Indus Basin Transboundary Water Issues in Past and Present Perspective

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Abstract

Indus basin river system comprises the main Indus and its five tributaries. Irrigation infrastructure in the basin makes it the largest contiguous block of irrigated agriculture in the world. At the time of partition of the sub-continent in 1947, boundaries between Pakistan and India were demarcated without due consideration of headwaters and their command areas. Resultantly, the rivers source waters and headworks of canals commanding huge area in Pakistan went under Indian control, giving rise to severe water sharing dispute. Inter-riparian negotiations failed but with the mediation of World Bank, Indus Water Treaty was finally signed in 1960. The treaty is comprehensive document whereby the three western rivers were allocated to Pakistan and the three eastern to India. The other provisions of the Treaty were constitution of Indus Water Commission, data exchange and dispute resolution mechanism. Over the years, the Treaty worked well for resolving transboundary water issues between the riparians. However, population growth and surging food and energy demands coupled with water scarcity gave rise to differences and disputes during the last couple of decades. This paper overviews water disputes between the two countries and sharing transboundary waters in the past and the present perspective. It highlights lacunae of the Treaty in the context of current era of climate change, environmental degradation and technological developments. It further suggests framing and implementing universal laws based upon equitable and fair sharing of transboundary waters all over the world for avoiding water wars.

Keywords : IndusBasin, Transboundaries, Water Resources, Water Issues

Introduction:

The Indus Valley is one of the most advanced ancient civilizations. It is also called cradle of civilizations owing to its substantial fertile land resources, waters of mighty Indus river system and favorable agro-climatic potential. The valley is segmental homogeneous with plain extending from foot hills of Himalayas to the coast of Arabian Sea, bounded on the west by Kirthar and Suleiman mountains ranges, on the east by Punjab plains up to Ambala and Kalka in India whereas low lying ridges divide it from the plains of Yamuna River. Length of Indus plains from Himalayan piedmont to Arabian Sea is more than 1500 km whereas its width in Punjab is up to 325 km. Expanse of the Indus Basin is shown in Figure 1. Almost 53 percent of the basin area lies in Pakistan. Indus basin is geographically divided into doabas, the land between two adjacent rivers, and each doaba derives its name from the bounding rivers. The initial agriculture in the plains commenced in about 3000 BC (Fahlbusch *et al.*, 2004). Inundation canals were traditional practices for managing irrigated agriculture. Modernization and expansion of irrigation system however commenced in the British era in the middle of the last century. It is now one of the world's marvelous and the largest contiguous irrigation system.

Figure 1 : Expanse of the Indus basin
(Source: http://www.rifah.org/site/the-indus-accord-1960)

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Climate

In general the Indus basin is divided into three climatic regions namely, Himalaya zone, Sub-Himalaya zone and plains. The overall climate varies from sub-tropical, semi-arid and arid in plains to sub-humid and alpine in mountainous highlands of the north. Precipitation has both temporal and spatial variation occurring in summer as well as winter. High precipitation occurs in southern slopes at altitudes between 900 to 1530 m whereas it is about 1250 mm in a strip of around 125 km wide east of main Jhelum River and goes up to 1800 mm in Himachal Pradesh which falls in Bari Doab. Precipitation in most of the upper Indus catchment is less than 800 mm and falls as low as 75 mm in Leh, where it mostly occurs in the form of snowfall at an altitude above 5000 m. Climate of Ladakh range areas is also very dry where rainfall is scanty but snowfall is frequent and at times heavy. Sub-Himalayan regions have 800 mm annual rainfall in the east and 375 mm in the west which decreases generally from northeast to southwest from about 750 mm to less than 125 mm in Sind (Fahlbusch et al., 2004). India is the second wettest country of the world where average annual rainfall is 1170 mm against the world average of 870 mm (Kumar, 2006). Contrary to that, climate of Pakistan is predominantly arid and semi-arid where more than half of the country receives less than 205 mm rainfall (Kahlown and Majeed, 2004)

Indus River System

Indus River System comprises the mighty Indus River and its 27 tributaries, of which 13 are in the hilly areas and 14 are in the plains. Total area of the **Indus Basin** is about 114 million hectares of which Pakistan covers major part of about 60 million hectares as detailed in Table 1, Table 2. It is fed by the world's three highest mountain ranges namely the Himalaya, the Karakoram and the Hindukush. The major tributaries are Jhelum, Chenab, Ravi, Beas and Sutlej which join the main Indus from the east, whereas the River Kabul combined with River Swat join from the west as detailed in Table 2. The average annual discharge of Indus River system is 207 BCM and stands to be the 21st largest river in terms of flow and the 6th largest in terms of length.

Table 1 : Distribution of the catchment area of Indus River Basin

Country	Drainage Area (million ha)	Percent area of country in the basin (%)	Comments
Pakistan	59.80	52.48	-
India	38.32	34.35	1600 km^2 Indian control, claimed by China
China	8.58	6.83	9600 km^2 Chinese control, claimed by India
Afghanistan	7.21	6.33	-
Total	**113.91**	**100**	-

Source: Estimated from data obtained from Government of Pakistan, Water and Power Development Authority, Lahore. Cited in, "Emerging Challenges to Indus Water Treaties" (Akhtar, 2010)

Table 2 : Salient features of the Indus River and its tributaries

River	Origin	Path	Length/ /annual flow	Tributaries	Glaciated Area (%)
Indus (Main)	Mansarowar lake, Tibet	Kashmir, Skardu, Tarbella, Multan and Arabian Sea	2880 km 100 BCM	Hunza and Gilgit at Raikot, Kabul at Attock and Chenab at Mithankot	12
Jhelum	Verinag spring, Indian Kashmir	Wular Lake, Muzzaffarabad, Mangla and Trimmun	820 km 28 BCM	Neelum and Kunhar at Muzzaffarabad and Chenab at Trimmu	1
Chenab	Himachal Pradesh (India)	Kishtwar, Marala Panjnad, Mithankot	1361 km 28 BCM	Jhelum at Trimmu, Ravi at Ahmadpur Sial, Sutlej at Panjnad	13
Ravi	Rohtang Pass in Kangra (India)	Chamba, Madhopur, Lahore, Ahmadpur Sial	894 km 7.8 BCM	Chenab at Ahmadpur Sial	3
Beas	Rohtang Pass in Kulu (India)	Kangra, Singbol, Hoshiarpur, Talwara	467 km 15.6 BCM	Sutlej at Harike	5
Sutlej	Lake Rakshastel Western Tibet	Ludhiana, Ferozpur, Bahawalpur	1542 km 16.64 BCM	Chenab at Panjnad	11
Kabul	Kabul, Afghanistan	Chitral, Kabul, Warsak, Nowshehra	480 km 21.4 BCM	Indus at Attock	-

(Source: Fahlbusch et. al, 2004)

The main Indus River emerges from Mansarowar Lake in Tibet at an altitude of 5494 m and after traveling some 3000 km through Himalayas, adjoining ranges and plains, it embraces Arabian Sea in the east of Karachi. Mountainous catchment of the Indus is about 44 million ha and has the largest frozen water reserves outside the polar region, which is major contributor of snowmelt and rainfall runoff. Total ice reserves of the basin have been reported about 2,738 BCM, which is 16 times the average annual Indus river flows (Ahmad and Joya, 2003). Snowmelt zone lies between altitude of 2500 to 5500 m, which accounts for most of the summer runoff that increases gradually from March to June and continues until September. Winter snow cover of the Himalaya goes up by 30-40%**.** All the major tributaries drain into the upper reach of 2150 km and the Indus with its tributaries make up one of the most important river systems in the world. The basin was converted into an extensively cultivated area during the British colonial era, with millions of hectares irrigated by large canals.

Origin of Indus Basin Water Dispute

The Pak-India water dispute originated from partition of sub-continent when water origins and diversion structures were not given any consideration while demarcating political boundaries between Pakistan and India. The agreed upon bases of division was that the Muslim majority areas would be included in Pakistan whereas right of accession was given to the princely states to join either of the two countries. The agreed upon division formula was however not Adhered to and a Muslim majority district of Gurdaspur, a gateway to Kashmir, was included in India that provided it with easy access to Kashmir, which is origin or pathway of the waters of the Indus River System. Accession of Kashmir to India declared by Hindu Raja was immediately acceded to, whereas similar accession desired by the ruler of the

princely state of Junagarh was not honored. In pursuit, India immediately moved to occupy Kashmir, but Kashmiries resisted and took control of a part of it, resulting in break out of war in 1948 between the newly born states. India took the issue to UN where stance of Pakistan was acceded to and it was decided to resolve the issue by holding a free and fair plebiscite under UN for determining right of accession of Kashmiries on majority vote. The then army positions were declared cease fire line under UN observers, later declared as Line of Control (LoC) in 1972. Unfortunately, the UN resolution has not so far been implemented. Resultantly, most of the headwaters of Indus and its tributaries went under Indian control including Modhupur Headworks on the River Ravi and Ferozepur Headworks on River Sutlej, falling at the periphery of Pak-India border. Those head works were feeding Upper Bari Doab Canal and Deepalpur Canal, which had 90% command area in Pakistan. India blocked supply of these canals thereby depriving irrigation water to the substantial tract of its fertile command area in Pakistan. Pakistan's irrigated areas suffered badly and agricultural production perilously threatened. An interim standstill agreement was signed in December 1947, whereby partial supplies were ensured uptill 31st March, 1948. However, the supplies were again cut off on 1st April, 1948, resultantly the important Kharif crop on the command area was damaged. New inter-dominion agreement was signed on 4th May, 1948 whereby the supplies were resumed for giving Pakistan time to develop alternate sources. India claimed all the waters of eastern rivers and demanded payment from Pakistan for the received water. Whereas, Pakistan contended to pay only for operation and maintenance and not for water that belonged to Pakistan prior to partition. After protracted negotiation mediated by the World Bank, the Indus Water Treaty (IWT) was agreed upon in 1960.

Indus Water Treaty

At the time of partition in 1947, altogether 64 percent of irrigated area and 83 percent of the cultivated areas of the Indus basin came under Pakistan (Fahlbusch, 2004). The treaty was result of stoppage of canals supplies and apprehensions of Pakistan that India owing to upper riparian of Indus Basin could potentially create havoc by blocking water supplies thereby inducing droughts and famine like situations in Pakistan. At that time about 8.5 million ha in Pakistan (Ahmad, 2010) were irrigated with Indus waters whereas boundary between the two countries was drawn disregarding prevailing irrigation network. Though it was expressly agreed by the stakeholders before the Arbitral Tribunal that the authorized zones in the common water supply would continue to be respected, but immediately after winding up the Arbitral Tribunal in 1948, India blocked waters in all the irrigation canals originating across the border thereby affecting 0.65 million ha of irrigated land in Pakistan. That necessitated immediate resolution of the dispute for future use and distribution of combined waters. India claimed proprietary rights of waters of the rivers in Indian Punjab and refused to accept Pakistan's demand of providing due share of those waters based upon the time honored formula that the prevailing uses were sacrosanct and excess waters should be divided proportionate to area and population of the riparians. The stance of Pakistan was in accordance with the accepted principle adopted in several treaties between states and provinces in the subcontinent. Although through an interim agreement of 1948, reduced supplies remained available, but direct negotiations between the two countries failed and the issue became too serious to sustain peace in the region. The negotiations recommenced in 1952 under the offices of World Bank and after prolonged bumpy proceedings, an agreement what is called Indus Water Treaty was finally signed in September 1960 that took effect retrospectively from 1st April 1960.

Salient Features of Indus Water Treaty

Distribution of the Eastern and the Western Rivers:

I. All the waters of the eastern rivers (Ravi, Sutlej and Beas) shall be available for unrestricted use of India. Pakistan shall be under an obligation to let flow and shall not permit any interference with water of the Sutlej Main and the Ravi Main in the reaches where these rivers flow in Pakistan and have not yet finally crossed into Pakistan. Pakistan however can only use it for non-consumptive and domestic purposes.

ii. All the waters, while flowing in Pakistan, of any tributary which in its natural course joins the Sutlej main or the Ravi Main after these rivers have finally crossed into Pakistan shall be available for the unrestricted use of Pakistan

iii. Pakistan shall receive unrestricted use of all the waters of the western rivers (Indus Jhelum and Chenab). India shall be under an obligation to let flow all the waters of the Western rivers, and shall not permit any interference with these waters (World Bank, 1960).

Furthermore, the aggregate storage capacity on western rivers was provided to India as per details given in Table 3.

Figure 2: The Indus River system showing western and eastern rivers

Table 3: Storage provision on western rivers to India

Sr. No	River	General Storage Capacity (BCM)	Power Storage Capacity (BCM)	Flood Storage Capacity (BCM)
1	The Indus	0.30	0.19	-
2	Jhelum (excluding the Jhelum Main)	0.62	0.30	0.93
3	Jhelum Main	-	-	Conditional to a duly prescribed flood level
4	The Chenab (excluding the Chenab Main)	0.62	0.74	-
5	The Chenab Main	-	0.74	-
Total		**1.54**	**1.97**	**0.93**
Grand Total		**4.44 BCM**		

(Source: World Bank, 1960, Indus Waters Treaty Annexure-E)

General Provisions:

i. The use of the natural channels of the rivers for the discharge of flood or other excess waters shall be free and not subject to limitation by neither party, nor any party shall have claim against the other in respect of any damage caused by such use.

ii. Each party declared its intention to prevent, as far as practical, undue pollution of the waters and agreed to ensure that, before any sewage or industrial waste is allowed to flow into the rivers, it would be treated, where necessary, in such manners as not to materially affect those uses.

iii. India was given entitlement not only to continue irrigate areas of 0.26 million ha from western rivers which were so irrigated as on the effective date, but was also entitled to irrigate another area of 0.28 million ha from the western rivers thereby making total provision of 0.54 million ha (68% of which was from the River Jhelum and 23% from the Chenab).

iv. The agreement precluded building of storages by India on the rivers allocated to Pakistan. However, if India wants to generate hydroelectric power it can only build run-of-the-river hydroelectric projects (unlike a dam or a reservoir), which do not create storages beyond that detailed in Table 3. Paragraph 2 (c & d) in Article III of the Treaty allows and Annexure D and E explain that how India can use the waters of western rivers for hydroelectric projects.

V. Pakistan agreed to make arrangements through replacement works for transfer of water from western rivers to eastern rivers for irrigation of command areas, headwaters of which were allocated to India (World Bank, 1960).

Indus Basin Replacement Works

As a result of the Treaty, Pakistan embarked on a gigantic project what is called Indus Basin Replacement Works (IBRW). The project was accomplished through Indus Basin Development Fund generated by the World Bank and other donor countries at an unprecedented cost of Pak Rs. 124 billion. It was the biggest irrigation project of the world at that time, which was completed in only ten years, and by which 17 BCM/year of water was managed to transfer from western to eastern rivers in addition to modernization and upgradation of the existing irrigation infrastructure. Resultantly, Pakistan side of the basin now has 3 large dams, 85 small dams, 19 barrages, 12 link canals, 45 canal commands, 110,000 watercourses and about 1 million tubewells. Total length of main canal system is estimated about 60,000 km and that of watercourses and field channels is about 1.6 million km. The present worth of the entire Indus basin irrigation infrastructure is more than US $ 300 billion which irrigates more than 19 million hectares of land (GoP, 2009). On the Indian side, the basin has 4 dams, 5 barrages, 2 link and 10 irrigation canals commanding an area of more than 5 Mha.

Indus Water Commission

In accordance with Article VIII of the Treaty, both India and Pakistan each created one post of Indus Water Commissioner, Figure 3 which together constitutes Permanent Indus Water Commission. The Commissioner of each country acts on behalf of his government for all the matters of the Treaty and servers as regular channel of communication unless either of the government decides to take any particular matter directly with the other government. The Commission meets regularly at least once in a year, or when requested by either of the Commissioners, alternately in each of the countries and can inspect, assisted by up to two advisors, works on Indus basin of both the countries. The major functions of Commission are:

- To establish and maintain cooperative arrangements for implementation of the Treaty, to promote cooperation between the parties in the development of the waters of the rivers particularly on specified aspects.
- Furnish yearly or other desired reports to both the governments by fixed date.
- To share, on a regular basis, extensive and comprehensive data on the water flows in each river, and water withdrawn from each reservoir, etc.
- To inform each other with relevant data of 'engineering projects'if either of the two countries plans to construct any of such projects on any of the rivers which causes interference in the water flow.

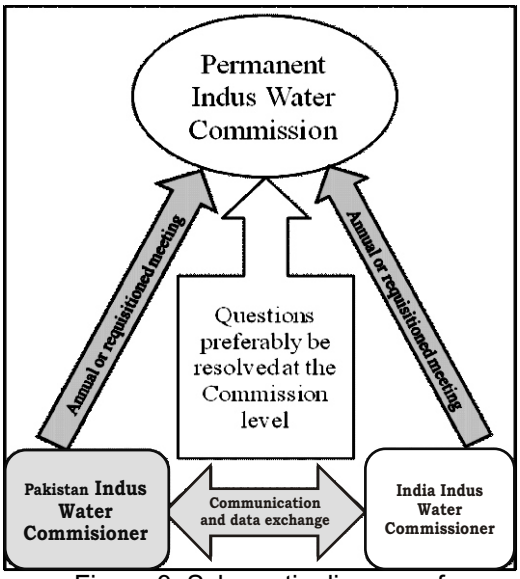

Figure 3: Schematic diagram of Permanent Indus Water

- To undertake once in every five years, a general tour of inspection of the rivers for ascertaining the facts connected with the various developments and works on the rivers.
- To undertake promptly, at the request of the either Commissioner, a tour of inspection of such works or sites on the river as may be considered necessary by him for ascertaining the facts connected with those works or sites.
- Make efforts to settle the differences between the parties promptly in accordance with the relevant provisions of the treaty (World Bank, 1960).

Dispute Resolution Mechanism

The treaty envisages a comprehensive tier mechanism Figure 4 for addressing any question which arises between the parties concerning interpretation or application of the Treaty or existence of any fact, which if established, might constitute a breach of the treaty. The Commission would first examine the question and endeavor to resolve the question by mutual agreement. If the Commission fails to reach an agreement, the question on the request of the either Commissioner would be dealt by Neutral Expert, who would decide whether or not the entire question or a part thereof falls in his purview as per contents of the Treaty and if it falls so shall render decision on merit accordingly. In case the question or a part thereof does not fall within the provisions of the contents of the Treaty, the neutral expert shall inform the Commission that in his opinion the question or a part thereof may be treated as a dispute, then the dispute would be deemed to have arisen, which would be referred by the Commissioners along with their views to their governments. Under such a situation, either government shall invite the other to resolve the dispute by agreement along with nomination of the negotiators together with enlisting the mediators for assistance of the negotiators if so agreed by both the governments. Alternatively, if the

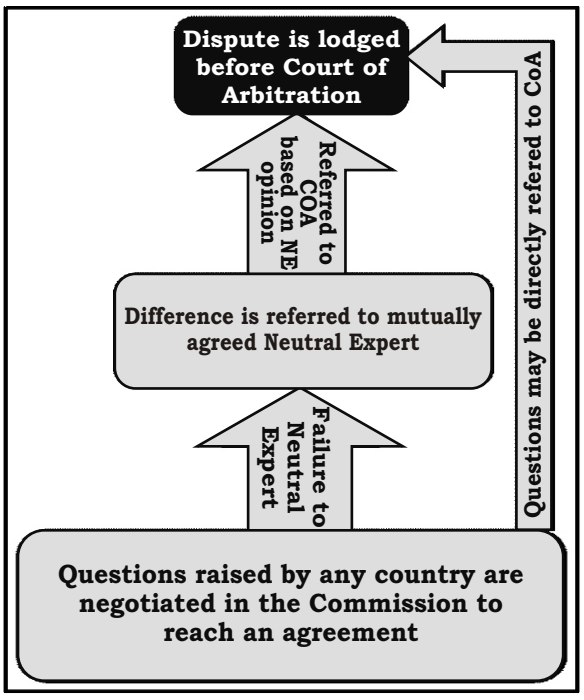

Figure 4: Dispute resolving mechanism of IWT

dispute is not resolved or not likely to be resolved through mutual negotiation or mediation, a Court of Arbitration (CoA) would be established for resolving the dispute. The Court would comprise altogether seven members with two members nominated by each of the country and the remaining three mutually nominated if so agreed, or by the World Bank if the two countries fail to reach an agreement for the three mutually agreed nominations. Although the treaty worked well for the first three decades but thereafter disputes started emerging, some of which are discussed in what follows (World Bank, 1960).

Baglihar Dispute

India started in 1999 the construction of run-of-the-river hydroelectric power generation dam (900 MW, 144 m high, 52 million m^3 pondage) at Baglihar over the River Chenab and commissioned in April 2009. After finalizing plans of the dam, India shared the project design with Pakistan who raised objections on the grounds that the design was in violation of the provisions of the IWT, especially the technical norms with regard to pondage level and gated spillway which would obstruct the flow of the Chenab River. Pakistan after formally exhausting all the available options as per provisions of the Treaty finally moved to the World Bank in January 2005 for appointment of Neutral Expert. The Neutral Expert gave a final decision in February 2007, and upheld objections of Pakistan by recommending reduction of pondage capacity by 13.5%, reduction of freeboard from 4.5 m to 3.0 m and power intake tunnel raising by 3 meters. Pakistan thinks that some design parameters were still too lax than were needed for feasible power generation thereby giving India a strategic leverage in times of political tension or war to maneuver or block flow of the river owing to its gated spillway. Under the Treaty, India could not reduce the Chenab River's flow to Pakistan below 1560 m^3/sec (55,000 cusecs) between June 21 and August 31 whereas it remained as low as 567 m^3/sec (20,000 cusecs) over the said period in 2008 (Akhtar, 2010).

Kishanganga Dispute

India is developing a 330 MW hydropower project in Kashmir over the Kishanganga River Figure 5, which originates in Indian held Kashmir and runs through Pakistan's part of Kashmir where it is called the River Neelum until it joins with the Jhelum River at Muzzaffarrabad. The Kishanganga hydropower project involves construction of a 37 m high dam across the river in Gurais and an underground powerhouse in Bandipora, both connected by a 24 km long head race tunnel. Water from the Kishanganga River would be diverted through the tunnel to the powerhouse. The diverted water after power generation would be drained into the Bonar nallah, which flows into the Wular Lake on the River Jhelum while flowing through Indian held Kashmir on its way to Pakistan. The line plan of the scheme is given Figure 6. Pakistan thinks that the project would have multi-faceted impact on its downstream agriculture, ecology and hydal projects.

NeelumJhelum Hydropower Project

Pakistan has already commenced in 2008 the construction of 969 MW Neelum-Jhelum Hydel project through a Chinese Consortium who was awarded the contract in 2007. The Neelum-Jhelum Project is a part of run-of-the-river power scheme designed to divert water from the Neelum-River to a power station on the River Jhelum. The power station is located in Azad Kashmir some 22 km south of Muzzaffarabad. More than 50% of the work has by now been completed and the project has been planned to accomplish in 2016. India's upstream Kishanganga Project has put at stake the very objective of Neelum-Jhelum Project as the Kishanganga Project will get diversion at upstream of the same river on which in Pakistan's part of Kashmir is the Neelum-Jhelum Project, thereby severely hampering its power generation. Indian point of view is that the project will divert only 10 percent of the river's flow while other estimates stand as high as 27 percent which would also affect irrigated area of 133,000 ha in Neelum Valley of Pakistan (Akhtar, 2010). Although, the impact on water flow below the NeelumJhelum Dam seems to be minimal as both projects would be diverting water to the Jhelum River, but Kishanganag project will have adverse impacts on the ecology of Neelum valley. Moreover, reservoir cushion provided by Wular Lake also deserve due consideration where Wular barrage is already a disputed project. Therefore in 2010, Pakistan lodged a case before the Court of Arbitration, complaining that

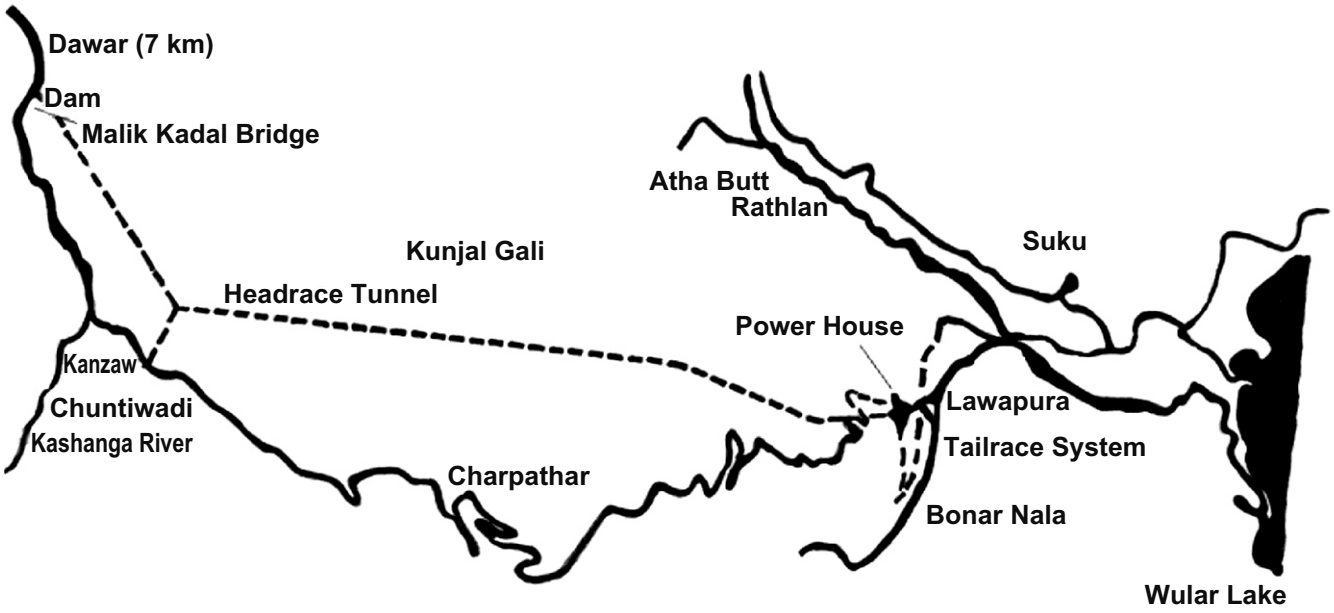

Figure 5: Line plan of Kishenganga project
(Source: www.tunneltalk.com/India-Mar10-Kishanganga-hydro-TBM-design.php)

the Kishanganga Project is violation of Indus Water Treaty as it would deprive Pakistan of its water rights due to aforesaid reasons. In 2011, the CoA after visiting both the projects asked India to stop construction of any permanent works that would inhibit restoration of the river. Although India cannot construct the dam, it has continued work on the tunnel and power plant with the intention to boost up the progress as soon as it gets some legal space. It is pertinent to mention that India has reduced dam height from the originally planned 107 m to 87 m and ultimately to 37 m, that exhibits the Indian design was against the provisions of the treaty.

Wular Barrage Dispute

Wular Lake is India's largest freshwater lake in Bandipura district of Indian held Kashmir. The lake is fed by River Jhelum and varies in size from 30 to 260 km^2, depending on the season. India in 1984, started construction of a barrage (also called Tulbul Project) having storage capacity of 0.37 BCM at the mouth of Wular Lake to regulate the release of water from the storage in the lake to maintain a minimum draught of 1.4 m in the river up to Baramula during the low flow periods for navigational facilitation. There has been an ongoing dispute between the two countries over the Wular Barrage Project since 1987, when Pakistan declared it violation of the Treaty. India stopped work on the project, but has since been pressing to restart construction with the contention that the Jhelum River through the Kashmir valley below Wular Lake provides an important navigational route for which an optimum depth of water is needed to sustain navigation throughout the year. India contends that this makes development of the Wular Barrage Project permissible. Pakistan maintains that the project is a clear violation of the treaty as will not only change catchment and ecology of the River Neelum but will also have adverse impact on the Neelum-Jhelum Project of Pakistan due to natural storage facility of Wular Lake. In fact, Kishanganaga and Wular Barrage are closely interlinked and India intends to develop the River Jhelum for navigation either through Wular Barrage or through Kishanganga Project with power generation as additional benefit.

Indian Projects on Western Rivers

India has either completed, carried out investigation or planned to construct a large number of dams on western rivers, of which the major ones include 13 on the River Chenab, 5 on the River Jhelum and 11 on the River Indus as detailed in Table 4 (Abbasi, 2012 and Akhtar, 2010 etc). The aggregate power generation capacity of those dams is several thousand megawatts, which gives an index of capacity of their operating pools and impact on downstream flow regime. In addition, investigation on many other small dams has also been reported, the exact details of which are not

yet available. Amazingly, India gives very limited data of its projects, completed or planned, on western rivers. Pakistan apprehends that completion of all those projects would enable India to substantially maneuver waters of the western rivers in order to aggravate water shortage problems of Pakistan.

Table 4: Indian major hydropower projects and dams on western rivers

The River	Sr. No.	Project name	Location	Specifications	Status
Chenab	1	Baglihar I-II	Doda district, Kashmir	900 MW, 144 m high	Completed 2008
	2	Dulhasti I-II	District Kishtwar, Kashmir	780 MW, 70 m high	Completed 2007
	3	Salal I-II	District Reasi Kashmir	790 MW, 118 m high	Completed 1998
	4	Kirthai	Athuli, Kashmir	990 MW	Completed 2011
	5	Pakal-dul	Doda, Kashmir	1000 MW, 167 m high	In Indian Court
	6	Bursar	Doda, Kashmir	1200 MW, 253 m high 2.5 BCM	Under investigation
	7	Sawalkot I-II	Doda, Kashmir	1200 MW, 197 m high	Under investigation
	8	Sali	Chenab, Kashmir	715 MW	Under investigation
	9	Raltle I-II	Chenab, Kashmir	560 MW	Under investigation
	10	Karwar	Kishtwar, Kashmir	520 MW	Under investigation
	11	Gypsa I-II	Bagha tributary	395 MW	Under investigation
	12	Naunath	Chenab River	400 MW	Under investigation
	13	Shamnot	Bhutnala	370 MW	Under investigation
	14	Barinium	Chenab River	240 MW	Under investigation
	15	Ans	Ans tributary	200 MW	Under investigation
	16	Raoli	Chenab River	150 MW	Under investigation
	17	Bichari	Mohu mangat nala	104 MW	Under investigation
Jhelum	1	Uri I & II	Baramula, Kashmir, close to control line,	730 MW	Uri-I completed 1997, Uri-II awaited
	2	Kishenganga	Bandipur, Kashmir	330 MW, 37 m high	Construction halted by CoA.
	3	Ujh dam	Indian Held Kashmir	280 MW	Planning stage
	4	Gangabal	Indian Held Kashmir	100 MW	Planning stage
	5	Sonamark	Indian Held Kashmir	165 MW	Planning stage
Indus	1	Chutak	District Kargil Susu Tributary of Indus	44 MW, 15 m high	Commissioned 2011
	2	Nimu Bazgo	Alhai, on Indus River, Leh, Kashmir	45 MW, 57 m high	Under construction
	3	Dumkhar I-II	Leh Khalsi Batalik Road	45 MW, 42 m high, 70 MW, 20 m high	Planning stage
	4	Ulitopp	Indian Held Kashmir	85 MW, 40.25 m high	Planning stage
	5	Khaltsi	Indian Held Kashmir	99 MW, 20 m high	Planning stage
	6	Achinathang-	Indian Held Kashmir	220 MW, 40 m high	Planning stage
	7	Sunit	Indian Held Kashmir	295 MW, 20 m high	Planning stage
	8	Parkachik-	Indian Held Kashmir	100 MW, 61 m high	Planning stage
	9	Kirkit	Indian Held Kashmir	100 MW, 30 m high	Planning stage
	10	Drass-Suru I-II	Indian Held Kashmir	95 MW, 25 m high	Planning stage

(Source: Akhtar, 2010 and Abbasi, 2012)

India has already commissioned Baglihar, Dulhasti, Salal, Kirthai and Chutak dams and is set to complete Nimo-Bazgo hydropower project. Amongst the planned projects, Bursar dam alone on the River Chenab would have 2.5 BCM storage against cumulative multi-purpose storage provision of 4.44 BCM on all the western rivers (Kiani, 2012). Moreover, it has also been reported (PILDAT, 2010) that India is planning to implement a mega project for linking the water surplus basins with water deficit ones through a network of 30 link canals by interlinking 37 rivers, which may include western rivers as well through tunneling. India has also aggrieved its other transboundary water stakeholders such as Bangladesh, Bhutan and Nepal through multiple self serving hydroelectric and irrigation projects (Tariq, 2010) and is now bent upon to get control of western rivers of Pakistan as well.

Critical review of the treaty

It has been stated elsewhere that bombs and shells cannot make as much damage to the lands of Pakistan as can potentially be done through blockage of water by India. Therefore one of the biggest advantages of the treaty was that it prevented an imminent war between the two basin states. Researchers at Oregon State University have found that the world's 263 transboundary rivers generate more cooperation than conflict. Over the past half century, 400 treaties have been signed on the use of rivers. Of the thirty seven incidents that involved violence, 30 occurred in dry and bitterly contested region formed by Israel and its neighbors (Economist May 1, 2008).The treaty is therefore said to provide a good foundation for resolving water dispute between the two riparians subject to the provisions of the treaty are adhered to in true letter and spirit. As a result of the treaty, each country became independent of using, planning and developing waters of the rivers allocated to it as per its own wish, will, demand, supply and interests without interference of either country, which reduced chances of disputes and tensions. Resultantly substantial storage Reservoirs, inter-river link canals and barrages based diversion infrastructure was developed owing to which canal diversions in Pakistan increased from 83 BCM to 129 BCM. That facilitated to make the irrigation system more demand oriented while it was earlier based on run of the river diversions contrary to the hydrological features of the basin having almost 80% of waters available only during monsoon months of July to September. Nevertheless, disadvantages of the treaty cannot be overlooked. The treaty in fact resulted in distribution of rivers rather than distribution of their waters. On overall all basis, Pakistan lost its historic legitimate share of waters of Indus basin (Waseem, 2007). India secured full rights for use of the waters of the three eastern rivers allocated to it and compelled downstream users to abandon traditional sailaba (flood) irrigation due to disappearance of seasonal flood waters which used to permit cultivation on considerable part of the area. It also severely damaged ecology of the eastern rivers some of which present a scene of either wastewater stream or river bridges constructed on sand dunes. The infrastructure developed also required additional heavy burden of financial resources for repair and maintenance and supplementing the silted up reservoirs. Social, environmental and economic implications of storage reservoirs developed inter-provincial controversies which not only compelled to abandon, or defer, several development projects but also threatened to rip the very fabric of the country. Kalabagh dam is still the issue of inter provincial hot debate and commencement of construction of Bhasha dam is yet to be realized, whereas existing dams are silting up at an alarming rate of 0.25 BCM per annum.

The Indus Water Treaty was signed in an era when groundwater development hardly started in the subcontinent. The Treaty therefore does not envisage any article or clause regarding usage or development of groundwater resources. Now when groundwater development has boosted up and become a substantial supplemental source of irrigation water, India is geographically in much better position for harnessing groundwater as well. The eastern rivers, which India has fully secured, were primary source of groundwater recharge in the peripheries of doabas. In the absence of the recharge source and owing to rapid growth of tube wells, groundwater mining is occurring at an alarming rate in Pakistan in the lower reaches of eastern rivers. Natural slope of eastern river doabas is also from Indian side towards Pakistan's territory. India has promoted rapid development of tubewells and their operation at highly subsidized electric tariff. That is certainly affecting the yield potential of downstream highly transmissive aquifer on western Punjab in Pakistan.

The treaty also does not take into account the climate change implications and the ecological changes that would occur half a century later, which may reduce runoff from its mountainous glaciers. As such the Treaty requires reconsidering the regimes of excess and scarcity of water (Dawn February 20, 2010). The Treaty gives very flimsy touch to the today's hot issue of pollution, the direct victim of which are always downstream inhabitants. The text of the relevant clause (Article 5 Clause 10) endeavors to conserve quality, without appropriate monitoring and surveillance provisions, required for the intended uses. As the surface water based water supply schemes are developing, downstream riparian would have serious health consequences because of deteriorated water quality at the upstream due to agricultural, industrial and population growth. Mr. Abbassi, a Pakistani Water Expert, is of the view that a satellite-based, real-time telemetry system in Indian Kashmir, installed at a minimum of 100 locations for monitoring water quality and quantity would help remove mistrust on data exchange (Abbasi, 2012).

Furthermore, Kashmir is an earthquake prone area where dam safety is of immense importance. Whereas India's dam success rate is not so good and 7 out of 67 have collapsed so far. Dam collapse always has catastrophic impacts on downstream settlements, but Indus Water Treaty does not envisage any clause for compensations to the victims. Another lacuna of the Treaty is that no country is bound to exchange any data when any project is at the planning stage and data sharing is carried out only six months before the commencement of construction. By the time the aggrieved country, after completing all the prerequisites of the Treaty, refers to the Neutral Expert and/or Court of Arbitration, the construction work continue and reach the advanced stage before the final verdict is declared, and ultimately gives leverage to the country having already completed substantial part the project. Making self serving explanations of the treaty, India has either completed or near to completion of several projects on western rivers, a summary of some of those is given in the Table 4. Those dams, inter alia, would substantially enhance evaporation and seepage losses as well. Economists are therefore of the view that the construction of large number of dams on the western rivers would enable India to maneuver or block water supplies especially in low flow periods. Resultantly, the delaying or missing of irrigation would have severe harmful impacts on our agriculture which constitutes more than 21% of GDP and is key contributor to our food security, international trade and for providing raw material to textile and sugar industries. Consequently Pakistan's food security and economy will both be at stake (Khan, 2008).

Sharing Water with Afghanistan

Pakistan and Afghanistan share nine rivers with an average annual flow of about 22.58 BCM, of which the River Kabul alone contributes 20.36 BCM. However, the River Chitral, originating from Pakistan, contributes about 10.5 BCM (47 percent of the shared resources) of the entire flow (Dawn, 20th April, 2011). The River Kabul originate from east of Kabul where it is small stream and its flow swells after being joined by a number of small tributaries and the River Chitral in Afghanistan. The River Kabul enters Pakistan at Warsak. On Afghanistan side, there are three dams on the River Kabul namely Naghlu (100 MW, 110 m high and 0.55 BCM), Darunta (installed 40 MW, present 11.5 MW), and Surobi (22 MW), which are located east of Kabul (Wikipedia, 2012). In Pakistan, a dam was built in 1956 on the River Kabul at Warsak near Afghan Border. The dam silted up very soon and is now serving only as hydropower plant providing 40 MW. The other major shared rivers are the River Kurram and the River Gomal, all of which join the main River Indus on its western side. The River Kurram and the River Gomal is almost non perennial with little flows having catchment area of 0.68 Mha, mostly feeding civil canals in KPK (Fahlbusch, 2004). So far there is no serious dispute on waters shared with Afghanistan due to insignificant storages. However, several projects are reportedly under planning stage. Therefore both the countries are endeavoring to reach an agreement regarding the use of shared waters.

Conclusions

The Indus Water Treaty is a comprehensive document that gives major to minor details of sharing transboundary waters and tier mechanism for resolving differences and disputes. It seemingly served to prevent wars on water disputes between India and Pakistan. But the wars so far fought between the two countries were in fact indirectly water wars, as each remained endeavoring to control head waters of Indus Basin and that too in an era when both the

countries were water surplus. With rapid population growth on both sides of border, Pakistan has entered into the category of water scarce countries owing to its inherent arid and semi climate, whereas India despite being the second wettest country of the world has also become water stressed. Being amongst the thickly populated countries of the world, food security is their major concern together with cheap energy to sustain industrial growth. Climate change implications have further added to these concerns like accelerated glaciers melting, may benefit only India. Sharing of waters under droughts also remains unaddressed. Under these circumstances, India being the upper riparian is trying to get more and more out of waters flowing though its territory taking advantages of the subjective clauses and/or self serving interpretations of the Treaty. The quantum of work completed, initiated or planned on the head waters of Pakistan has added to its apprehensions that India will use the structures on western rivers as strategic, political and economic tools. Because in sharing transboundary waters, not only quantity but timing of flows is also of extreme importance. Violations of the timing for filling of Buglihar dam, duly mentioned in the Treaty, have strengthened these apprehensions. Climate change, environmental concerns, and using state of the art data sharing mechanisms are the issues least tackled in the treaty. That may give rise to multiple dimensions to differences and disputes. The Court of Arbitration is, in fact, not a Court of Justice but facilitator for arbitration. Trust deficit is already there and both the countries are nuclear powers. The international community is therefore required to frame and implement universal laws based upon equitable and fair sharing of transboundary waters all over the world for avoiding water wars.

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