhelum, Ravi, Beas, Sutlej and Chenab rivers. Indus and Sutlej originate from Lake Manasarovarin in Tibet. Chenab River originates from Himachal Pradesh in India and flows through Kashmir valley and into Pakistan. Ravi also originates from Himachal Pradesh but directly flows into Punjab and then Pakistan. Beas originates and flows entirely in India. Jhelum originates in the Kashmir valley of India and flows to Pakistan (Zhawari, 2004, 2009). Kabul River rises in Afghanistan and flows through the Peshawar valley to join the Indus at Attock. These five main left bank tributaries have an aggregate length of more than 2,800 miles and Kabul River and Kurram River together cover more than 700 miles (Allouche, 2005).

The basin is the home to three world's mightiest mountain ranges (Karakoram, Himalayan and Hindukush). The basin originates at 17,000 feet above sea level in Tibetan plateau. The river pass through Indian occupied Jammu and Kashmir, enters into north area of Pakistan and finally merge into an Arabian sea. Most of its flows around 69% originate from India, compared to 12% for Tibet and Afghanistan and 19% for Pakistan. (Khosla,1958). The drainage area which extends into india is 45,000 square miles and contribute to an average annual inflow (including all rivers) of 175 million acre feet. (Qureshi et al., 2011). The snow melting in the Himalayan-Hindukush regions and precipitations in mountains are the major components of the annual flow of these rivers. Climate is not uniform over Indus basin region. It varies from arid to semi arid to temperate sub-humid in the plains of Sindh and Punjab provinces. Annual precipitations ranges maximum 2000 mm on mountain slopes and between 100 to 500 mm in the lowlands. Abundant flow is during the monsoon season (July- September), which contributes 51% of annual flow (Ojeh, 2006).

Fig 4: Indus Basin



Source: (Sridhar, S., http://www.bharat-rakshak.com/SRR/Volume13/sridhar.html)

4.2 Indus River system and its importance for India and Pakistan:

Indus river basin drains the highland of four riparian countries, Pakistan, India, Afghanistan and China. The rough terrains surrounding the river in China and Afghanistan has so far minimized these states ability to develop the river within their border but China and Afghanistan are asserting their rights to a reasonable and equitable share of the Indus tributaries flowing through their territory (Salman, 2008). Afghanistan has started to build a dam on Kabul River for hydropower generation but mainly India and Pakistan are dependent on the Indus river system. Out of about 193 million total populations, 72% of Pakistan and 23% of Indian live in Indus basin system (Laghari, et. al. 2011).

Table 4: Riparian States in the Indus River Basin

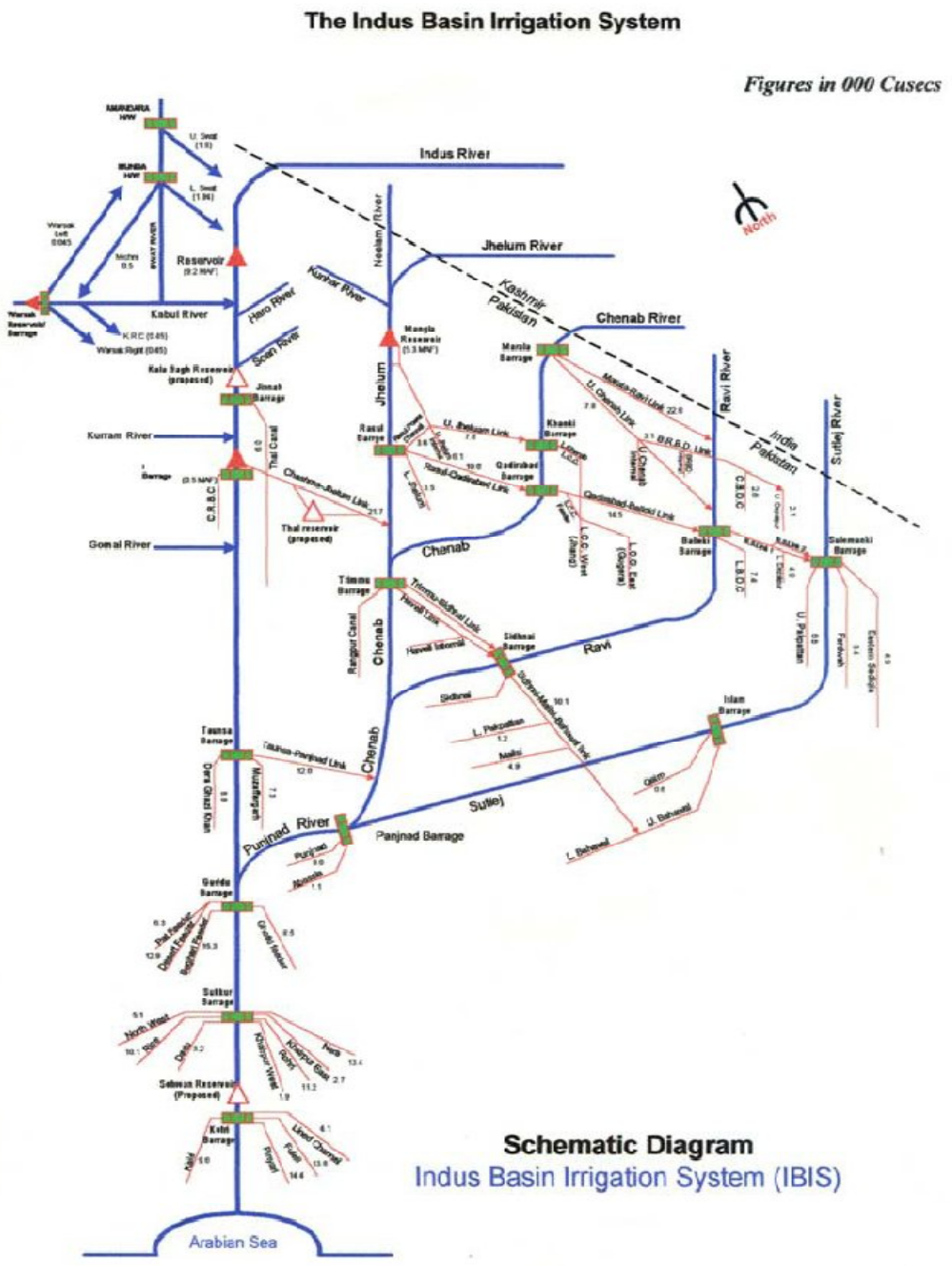
Basin name	Area in sq. km	Countries	Area of country in basin (sq. km)	Country percent area
Indus	1,138,800	Pakistan	597,700	52.48
		India	381,600	33.51
		China	76,200	6.69
		Afghanistan	72,100	6.33
		Chinese control, claimed by India	9,600	0.84
		Indian control, claimed by China	1,600	0.14
		Nepal	10	0.00

Source: (ASIA: International River Basin register *(updated August 2002*) http://www.transboundarywaters.orst.edu/publications/register/tables/IRB_asia.html

The Indus river system is a major source of water for Pakistan and north-western part of India. (Swain, 2009). For relatively arid north- western province of India, which have become the country breadbasket, the Indus River provides the economic foundation (Zahwari, 2009).

For Pakistan, Indus River is the main source for domestic, industrial and agricultural water. Agriculture is vital for Pakistan's welfare and its role is like a backbone in national economy. This sector employed 43% of Pakistan's labour force and contributed about 25% of Pakistan GDP. In spite of the fact, Pakistan agriculture is mostly dependent on irrigation network because of little rainfall, low quality ground water etc. Of the total irrigated area of Indus River, 74 % is located in Pakistan (Laghari, et. al. 2011) that provides over 60% of the water utilized for irrigation purposes through the world best and largest irrigational network (Miner et al., 2009). The irrigational network comprises of 3 reservoirs (Tarbela, Chashma on Indus River and Mangla on Jhelum River), 19 large river barrage and 45 independent irrigational canal commands, some 1.6 million km water courses and 144 large dams (Kamal, 2008). The irrigational network almost spread out more than one third part of country. About 78% of Pakistan's cultivated area is under irrigation and it ranks second in the world after Egypt (Ahmed et al., 2007).

Fig 5: Indus Basin Irrigation System



Source: *(Kamal,* 2008)

4.3 Background:

The canals and barrages built under the British rule to serve Indo-Pak continent were under partition in 1947. As a result of partition, these canals network is divided into East Punjab that is in India and West Punjab in Pakistan. For India, the real problem arose when out of 26 million acres of land annually irrigated by Indus and its tributaries, 21 million acres became part of Pakistan (Allouche,2005). But, the headworks of the entire network remained in India. During the division of Punjab into East and West regions, Punjab partition committee was established to settle down the dispute related to division of assets between East and West Punjab provinces. In 1947 both east and west Punjab were agree that water shall be divided equally.

Pakistan and India disputes over Indus water erupted soon after eight months of independence, when India cut off the water coming across the border into Pakistan in 1948. East Punjab cut off the supplies of every single canal that crossed the border and declared its decision not to restore the flow of these canals, unless west Punjab recognized that it had no rights to the water and resumed the flows only after Pakistan made a payment to India. This situation was extremely stressful for west Punjab farmers dependent upon them (Uprety et al., 2010).

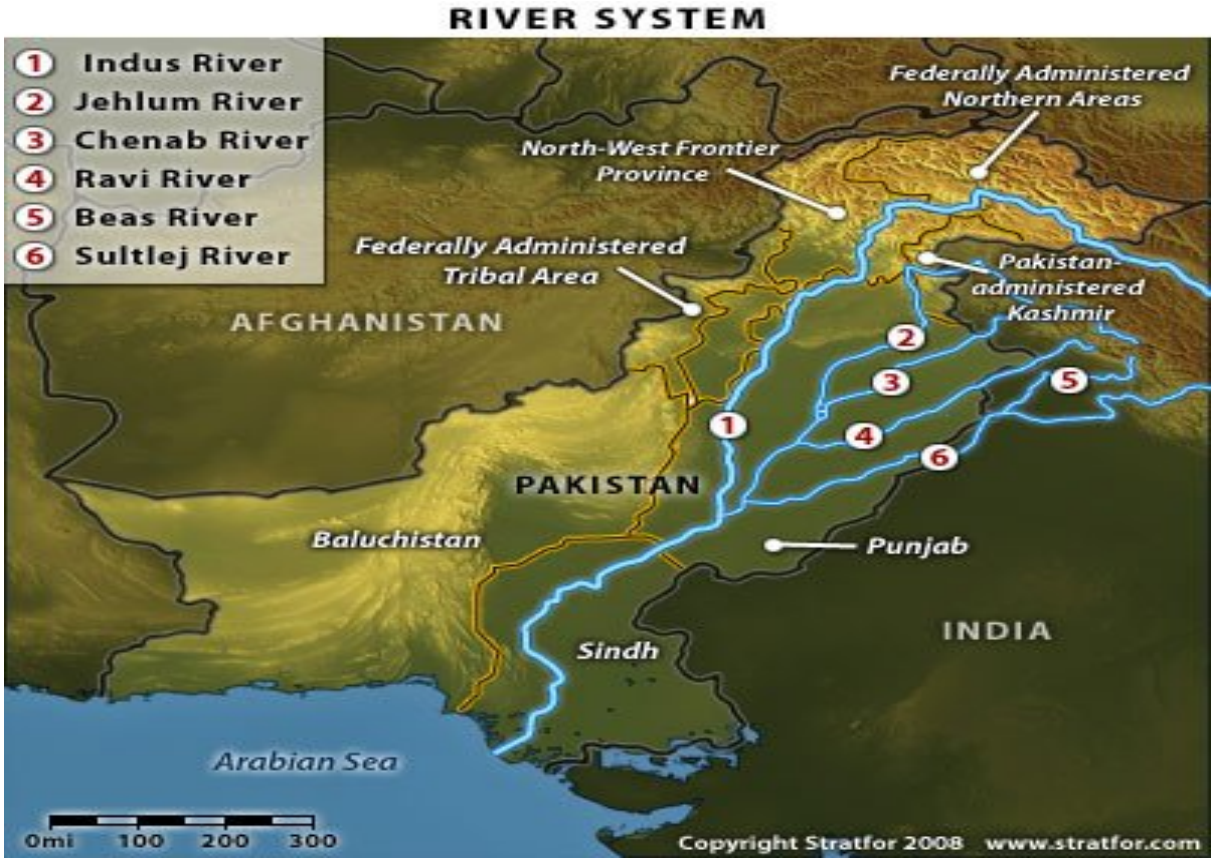
In May1948, Simla agreement was signed but, Pakistan rejected it in early 1950s arguing that it has been forced upon them. From the early 1950s the situation had reached to a deadlock and there was no communication over water between both countries for a long period of time (Allouche, 2005).

4.4 Indus Water Treaty (IWT):

The president of International Bank of Reconstruction and Development, Mr. Eugene Black offered his good office to settle the water dispute. After close to eight years of negotiation the IWT came into existence. The IWT was concluded by India and Pakistan with the World Bank's mediation on 19th of September 1960 (Swain, 2009). IWT based on the allocation of Indus and its tributaries. According to IWT the three Eastern Rivers (Ravi, Beas and Sutlej) allocated to India

and three Western Rivers (Indus, Jhelum and Chenab) allocated to Pakistan. India has unrestricted use of the Eastern Rivers and Pakistan has a right for the exclusive use of Western Rivers. India can use the water of Western Rivers for hydropower generations, to meet the domestic, Industrial and irrigation requirements of Jammu-Kashmir and also develop these tributaries for flood protection, floating of timbers and fishing (Zahawari,2009). It clearly mentioned in IWT that, Pakistan has to construct infrastructure to meet the Eastern Rivers needs from the Western Rivers and India has to pay fixed amount of money to Pakistan to build infrastructures. Both parties have to regularly exchange flow data.

Fig 6: Indus Water Treaty and river system



Source: www.stratfor.com

A permanent Indus commission (PIC) established to supervise implementation of the IWT. Implementation of IWT with the involvement of PIC is one of the successful agreements for resolving trans-boundary water issues. PIC worked very well for maintaining the soul of treaty. The commissioners are obliged to meet once a year, altering their meetings places between the

two countries. During their meetings, they plan and organize their tours, exchange data and information regarding the current and future developments. If either of the countries have questions, regarding the projects and maintenance work, the problems can be referred to PIC. If PIC is unable to resolve the issues, then the question becomes a difference and could be referred to a Neutral expert, either appointed by two members of commission or by a third party (World Bank's) (Uprety et al., 2010). If the neutral expert failed to solve the difference then it should be treated as disputes and then International Court of Arbitration (ICA) could be establish to resolve the disputes. (Swain, 2009).

4.5 Water Crisis in the Indus Basin:

Pakistan is one of the world's most arid countries with an average rainfall of less than 240 mm (Briscoe et al., 2005). Indus water is the only source of water for domestic agriculture and industrial needs. Agriculture importance is like the backbone in Pakistan's economy. Indus flow plays a major contribution in maintaining and developing Pakistan's economy as it provides over 60% of the water utilized for irrigation purposes (Miner et al., 2009). Continuation in population growth with high demand of food, water and energy increasing strains on limited water resources. Now a day Pakistan faces a very severe water crisis. One third of the country population is living under water stress condition. An estimated report of November 2008 shows that out of 165 million population of Pakistan, 25% are below poverty level, 98 million rely on agriculture, 50 million do not have access to safe drinking water and 74 million have no sanitation. The gap between demand and supply is widening. In 2004, water shortfall was 11 MAF which is expected to ascend to 31 MAF in 2013. Water availability has been declining at an alarming rate from 5000 cubic meter per capita in 1951 to about 1100 cubic meter currently and it has been projected to less than 700 cubic meter by 2025 (World Bank, 2006). Pakistan's total water demand in 2025 is projected to 338 bcm suggesting a gap of 100 bcm (Toufiq et al., 2004).

Compared to Pakistan, India is a semi arid country. Over 70% of Indian's live in rural areas and agriculture is the primary source of their livelihood. About 200 million people are directly employed by agriculture (Government of India Ministry of Agriculture 2005). Population is

growing rapidly after China, India is the second largest country having population of 1,241 million (2011 world population datasheet). Rising population with high demand of water put more pressure on limited resources. India's per capita water availability has declined from 5000 cubic meters in 1950 to 1800 cubic meters in 2005 (Akhtar, 2010) and it has been assumed that per capita water availability will fall below 1000 cubic meters by 2050. Growing demand of food and energy pushed India to concentrate for water conservation and power generation projects. Many analysts argue that GDP growth of 7% per year requires a 10 % increase in annual supply. India booming economy needs energy to grow particularly in Jammu and Kashmir that has many potential hydroelectric sites despite the fact that, Jammu and Kashmir faces energy crisis. Despite the potential of 30,000MW of power, 25% of our population has no access to electricity and 75% is getting episodic electricity (Parvaiz, 2011).

High demands of water to meet the challenges of rapid increase in population, increased urbanization and industrialization creating a competing environment for a limiting water resource. Limited water availability with high demand also creates some sort of intrastate tensions in Pakistan and India. Both countries desperately need water for booming their economy and trying hard to get access as much as they can. Although, the Indus water treaty has been successful in managing the war between Pakistan and India two and half times and worked very well for more than 50 years. But, there are series of disagreement going on between both these riparian countries.

4.6 Baglihar Hydroelectric Dam:

Baglihar Dam was one of the most controversial issues. India planned to build Baglihar dam on the Chenab River 60 miles up streams from the Pakistani border. Under the IWT India has a right to build upstream non storage facilities but it must not alter or influence the flow of the river. Pakistan had a number of objections over the construction of this dam. Pakistan claimed that dam design did not following the criteria (a), (c), (e) and (f) of paragraph 8 of Annexure D to the treaty.

- Criteria (a) states that the work shall not be capable of raising the water level artificially above the full pondage level specified in design. Pakistan claimed that dam design is

excessive and provided ability to India for raising artificial water level above the full pondage level (Bhatti, 2011 and Uprety et al., 2010).

- Criteria (c) requires that the maximum pondage in the operating pool not to exceed twice the pondage required for firm power and Pakistan claimed that the pondage in operating tool mentioned by India is excessive. So it should be reduced (Bhatti, 2011 and Uprety et al., 2010).
- Criteria (e) state that if the conditions for gated spillway is necessary, the bottom level of gates in normal closed position shall be located at the highest level consistent with sound and economical design. Bone of contention on this point, Pakistan claimed that design was not based on reality and correct estimates of flood discharge. Pakistan claimed that spillway was not necessary. Either un-gated or surface gated spillway could be provided with the bottom of the gates with the highest level (Bhatti, 2011 and Uprety et al., 2010)
- Criteria (f) require that intake for the turbine shall be located at the highest level coherent with sufficient and economical construction and operation of the plant as run off river plant. Pakistan had an objection that the location of intake power is not at the highest level as mandated in IWT (Bhatti, 2011 and Uprety et al., 2010).

Although, both countries tried hard to settle the issue by themselves but bilateral negotiation did not bear any productive result. So, first time in the history of IWT, on January 15, 2005, Pakistan asked for World Bank to appoint a neutral expert to resolve the differences over Baghliar dam. After five months of the original request, Raymond Lafitte, professor of Swiss Institute of Technology in Lausanne was appointed as a neutral expert to address the differences regarding Baglihar project.

In February, 2007, Lafitte delivered his final decision to both parties and also one copy of decision to World Bank. In his report he partly addressed some objections of Pakistan like, reduced the pondage capacity, increased 3m height of power intake and acknowledged India's right to construct gated spillway. Both countries agreed to follow the final descision of the neutral expert.

But, the dispute again activated when, India filled the dam during the dry season in 2008, that seriously disturbed the livelihood and agriculture production of Pakistan. Pakistani media and local people blamed that India stole water having rights of Pakistan. The filing of Baglihar dam above Marala reduced the flow as low as 20000 cusec, whereas India obliged to maintain the minimum inflow at the level of 55,000 cusec (Bhatti, 2011). Pakistan lost about 2 MAF of water from August, 25, 2008 to September, 4, 2008 and it adversely affected Pakistan's wheat crop (Kugelman, 2009). President of Pakistan even raised the issue in his speech to the UN General Assembly (Swain, 2009). Pakistan strongly protested and claimed that India is violating the IWT. But this time, Pakistan decided to solve the issue by negotiation. Indian commission admitted that reduction was because of unavailability of any mechanism to pass the flow at the low level. He explained that this happened because we were expecting heavy rainfall during these days. Pakistan's Indus commissioner in an interview told that although "Pakistan felt that parameter and procedure mentioned in IWT were not followed during the initial filling of the dam. We have resolved the differences on the initial filling of the dam in a spirit of cooperation and good will and India gave us the insurance that it will be careful in future" (Parasi, 2010).

4.7 Wullar Barrage/ Tulbul Navigation Project:

Wullar barrage or tulbul navigation project being constructed by India on Jhelum River just below Wullar lake located 25 kilometers north of Srinagar at 5180 feet above sea level (Noorani, 1995). The project has been started by government of Indian state of Jammu and Kashmir. The dispute emerged in 1985 when Pakistan learnt through the notification of tender notice in newspaper. Pakistan calls it a Wullar barrage constructed by India for storage purposes and India refer it as a Tulbul Navigation project for transportation of fruits and timbers (Misra, 2007).

Pakistan strongly opposed the construction of this project. Pakistan claimed that construction of such a project on that site had a potential to unfavorably affect the triple canal project in Pakistan namely, Upper Chenab Canal, Upper Jhelum Canal and lower Bari Doab Canal. Pakistan believed that construction of this barrage would provide India with the means to control over River Jhelum that could facilitate India to stop water flow during winter (Bhatti, 2011). The

Mangla Dam on Jhelum River, which is a main source of irrigation and electricity for Punjab, would be adversely affected. Moreover, Pakistan has an apprehension that India could close the gate of barrage during war so, enhancing the ability of Indian troops to come in Pakistan. Pakistan remembered in the connection of 1965 war, when Indian army had failed to cross the Bambanwali Ravi Bedian Link Canal because of its full flow.

Indian government argues that, the purpose of Tulbul project is only to improve the navigations in Jhelum River during lean month in order to connect Srinagar with Baramula (Misra, 2007). Indian claimed that 90 percent of this project would be beneficial to Pakistan, as it would increase the power generation capacity of Mangla. The project would regulate the supply of Mangla dam as well as increase the efficiency of irrigation network in Pakistan Punjab. India argues that the Tulbul Project would be effective in reducing the flow of water during the flood seasons and suggest that Pakistan should bear the share of construction (Uprety, 2010). Pakistan assert that the Wullar barrage capacity is more than 300,000 acre feet and according to IWT, the India is only allowed to construct storage work on western tributaries, if it does not exceed 100000 acre feet and the design has been approved by Pakistan. Pakistan referred this issue to the Indus commission in 1986, but commission failed to resolve it. Pakistan then decided to take the case to a International court of arbitration (ICA), but India postponed the construction. About ten rounds of talk have already been done but only with little progress. Pakistan gave an option to stop the construction of Kishanganga project on Neelum River, which would affect the Neelum-Jhelum Project constructed by Pakistan.

4.8 Kishanganga Hydroelectric Project (KHEP):

Now the current controversy is related to Kishanganga hydroelectric project (KHEP) that entangled two countries in conflict. This is the 330 MW Hydropower project in India about 160 km upstreasm of Muzaffarabad. The KHEP involves the 100 km diversion of Kishanganga River (called the Neelum Riverin Pakistan) to a tributary named Bunar Madumati Nullah of Jhelum near Bunkot, through a 22 km tunnel. The water will rejoin the Jhelum through Wullar Lake near the town of Bandipur in Baramula district. Neelum is the greatest tributary of Jhelum River and runs about 150 km in Pakistan controlled Kashmir before it joins the Jhelum River near

Muzafarabad. Because of this diversion, instead of Muzafarabad it will rejoin Jhelum in Indian controlled Kashmir. This diversion will change the direction of river about 204 km before it joins the Jhelum River near Muzafarabad, the site where Pakistan Neelum-Jhelum hydel Project is situated (Akhtar, 2010).

4.8.1 Objectives of India on Kishanganga project:

The Indian objectives over the construction of Kishanganga hydropower projects are:

- To augment power output of Uri Hydel Power Project (480 MW) by additional regulating water
- To augment supplies in the Wullar Lake for use during the lean period.
- To utilize the hydroelectric potential of J&K for the states of Punjab, Haryana, Himachal Pradesh, Chandigarh, Rajasthan and Delhi (Admin, 2009).

Table 5: Salient Features of Kishanganga Dam

Typen of dam	Concrete gravity dam
Length	268 m
Height	75.5 m
Live storage	1,40,700 acres
Total storage	1,78,200 acres
Dead storage	46.25 m^3
Maximum discharge	70,500 cusecs
Capability of reservoir	220 m^3
Capacity	330 MW
Number of gates	4

Type of spillway	Gated type
Length of spillway	60 m
Crest level	2422 m

Source**:** (Admin, 2009)

4.8.2 Pakistan's Apprehensions:

Pakistan first received a report about the Indian's plan of this project in 1988, while India officially confirmed it in 1994. Pakistan claims that India is violating the IWT by diverting the water and water drawn from a given tributary must be return to the same river. According to IWT, upstream must release as much water as downstream have the capacity to store it and the diversion will also affect the ecosystems, it submerged the Pakistan controlled Kashmir and entire Neelum valley. It will affect 133, 000 hectors of irrigation in the Neelum valley. Pakistan also claims that 11 percent of water flow in summer and 27 percent flow in winter would reduce due to Kishanganga project. The Hydropower generation capacity of 969 MW Neelum-Jhelum Project which Pakistan is constructing on Jhelum River would reduce by 11 percent. The Kishanganga dam could reduce Pakistan's total water availability from an estimated 154 MAF per year and may affect a significant portion of the Mangla dam storage capacity besides declining the pressure required to generate electricity in Neelum-Jhelum Power Project. Pakistan also claims that the feasibility study of Neelum-Jhelum project has acquired right in favor of Pakistan. (Admin, 2009).

4.8.3 India's Apprehensions:

India argues that the diversion will not affect the flow of water because the quantum of water will be the same as it before. The diversion of river is not matter instead of meeting in Pakistan controlled Kashmir it would meet in Indian controlled Kashmir. India also rejected Pakistan's objection of favoring feasibility study by quoted the Indus water treaty according to that the project authorized first would give top priority *(*Admin, 2009).

In May 2004, India promised to freeze all its work on the site and hold a meeting with Pakistan to remove its objections. Pakistan raised six objections of which one related to the power generation scheme, two to the diversion of water and three related to the design of dam. The issue was discussed in five meetings from November 2004 to November 2005 but it did not bear any prolific results. In 2006, India submitted the revised plan of the project, brought down the storage capacity by reducing the height of dam from 75.48m to 35.48 m. Pakistan rejected the revised plan having objection over the diversion of the water. Because, it will adversely affect the Neelum-Jhelum Project capacity, that Pakistan has a plan to complete in 2015 one year before the completion of KHEP.

According to the press report Pakistan Indus water commission Sayed Jamat Ali Shah said that New Dahli is not cooperating with us. Indian Government is not providing any project information before according to Indus water treaty the states have to share information on any new project before six month of starting.

“India never stole or blocked Pakistan's share of waters and has assured Pakistan that New Delhi would implement Indus Water Treaty in letter and spirit”.

Indus Water Commissioner of India G. Auranganathan (Shaukat, 2010) .

Chairman Indus Water Treaty Council Hafiz Zahoor-ul-Hassan Dahr has stated that like the 131 round talk between Pakistan and India under Indus water treaty not bore any fruit and the latest series of dialogue would meet the same result (The Nation, 2010). India is still willing and in favor of bilateral talk but Pakistan decided to take this issue to World Bank. So, Pakistan sent a legal notice to India on 20 May 2010 on Kishanganag hydropower project (Sify news, 2010).

Because of the technical and legal objections, first time in the history of IWT, Pakistan took this issue to ICA. Pakistan nominated Jan Paulsson, head of Norwegian international law firm, and Bruno Simma, of the International Court of Justice, as its arbitrators in the Court of Arbitration. India nominated Peter Tomka, Vice-President of the International Court of Justice at Geneva and Lucius Caflisch, a Swiss international law expert who is a professor at the Graduate Institute of International Studies to represent it in the dispute. Although the two countries have rejected each other’s nominees for the Court of Arbitration, they decided to set up a panel comprising a

chairman, a legal member and an engineer to select the umpires, by drawing lots. In response to the Pakistan appeal, ICA on 25th September, 2011 has barred India from going ahead to work on controversial KHEP on Neelum River (Raza, 2011).

4.9 Future Projects:

Besides the above mentioned disputes, according to some expert in Pakistan, India has a plan of number of hydro project on the western rivers that has been attributed to Pakistan according to IWT. The list of that project is given in below tables (Bhatti, 2011).

Table 6: Indian Projects on Western Rivers

Indian Projects on Chenab River					
No	**Name of Plant**	**Location**	**Discharge**	**Power Capacity**	**Status**
1.	Baglihar (Phase-I)	147 kms U/S Marala HW	430	450 MW	Completed
2.	Salal	45 miles U/S Marala HW	14550	690 MW	Completed
3.	Dulhasti (I&II)	Near Kishtwar on Chenab River	7522	780 MW	Completed
4.	Rajouri	On Darhali Nallah a sub tributary of the Cheab	87	3 MW	Completed
5.	Killer	On Mohal Nullah a tributary of Chenab	43	0.3 MW	Completed
6.	Thirot	On thirot Nullah a tributary of Chenab Bhaga	81	4.5 MW	Completed
7.	Shansha	On Shansha Nullah a tributary of Chenab	50	0.2 MW	Completed

8.	Billing	On Billing Nullah a tributary of Bhaga	25	0.1 MW	Completed
9.	Sissu	A tributary of Chenab	25	0.10 MW	Completed
10.	Chinani-II	ON Jammu Tawi River	251	2 MW	Completed
11.	Bhadarwah (Remodling)	ON Haloon Nullah a tributary of Neeru Nullah	300	1 MW	Completed

No	**Name of Project**	**River/ Tributary**	**Capacity**	**Status**
1.	Sawalkot Stage-I & II	River Chenab	1200 MW	PFR & DPR prepared
2.	Kiru	River Chenab	430 MW	DPR prepared
3.	Pakal Dul Stage I & II	River Chenab	1020 MW	PFR & DPR prepared
4.	Ratle	River Chenab	560 MW	DPR prepared
5.	Bursar	River Chenab	1020 MW	PFR & DPR Prepared
6.	Kirthai Stage I & II	River Chenab	600 MW	PFR prepared
7.	Shamnot	River Chenab	370 MW	PFR prepared
8.	Naunat	River Chenab	400 MW	PFR & DPR Prepared
9.	Karwar	River Chenab	520 MW	DPR prepared
10.	Barinium	River Chenab	240 MW	PFR prepared
11.	Patam	Miyar Nallah	60 MW	Yet to be

				investigated
12.	Teling	River Chandra	81 MW	Yet to be investigated
13.	Tinget	Miyar Nallah	81 MW	Yet to be investigated
14.	Miyar	Miyar Nallah	90 MW	Yet to be investigated
15.	Tandi	River Chenab	150 MW	Yet to be investigated
16.	Rashil	River Chenab	150 MW	Yet to be investigated
17.	Dugar	River Chenab	360 MW	Yet to be investigated
18.	Chhatru	River Chandra	108 MW	PFR prepared
19.	Khoksar	River Chandra	90 MW	Yet to be investigated
20.	Seli	River Chenab	150 MW	Yet to be investigated
21.	Bardang	River Chenab	114 MW	Yet to be investigated
22.	Sachkhas	River Chenab	210 MW	Yet to be investigated
23.	Gondhala	Bhaga Nallah	144 MW	PFR prepared
24.	Reoli	River Chenab	715 MW	Yet to be investigated

Indian Projects on Jhelum River		
S/No	**Name of Plant**	**Location**

1.	Uri HE Plant	16 miles downstream of Baramula
2.	Pahalgam	Anantnag
3.	Bandipura	On Madmatti Nullah, tributary of Jhelum
4.	Sambal HE Plant	Near Village Sambal, at a trtibutary of Jhelum
5.	Lower Jhelum HE Plant	8 miles downstream of Baramula
6.	Asthan H/E Plant	Asthan Nullah, a tributary of Kishenganga River
7.	Matchil HE Plant	Dadhi Nullah
8.	Dachhigam HE Plant	Degwan Nullah
9.	Karan HE Plant	On Kesharkatta Nullah
10.	Kamah HE Plant	Qazi Nag Nullah, a tributary of Kishenganga Nullah
11.	Upper Sind HE Plant	Wangat Nullah
12.	Parnal HE Plant	Suran River, a tributary of River Poonch
13	Poonch HE Plant	Betar Nullah

Source: (Bhatti, 2011).

5. DISCUSSION

5.1 What does all this mean?

The human activity (building infrastructure, agricultural pollution etc.) and water resource interaction creates a complex situation. High population density, climatic change, fluctuation in annual flow of water and poor managements creates a water scarce situation. Competing demand for scarce water resources not only creates tension among users, also affect environment and ecosystem. In case of international rivers the situation become worst as it develop political tensions and regional instabilities.

The Indus River is shared between Pakistan, India, China and Afghanistan. Pakistan and India are mainly dependent on the Indus water flow. In general people living in the basin whether in Pakistan or India are dependent on this River for their livelihood. Both countries are highly dependent on the water because their economy based on agriculture and industrialization. Farming is their main activity. For Pakistan, the Indus flow is the life blood. Pakistan is located in semi arid to arid region with an average rainfall less than 240 mm. irrigation is the main source for agriculture practices and 74% of Indus irrigated area falls in Pakistan region. Pakistan is nearly under water stress condition having 1000 cm^3 per capita availability below which social and economic consequence are badly affected. India steadily moving towards danger zone there is 60 % reduction in per capita availability of water from the last 50 years and it has been estimated that in next 50 years equal reduction is possible**.**

Increase in population density with greater requirement of food and energy needed high water demands. To meet the future demand both countries are striving utmost to get access of maximum water. In their quest, they often overlook the need and values of each others. The competition over Indus water share resource is affecting Pakistan and India relationship and is a constant source of tension. Although, 1960 IWT signed between India and Pakistan for the purpose to resolve all water related issues. According to that Pakistan is allocated to 135 million acre feet (SRSIS-NTS, 2011) of water annually and India can use the water of western rivers for non consumptive purposes. A permanent Indus Commission (PIC) established for monitoring

and implementation of IWT. IWT worked very well more than 45 years but from the last few years, disputes emerge among states on water issues.
After analyzing the issues three following major claims can be extracted.

5.1.1 Limitations in IWT:

Agreements on water have the prime importance in water allocation. It brings the national and international community to the same table for the joint management of their common resource. Signing agreements over water sharing might be easy but the real problem is to keep alive the agreements in letter and spirit. Agreements over share water resource not only motivate the riparian states to work together but also can be a source to promote peace and cooperation among states on other mutual issues. But the validity of agreements depends on the mutual interest of all the stakeholders, strength of their relationship, level of interdependency and cooperation. States with a good political relationship and mutual interest tend to co-operate more affectively then adversarial states. Agreements with good characteristics need to be workable for a long period of time. Only then they can positively contribute in peace and cooperation within a basin by addressing the future water needs of the riparian countries (Swain, 2007).

The 1960, Indus water agreement (IWT) signed for water allocation of Indus River between Pakistan and India. IWT worked very well for more than forty five years. During this time period both states have a difference on many issues but they settle the dispute by themselves. PIC tried hard to work in letter and spirit for the implementation of IWT. But one of the main drawbacks is the amputation surgery of the Indus basin into two. According to IWRM the whole basin should be treated as a single unit so that states can cooperate in more effective way for the sustainable management of river and land resources. But, this division reduced the level of cooperation among states. Although both state are highly interdependent on each other for the construction of infrastructure and pollution control etc. But in this agreement the level of joint basin management seems to be missing.

Another drawback is missing the perception of all stakeholders, their needs and future demands. Jammu and Kashmir is a disputed territory of which major part is under the control of India. At the time of treaty the population of Jammu and Kashmir was 3.5 million which now has increase

three times. Increase population demanding more water and energy for boosting their economy. While, according to IWT Jammu and Kashmir can use only 10% of hydroelectric potential and 40% of cultivable land. Due to this restrictive use, people in Jammu and Kashmir facing high energy crisis.IWT signed in 1960, with the simple division of Indus basin without considering the future need. According to IWT, annually 135 MAF water were allocated to Pakistan. Compare to that time Pakistan population now has grown three times. Population growth result in declining per capita water availability. Now, Pakistan is under water scarce situation and the situation become worst in future if the current circumstances go as such.

5.1.2 Lack of Trust and Cooperation:

Effective transboundary cooperation over shared water resources is closely related to the establishment of institutional organizations. Sufficient institutional capacities within an enabling environment are necessary for promoting good cooperation in order to manage the international river basins. Cooperation over shared water resource maintains regional stability by promoting peace and improving economic efficiency. Cooperation will enable better management of ecosystem, providing benefits to the river and underpinning all other benefits that can be derived. Cooperation over shared water resource can ease tension and provide gains in the form of savings that can be achieved (Sadof, et al., 2002).

Sustainable international rivers development depends on the cooperative management strategies. The IWRM concept of building cooperation at political, institutional and technical level within an enabling environment is the complimentary element for sustainable river basin management. Transboundary cooperation depends on the political, geographic and cultural circumstances. The countries having a bad history of political relations are less cooperative than others. Even in the presence of bilateral agreements, such countries are more reserve to cooperate unconditionally because of trust deficits. The establishment of an internationally acceptable legal principle to share the common rivers may itself not bring a solution. Complex water disputes can only be solved by co-operations and compromises (Swain, 2007).

IWT 1960 agreement is a successful bilateral agreement that obliged both states to cooperate on water management issues under the supervision of PIC. The commission is trying hard to

monitor and implement of the IWT. As both states are striving to utilize limited resources with full potential by constructing hydropower projects and storage reservoirs. Pakistan claimed that India is not providing fair information on time as obliged in IWT to share information on any project before six month to start. Pakistan as a lower riparian has a fear of flood and drought by the construction of Indian's projects on western rivers and have a perception that India would be able to harm Pakistan during war time. These unilateral actions performed by upstream bear a fear of water scarcity to lower riparian.

Although, India is denying Pakistan's objections but this distrust environment is a result of lack of joint river basin management institutions, poor political relations and lack of cooperation. Due to poor historical political relations and lack of information exchange, a trust deficit environment has been developed between both states, that's became a major obstacle to achieve potential cooperation. This lack of trust and cooperation has led to several negative social, environmental and economic impacts, creating regional instabilities by affecting the livelihood of local people in Pakistan.

5.1.3 High politics:

International rivers are more prone to conflict because of the involvement of more than one state interest. Poor state relations and lack of trust makes the water issue more politicize. States focused on other issues like nation security instead of considering the overall cooperative management of shared water resources. The involvement of political bodies in policy making and implementation put the water in less priority.

Indus river system also has the same effect. Because of the hostile relationship between Pakistan and India the element of effective joint cooperation seems to be missing. Kashmir issue and Pressure of fundamentalist group of people from both sides is the major obstacles in resolving water related issues jointly. Moreover, as Indus seems to be a more political case; lack of accountability and transparency is highly observable in Indus water issue. Water governing authorities from India fear to give relevant information before time. All these Situations are the hindrance in joint management of Indus River Basin.

5.2 Revision of treaty:

Many analysts from Pakistan claim that IWT is not in favor of Pakistan and experts from Kashmir have opinion that IWT is limiting their right to use water. The 1960 agreement of IWT does not fulfill the requirement of IWRM. IWRM is holistic and participatory approach; focus on the integration of all the sectors in decision making and implementation by considering the perspective of all stakeholders for sustainable management. This element of all stakeholder participation seems to be missing in 1960 agreement. The other major limitation of IWT is missing the considerations of future water demands. Treaty was signed when water was abundance and now due to high population growth and climate change both countries are facing water scarcity. Some experts also argue that IWT is not supporting the concept of IWRM because of the partition of Indus into two parts. According to IWRM, the whole basin should be taken as a single unit and it is essential to consider its social, economic and environmental interest for sustainable management. The partition of Indus basin into two has divided the interest of the users and also affected the environment and ecosystem of Indus basin.

IWT worked very well for more than forty five years, till now both countries are striving to implement the treaty with soul and spirit. The current circumstances reveal that IWT does not seem to work efficiently in future. Both countries have high water need for boosting their economy and to meet the future demands. To prevent the future disasters of acute water shortage, there is a dire need to revise the treaty according to the present and future demand of all the states while keeping in mind the environmental sustainability and equity.

Although, IWT obliged both countries to be interdependent before taking any action on Indus river but the level of cooperation is very low. The unilateral actions of India like construction of dams for hydropower generation and navigation projects extremely affecting the livelihood of Pakistan. As Indus is the life blood for Pakistan, is facing a high water scarcity situation and the conditions will become worst in near future. Now, there is a need for both countries to come forward and reconsider the IWT in a comprehensive way by involving the participation of all major stakeholders and considering their interests, needs and future demands.

Sustainable river basin management needs an effective role of river basin organizations. Organizations for managing share water resources could work efficiently, if they are independent to make decisions and willing to cooperate fairly. Under the revised treaty, a joint river basin organization should be established for sustainable and efficient utilization of Indus water resource. The organization should be independent and free to make decisions without any political pressure. There should not be any political interference in decision making and management of river resources. Working efficiency of joint river basin organization become strong by the participation and joint work of technical staff from riparian countries in analyzing the situation and decision making process.

As, in case of Columbia River, the 1964, Colombia river treaty between USA and Canada has provided significant benefits through the coordinated river basin management to both countries. To analyze the future flood and power situation both countries are cooperating on joint river basin management. There is no interference from political sides, only technical staffs are responsible to analyze the future needs and management requirements. After analyzing the whole situation the member of technical staff is free to take decision that is beneficial for both countries (U.S Army Corps of Engineers, 2009). There is a need to organize such type of joint Indus river basin organization for the sustainable management of limited Indus water resource. Establishment of joint river basin organization could be a catalyst to build trust among these two hostile riparian and will also enhance the benefit sharing. Sharing the benefits of cooperative water management is an integral part of the successful treaty design and implementation. In revised treaty, whole basin should be considered as a single unit and all states should oblige to cooperate fairly.

Cooperation at political, institutional and technical level is vital to manage share water resources effectively. Effective cooperation between states on shared resource not only improves the better management, it also enhances the regional stability by reducing the tensions at international levels. Establishment of joint river basin organization will be helpful in promoting cooperation by improving the level of transparency and accountability.

6. Conclusion:

Water as a sign of life is essential to maintain the daily life routine. Water as a limited resource is under stress due to the high population density, climate change, urbanization and poor management. Competing demand on a limited resource contribute in arising acute water conflicts and disputes among the users whose livelihood mainly depend on it. In case of the international rivers the situations become more complicated. The rivers cross political boundaries, sometimes difficult to manage because of the poor political relationship.

Indus River is shared between four riparian countries. Pakistan and India are the two major countries dependent on Indus water flow. The 1960 agreement of Indus Water Treaty was signed between Pakistan and India for sharing the Indus water resource. This agreement was based on the amputation surgery of Indus River that gave the right of three eastern tributaries (Ravi, Beas and Sutlej) of Indus to India and western tributaries (Jhelum, Chenab, Indus) to Pakistan. Now, because of the high population density, climate change and high water demand both countries are facing water stress situation and trying hard to get as much water as they can. Construction of dams, hydropower units and navigational project is a need to meet the future challenges of water and energy crisis. Building of such infrastructure without considering the value and norms of other creates conflict among both countries. The reason behind this conflict is the lack of cooperation because of the poor political relationship and distrust among both countries. In case of international river basin Cooperation and coordination is necessary for the regional stability and sustainability.

Sustainable river basin management is necessary for the prosperity and regional stability and it depends on the political will, cooperation, coordination and compromise. Application of IWRM approach at basin level is best for sustainable Indus river management. In the presence of high political will and commitment, the IWRM framework of enabling environment, institutional arrangement and managing instrument are the best tool for the successful application of IWRM at basin level. It is not always possible to apply all the element of general IWRM framework at once. So, a step by step proceeding is vital for effective application of IWRM (GWP, 2009). In case of Indus River, it can be easier as compared to other international rivers, because of the

already existing international water agreement and organization. Now, there is just a need to revise the 1960 agreement by considering the future needs and perception of all stakeholders. An independent joint river basin organization should be established that make policy and decision without any political pressure by inviting and considering the perception of all major stakeholders for sustainable management.

7. References

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