TELESCOPING INDUS WATERS TREATY THROUGH THE LENS OF CLIMATE CHANGE

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About the Publication

This research paper is the outcome of a collaboration between the Hanns Seidel Foundation (HSF) Pakistan and HSF India and eminent researchers from South Asia on the topic of climate change and environmental security. To explore the scope for international cooperation and political harmonization of national environment policies, HSF India and Bangladesh Centre for Advanced Studies brought together experts from Pakistan, India, China, Bhutan, Nepal, Myanmar and Bangladesh.

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Abstract

To rationalize and regulate waters of Indus River Basin (IRB) between Pakistan and India, Indus Waters Treaty (IWT) was signed on 19 September 1960. At that time, the world was not much familiar with the phenomenon of climate change. In last half of 20th century, there have been immense technological and educational advancements in the field of hydrology, water resource management, trans-boundary watercourse management, conflict resolution, environment monitoring, data acquisition, storage, sharing, archiving techniques and above all the emergence of new paradigm of Climate Change has added a new dimension to water availability. Water quantity with different variables like volume of water, timings and duration of its flow and frequency with varying intensity as well as water quality has immensely changed over the years. Pressures such as population growth, urbanization, economic development and climatic extreme events like drought and floods, decreased level of sub-surface water and aquifers etc. have substantially altered water demand and supply equation in Pakistan. Consequently, water has become a source of tension between the two countries and has the latent potential to turn into a conflict if the existing knowledge and practice gaps in IWT are not timely managed. One of the solutions to the problem lies in incorporating current knowledge Climate Change in IWT and aligning it with the current set of international rules and water laws. Absence of these aspects in IWT has negative impact on Pakistan because it has only one river basin to draw waters from. There is a need to develop a framework which should enable both the countries to develop consensus for incorporating climate change related clauses and provisions in IWT.

Key Words: Indus Waters Treaty, Transboundary Waters, Water Resource Management, Climate Change, Conflict Resolution

Introduction

The United Nations Framework Convention on Climate Change (UNFCCC) defines climate change as 'a change of climate which is attributed directly or indirectly to human activity that alters the composition of the global atmosphere and is in addition to natural climate variability observed over comparable time period'(Smit, Burton et al. 2000, Barry, Ian et al. 2014). The UNFCCC definition is more restrictive in nature and excludes climate variability from its scope. On other hand, Climate Change according to Intergovernmental Panel on Climate Change (IPCC) is 'a change in the state of the climate that can be identified by changes in the mean and / or the variability of its properties and that persists for an extended period, typically decade or longer. Climate change may be due to natural internal processes or external forcing or to persistent anthropogenic changes in the composition of the atmosphere or in the land use'(Solomon 2007, Dai 2016). IPCC definition is more all encompassing and can be further paraphrased for common sharing as a change in the climate that persists for an extended period spanning over decades or longer resulting from the causes related to natural process or human activities. Combined together or separately considered any one of the two definitions, climate change has emerged as a phenomenon reckoned with as a global reality(Brown, Hammill et al. 2007,Ahmed, Mashkoor et al. 2016).

Due to increased emission of Green House Gases (GHG), the global temperature is rising. In 20^{th} century, as reported by the IPCC 2007, the rise in global temperature is 0.76^0C whereas in first decade of 21^{st} century, a rise of 0.6^0C has been experienced(Solomon 2007). Rise in temperature has disturbed weather systems. As a result, climate change is impacting each walk of life. Most affected commodity by climate change is water as both of its main sources i.e. rainfall and glaciers melting have been disturbed(Arguez and Vose 2011). Pakistan draws its water from

shared Indus River Basin (IRB) which has also been adversely impacted by the climate change. To rationalize the use of water between Pakistan and India, an international protocol known as Indus Waters Treaty was signed on 19 September 1960 under the auspices of World Bank. Indus Waters Treaty is considered as a successful water agreement between India and Pakistan as it made both the countries cooperate with each other for over half a century albeit with certain exceptions by the upper riparian, the India. At the time when treaty was framed in 1960, the phenomenon of climate change had not been discovered, even if it was known, it was not felt with the intensity as it is being experienced now, therefore, it was not factored in the Treaty. Absence of this phenomenon from the Treaty has negatively affected IRB and is adversely impacting Pakistan as it has only one river basin to draw waters from whereas India has over a dozen river basins for complete country. The water quantity with different variables like volume of water, timings and duration of its flow and frequency with varying intensity has immensely changed in last fifty years. With variation in quantity of water, the quality of water has also changed. Main water quality attributes like sedimentation, salination, and chemical, mineral, industrial and municipal pollutions are some of the few quality degrading agents introduced over a period of time.

Terrestrial life revolves around water. Presence, absence, abundance or scarcity of water outlines the dimensions of natural, social and economic systems on earth. World over, the freshwater is a scarce resource which has been distributed unevenly and irregularly. Major sources of freshwater lie in transboundary basins which transcend politically divided borders. The political borders breed hydro-politics between riparian states which often results into disputes and conflicts between the states sharing transboundary water resource. In shared water resource, where mutual water utilization agreements have been carved by the riparian states, there this shared commodity has become a source of cooperation contrarily to those rivers and basins where the mutual

understanding was either missing or was inadequate, it always remained a source of tension amongst the states. Between Pakistan and India as well, the water tension had started brewing up right after the partition and got only resolved when the treaty was reached between the two states under auspices of the World Bank in 1960.

Presently the communities and countries are experiencing those sort of pressures related to water which were not conceivable in the past. These pressures which include population growth, urbanization, economic development and climate change etc have altered water demand and supply equation. In future as well, these pressures will get exacerbated rather than reduced as the efforts to bring these under control are much lesser and meager than the impact of factors multiplying their negativity. These pressures will increase the tensions in those sectors which have been characterized by the cooperation in the past. Main reason behind shifting of bias from cooperation to conflict in water related treaties lies in the fact that most of the transboundary water agreements fail to appropriately consider hydrological variability of fresh water systems thus missing effective clauses and provisions which can adequately cope up with the changes. Absences of such clauses from transboundary water agreement lead to instability of the agreement and arising of conflictual situation amongst the states. Of all the pressures which can alter pattern of water demand and supply equation, climate change is the most impacting factor. This factor can alter water quantity and water quality by inducing the changes in hydrological cycle. Climate change being catalyst in inducing variability in water quantity and quality poses serious threat to the stability of transboundary freshwater resource agreement (Cooley and Gleick 2011).

In the face of water variability, incorporating mechanisms to bring flexibility and introducing clauses and provisions to deal with the problems related to water quantity and quality impacted by the climate change is the way to retain stability in a treaty. To incorporate climate

change related clauses and provisions in a transboundary water agreement, a legal process commonly known as climate proofing provides that flexibility to an agreement with which it can adjust to the consequences of climate change. All those climate change related factors like equitable and sustainable utilization of water resource, avoiding damage and loss to other riparian states , managing extreme events like drought and floods, maintaining ecological balance in the basin, management of basin aquifer and ground water, monitoring and data archiving, data and information sharing, joint institutions for basin water management, amendment and review procedures, dispute resolution and conflict management etc if appropriately incorporated in a transboundary agreement can bring culture of cooperation rather than dispute (Rasul, Mahmood et al. 2012).

Context

Just as oil creates disputes and conflicts between the states likewise water has its own long history of hydro-politics on world arena. All transboundary river basins which have led to inking about 300 mutual water agreements across the globe are testimony to the fact that timely management of future supply and demand matrix is necessary for peace and stability in the region in general and within the riparian states in particular. Review of transboundary agreement amongst riparian states for Nile, Rhine, Mekong, Jordon, Danube, Tigris, Euphrates, Brahmaputra and Colorado Rivers etc have created an environment of cooperation and amicably avoided conflicting situations. Climate proofing of transboundary water agreements is a legally apt process which can reduce the climate based risks to bare minimum. This process may not be an end in itself rather it is an effective mean to bring flexibility in the treaties and agreements which can suitably absorb the negative effects of climate change through capitalizing on technological, institutional, social and legal innovations rather than waiting for the existing treaties to succumb to the burgeoning

future pressures. The climate proofing of transboundary water treaties has requisite and promising potential to address low probability but high magnitude climate events like floods and can provide a long term sustainable solution to the stresses being caused by climate change in social, political, and economic planes(Kabat, Van Vierssen et al. 2005). In light of the foregoing, for telescoping Indus Water Treaty through the lens of climate change, its reappraisal from historical perspective, evolution, formulation, implementation, operation and dispute resolution etc are mandatory for recommending a sustainable and workable format for incorporation into the Treaty through climate proofing.

Since ancient times, South Asia is an agro-based economy. Rivers have remained the major source of water for irrigation(Epstein and Jezeph 2001). These rivers, mainly comprising glaciers melt water originating from mountain regions in the north, flow down south. After meeting basic agriculture, hydropower generation or domestic needs, the rivers fall into the sea. Right from the beginning, British after establishing their rule in sub-continent, had realized the significance of development of irrigation system since agriculture was the main revenue generation source and had started efforts in that direction(Banerjee and Iyer 2002). Although from mid 19th century, colonial rule had started receiving physical threat to its survival in sub-continent as is visible from the War of Independence in 1857 yet no threat to the homogeneity of sub-continent was felt since the political struggle was focused against British and not on dividing the land into dominions or states(Kokila 2013, Nayar 2015). It was only in early 20th century; the realization for creating two different nation states by the Hindu and Muslim entities of the sub-continent surfaced as a motivating thought. By this time, the development of irrigation systems in sub-continent particularly in the province of Punjab, the food basket of sub-continent, had already attained a

natural shape of irrigating arable land with the help of head works along the flow line of rivers like Ravi, Beas and Sutlej(Jain, Agarwal et al. 2007).

World War II and struggle for independence in sub-continent were two parallel events though with their dissimilar dynamics yet both exerting pressure on British government to bring their empire into manageable limits(Rich 1990). By the end of World War II, the independence struggle in sub-continent had picked up an unbearable momentum against British. British had started reconciling with the emerging realities and work on exit strategy from sub-continent had started. With mounting pressures on Britain from inland and abroad was minimizing the options of retaining India as part of the empire. Proposals for drawing boundaries between two states based on their religious majority areas started receiving deliberations through consultative processes between leading political parties, the Congress and Muslim League. Under the pressure of this indigenous political struggle, British rule in sub-continent weakened to its buckling limit and in August 1947, it led to creation of two independent nation sates, Pakistan and India(Copley 1993). Besides other shared commodities necessitating division between two nation states, geography and hydrology were two vital assets which needed fair division. But unfortunately, after the division of sub continent two issues related to Kashmir and shared water resource remained unresolved. The reasons for disregard to fair division of geographical and hydrological assets notwithstanding, both the issues i.e. Kashmir and IRB will remain perpetual bones of contention between Pakistan and India till these are resolved on sustainable foundations(Kazi 2006).

IRB comprises six major rivers, the Indus, Jhelum, Chenab which are commonly known as western rivers and Ravi, Beas and Sutlej commonly known as eastern rivers. Five of these six tributaries of IRB have their point of origination in Indian held Kashmir. Indus River is the only tributary which cuts across Hindukash – Karakorum – Himalayan (HKH) Ranges having its major

part in Pakistan(Husain 2010). Basin covers an area of about 1.12 square kilometers. With varying proportions, the IRB is shared by China (8%), Afghanistan (6%), India (39%) and Pakistan (47%). Total water from IRB amounts to 171 Million Acre Feet (MAF). 20 % of it amounting to 34 MAF flows in eastern rivers whereas 80 % amounting to an average of 138 MAF flows in western rivers (Alam 2002, Kahlown and Majeed 2003). Before the partition in 1947, British had developed in sub continent one of the most efficient and the largest irrigation systems in the world. At that time, approximately 37 million acres were being irrigated from the flow of Indus River Basin. After the partition, major part of irrigated land formed part of Pakistan. Out of 37 million acres, about 31 million acres which made over 84% of irrigated land came to Pakistan's share. Whereas for controlling irrigation system, the heads works were constructed upstream of all tributaries flowing through India for downstream lands which made part of Pakistan territory after partition(Basharat, Ali et al. 2014).

Two major such head works were Madhopur Headwork on River Ravi from where Upper Bar Doab Canal originated and Ferozepur Headwork on River Sutlej from where the Dipalpur Canal originated. Both of these lay on Indian side whereas the area to be irrigated by the canal lay in Pakistan after the partition. From these two canals, 64.4 MAF of water making 80% of its total volume was earmarked for the lands which made part of Pakistan whereas 8.5 MAF was committed for the lands which made part of India. Contrarily over 25 Million of the population benefitting from water of these two canals was in Pakistan who were left on the mercy of upper riparian India and about 21 million populations living on Indian side were disconnected from their traditional source of food grain. That was how; disregard to the hydrology of the area while delineating geographical borders gave birth to the embryo of Indus water dispute between India and Pakistan. Political decision of splitting India into two nation states where new boundaries divided religio-

socio-economic integrity of people led to communal riots and killings just after the partition announcement resulting into 17-20 million people migrating from one side of the newly established frontier to the other. This dreadful saga of human distress was further exacerbated due to wrongful drawing of border excluding Kashmir from Pakistan leading to an armed struggle against an unpopular and unlawful decision. This situation in the backdrop can help a reader understand that how water issue which had not been foreseen by any the governments heightened the conflict between two newly born states(Mehta 1988).

Emotionally charged politico-social environment prompted the East Punjab provincial government to apply their positional status of upper riparian. They stopped the discharge of water to the canals flowing to Pakistan on 1 April 1948 from the head works under their control since the 'Standstill Agreement' reached between the Chief Engineers of East Punjab (India) and West Punjab (Pakistan) in December 1947 had expired on 30 March 1948. The discharge of water was resumed in May 1948 on payment for administrative costs by Pakistan. The stoppage of water discharge to Pakistan by India rang the alarm bells into the minds of Pakistan political hierarchy and a realization emerged for securing the economic independence and foregoing the idea of integrated economic development of Indus River Basin potential. David Lilienthal former Chairman of Tennessee Valley Authority (TVA) and US Atomic Commission, who had visited India on invitation of Indian Prime Minister Jawaharlal Nehru, had desired that both countries could benefit from the enormous economic potential of the basin by using modern engineering skills and building water dams with a network of linked canal(Haines 2014). He sensed that by developing economic potential of Indus system, Pakistan's fear of economic dependence on India will be greatly assuaged and the Kashmir issue which had turned into a bone of contention will be

muted. He had proposed that such a novel imaginative plan should be sponsored and financed by World Bank with the help of consortium of likeminded countries(Mehta 1988).

Lilienthal proposal persuaded Eugene Black, the then president of the World Bank to explore the possibilities of finding an innovative solution which could economically benefit newly born states. In 1952, when negotiation on Indus water dispute started in Washington under the auspices of World Bank, both India and Pakistan gave their respective proposals. India's proposal centered on pre-partition idea of basin unity, water storages and linkages in Indian controlled areas. According to Indian proposal, Pakistan would bear proportional cost to draw requisite benefit. Correspondingly, Pakistan's proposal was different. Pakistan proposal did not envisage any Indian right on three western rivers (Chenab, Jhelum and Indus) and proposed only 30% rights on eastern rivers (Sutlej, Beas and Ravi). Proposals by both India and Pakistan were divergent therefore a solution was proposed by the World Bank(Kirmani and Guy 1997). By 1954, the deep differences between both the disputants, India and Pakistan had fully surfaced and therefore the idea of integrated Indus River Basin management as envisioned by David Lilienthal was finally abandoned by the World Bank(Wolf and Newton 2008). The World Bank took six years in discussion and deliberation to finalize the treaty on Indus River Basin which was finally signed by President of Pakistan Ayub Khan and Prime Minister of India on 19 September 1960 (Miner, Patankar et al. 2009).

Conceptual Framework

Indus River Basin

Indus River Basin comprising six rivers i.e. Indus, Jhelum, Chenab, Ravi, Beas and Sutlej shares boundaries between India and Pakistan. As it is evident from Figure-1, Indus River is the longest river of all its tributaries and cuts across Hindukash – Karakorum – Himalayan (HKH) Ranges having its major part in Pakistan(Husain 2010). Total area of the Basin which spans over about 1.12 square kilometers is distributed in varying proportions amongst four major countries. 47% of Basin area lies in Pakistan, 39% in India, 8% in China and 6% in Afghanistan. Total water from IRB amounts to 171 Million Acre Feet (MAF). 20 % of it amounting to 34 MAF flows in eastern rivers whereas 80 % amounting to an average of 138 MAF flows in western rivers (Alam 2002, Kahlown and Majeed 2003, Ahmed, Mashkoor et al. 2016). Due to degree of geographical, political, social and economic linkages, major stakeholders for IRB are India and Pakistan. Six tributaries of the Indus River Basin are divided in two halves. The western half of the Basin comprises River Indus, Jhelum and Chenab whereas the eastern half comprises River Ravi, Beas and Sutlej.

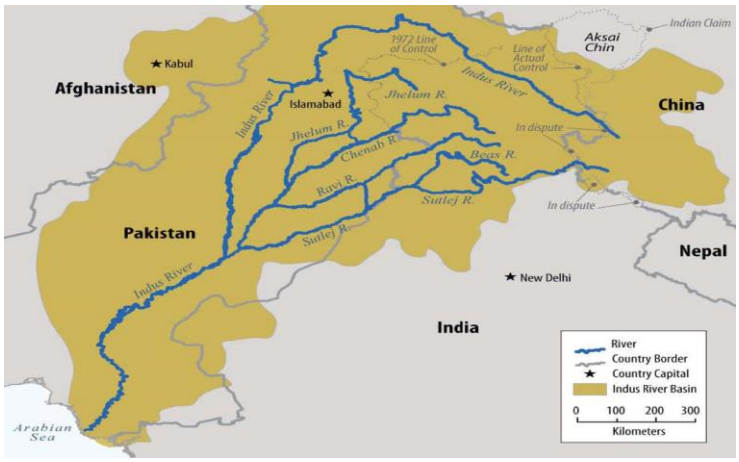

Figure-1 - Map showing Indus Water Basin with all its six tributaries

Source: http://defence.pk/threads/Indus

Indus Waters Treaty

Indus Waters Treaty (IWT), as signed on 19 September 1960 comprises 12 articles and 8 annexures. The Treaty outlines principles to share water of Indus River Basin between Pakistan

and India. Treaty specifies the jurisdictions of both the countries on different sets of rivers in western and eastern halves. Treaty also defines the rights and obligations of both Pakistan and India while sharing the water. Articles II of the Treaty lays down the provisions regarding unrestricted use of waters of eastern rivers (Ravi, Beas and Sutlej) by India. According to these provisions, all the waters of eastern rivers are available to India except for domestic and non-consumptive use by Pakistan of that water which flows into its territory. Articles II linked with Annexure H of the Treaty also outlined the arrangement for management of water for Pakistan from existing Head Works on eastern rivers in India for the transition period spanning from 1st April 1960 to 31 March 1970, maximum extendable to 31st March 1973. During this transition period, the replacement works for managing own share of the water independently by Pakistan were to be completed with the help of the World Bank(Mehra 2016).

Article III of IWT contains provisions regarding western rivers (Indus, Jhelum and Chenab). According to the article, all waters of western rivers are available to Pakistan for unrestricted use. India is obliged by the article not to permit any interference with these waters except for domestic, non-consumptive, agriculture (as set out in Annexure C) and hydro-power generation (as set out in Annexure D) uses. Article IV of the treaty outlines provisions regarding both eastern and western rivers where rights and obligations of both India and Pakistan are reiterated. It also indicates the urgency of constructing the replacement works for irrigation purposes from western rivers to the eastern part of the country for the areas which were dependent on Indian side Head Works on 15 August 1947. These replacement works included three dams, eight link canals, three barrages and 2500 tube wells for which World Bank pledged US $ 1.21 Billion for Pakistan. It is repeatedly highlighted in the Treaty that both the countries should exchange information, share data and not to create any damage or harm to other party in the process

of applying its right on its respective waters. For implementation, monitoring and dispute resolution, a Permanent Indus Commission was also established which ever since is a functional component for the purpose till date(Jamir 2016).

Since signing of the Treaty, Pakistan and India are sharing waters of IRB. As an amicable resolution of transboundary conflict between new newly born two states, IWT is considered a successful undertaking by the World Bank. There have been instances where India as an upper riparian has exercised or tried to exercise its right of non-consumptive use on waters of western rivers without due regard to the damage or harm to lower riparian in the process. Permanent Commission of Indus Waters (PCIW) a dispute resolution and treaty implementation body though endeavors to settle the issues mutually yet both the national commissioners are found failing to resolve the dispute bilaterally and as a compulsion Pakistan as a lower riparian is compelled to approach international platforms of justice or arbitration for third party dispute resolution. In transboundary water resource, lower riparian is usually found at disadvantage as the liberty to muddle with common waters rests by virtue of its geographical location with upper riparian(Salik 2016).

Controversies

According to IWT, waters of three western rivers are available to Pakistan with a proviso which allows India non consumptive use such as hydro power generation or agricultural use to a specified limit. India has recurrently applied this provision to her advantage without due regard to its impact on lower riparian in terms of water quantity, water quality, damage to downstream ecological system, environmental degradation or ground water depletion. Annexure C of IWT

allows India to use about 1.3 MAF of waters from western rivers for agriculture purpose whereas Annexure D and E illustrate the conditions for non-consumptive use of water. Sub clauses (a), (c), (e) and (f) of paragraph 8 of Annexure D of the Treaty explicitly define the design of the hydropower plants and maximum reservoir capacity for India on western rivers. Contrary to the parameters laid down in the treaty, India crosses the limits without taking Pakistan into confidence by prior sharing of the information on design specifications or environment impact assessment which leads to legal battle involving international players between India and Pakistan(Akhter 2015).

The first controversial case between India and Pakistan which echoed international corridors was regarding 450 MW Baglihar Hydro Power Project (HPP). It is a run of the river power project conceived by India in 1992. When its construction commenced in 1999, Pakistan claimed that some of its design parameters were too lavish than were indeed required for the purpose. Pakistan feared that these lax design parameters will enable India to manipulate flow of water by accelerating, decelerating or blocking the water volumes downstream which could provide a strategic leverage to India during political tension or war against Pakistan. These allegations were continuously denied by India. Pakistan after having failed to resolve the dispute through internal dispute resolution mechanism of IWT, approached World Bank in April 2005, a broker and signatory to the treaty, to appoint a neutral expert with a view to peacefully resolve the differences under Article IX (2) of the IWT. World Bank constituted a technical and legal team headed by an expert Raymond Lafitte on 12 May 2005 which delivered its final judgment on 12 February 2007(Ahmad Wani and Moorthy 2014).

Raymond Lafitte while framing his judgment referred to the latest bulletin of International Commission on Large Dams (ICLOD) rules of science and state of the art practices and also

applied Vienna Convention on the laws of treaties. Raymond also highlighted the significance of latest knowledge of science in interpretation of various clauses of treaties. Emerging knowledge of hydraulic, latest research on dams, climate change and environmental sciences was also applied before giving verdict to resolve Baglihar dispute. According to the judgment, the original HPP design as planned by India was upheld; however minor changes were incorporated to adjust the design. Although outcome of the process was not as expected by Pakistan yet it set a precedence to be followed for third party dispute resolution in case a conflict arises between India and Pakistan in implementation of IWT. On western rivers, India has made mega hydro development plan which has serious implications for Pakistan. The hydro power generation being developed on western rivers is much more than the requirement of that area of Indian held Kashmir (IHK). The power so generated from common waters is being exported to Indian national grid which is in contravention to the spirit of IWT(Rao 2013).

Second project which became controversial is Wullar Barrage or Tulbul Navigation Project, located on Jhelum River about 30 kilometers north of Sri Nagar and still remains unresolved. In this project, India intends building a barrage on the mouth of Wullar Lake where it meets River Jhelum with a storage capacity of 0.3 MAF which surpasses the limit as specified in Annexure D of the IWT(Khalid, Mukhtar et al. 2014). Another project which has developed deep differences between Pakistan and India is a 330 MW Kishanganga Hydro Electric Power Project (KHEP), a run of the river hydro power scheme designed to divert water to a power plant in Jhelum River Basin from Kishanganga River – known as Neelum River in Pakistan. The construction started in 2007 without consent of Pakistan. Bypassing 213 kilometers of Neelum River, water is planned to be diverted to Wullar Lake through a 24 kilometer long tunnel ultimately running through Jhelum River to Muzaffarabad in Azad Jammu and Kashmir (AJ&K). This project will

increase the catchment area of River Jhelum and deprive long stretch of River Neelum of water causing damage and harm to water quantity, water quality and ecological system downstream which is a serious violation of Article IV(3),c and specially paragraph (5) and Article VII(1)(b) of the IWT. Pakistan raised the issue on interpretation of KHEP to Hague Court. The Hague Court in the final order asked India to increase the environmental water flow downstream from the dam at all times to 9 cubic meters per second (Cumsec) as against the Indian government proposal of 4.25 Cumsec (an increase of 112%). The Court also rejected the Indian plea for reconsideration or re-interpretation of Permanent Court of Arbitration order of February 2013 that the under construction 330 MW Kishanganga Hydro Electric Power Project (KHEP) and all other subsequent projects cannot draw down the water level in projects below the dead storage level(Gopal 2013).

The recent project which has become controversial is 850 MW Rattle Hydro Power Project on Chenab River which has faulty design and has been objected by Pakistan. If India manages to construct Rattle Hydropower Project on Chenab River under its existing objectionable lax design, it will adversely affect the water flow of Chenab River at Head Marala which has detrimental economic and social impact for Pakistan. India has already built 330 MW Dulhasti HEP and 450 MW Baglihar HEP on Chenab and Ratle HEP with its existing faulty design will be third of its kind and biggest of all. Ratle HEP will be three times bigger than the Baglihar HEP and correspondingly will have negative political, economic and social impacts for Pakistan. Pakistan through its Indus Water Commission has struggled for a long time that India consents joint nomination for neutral expert within the stipulated period for resolving the Kishanganga and Ratle HEP issues but there has been no response from Indian side. Finally Pakistan decided in December 2015 to step up the level and approach World Bank for nomination of neutral expert to resolve the lingering IWT issues between both the courtiers. Besides these few examples which have been

cited here for contextualizing the issue at hand, there are numerous storage and hydro power generation projects on western rivers which are being constructed by India in violation of the IWT and their details have intentionally not been shared with Pakistan. According to Article IV of IWT, either of the parties is obliged to exchange information and data related to the projects being developed in IRB which is not being done by India. According to ICOLD as well, of which Pakistan and India both are signatories, exchange of information and data for developing new projects on shared waters is an unavoidable obligation which India had repeatedly been evading as an upper riparian and usurping illegally the rights of lower riparian leading it to perpetual frustration which is bound to deepen the conflict in future if this state of affairs continues unabated(Das 2016).

Treaty through the Prism of Cooperation and Conflict

IWT is considered as the oldest and strongest confidence building measure between India and Pakistan. Initial reservations of both the countries after signing the IWT in 1960 notwithstanding, since its inception, the treaty has endured tense political relations and three wars between nuclear rivals. Despite the feelings of transgressions and objections by upper and lower riparian respectively, the treaty has generally been considered as a source of cooperation and not the conflict between India and Pakistan. At international level as well, IWT is considered as a successful technical and legal instrument for distribution of shared water resource of IRB. World Bank, the broker of IWT, also takes the treaty as an enduring document and boasts for its success and survivability. As upper riparian, India also views the treaty as an effective instrument of distribution of a common water resource as it has completely controlled the waters of eastern rivers

without letting a drop flow downstream except the unavoidable escapages and unintended flows whereas on western rivers, the specified limits of non-consumptive water utilization are recurrently violated by India. With climate change phenomenon impacting the water quantity, water quality and ecological systems resulting into extreme meteorological events like floods and droughts, frequent violations by India in water utilization on western rivers, lack of information and data sharing by India, weak monitoring and implementation mechanism for the treaty and demand of water for food and energy increasing due to more population, urbanization, improved quality of life, intensive ground water extraction and fast aquifer depletion, Pakistan has started feeling the pressure as its water stress is exorbitantly increasing(Mehra 2016).

According to Boulding, conflict most popularly is described as a struggle over values and claims to scarce status, power and resources. In the absence of agreed rules prescribing equitable distribution or absence of effective monitoring and implementation mechanism intensify the efforts for attainment of the desired goals (Brochmann and Gleditsch 2012). If the agreed rules are established with an inbuilt mechanism to monitor and implement the distribution of scarce resource but its governance is too weak to be effective then the dominant party takes advantage of the void where as in relatively weaker party it breeds discontent and frustration (Mack and Snyder, 1971). In a particular conflict situation, actions and counteractions lead to attempts for control of outcome of interventions. Since aspirations of all stakeholders cannot be met simultaneously therefore the goals and activities become incompatible when one's own interests are threatened by action of another (Pruitt and Kim, 2004). Stakeholders in a competitive environment having opposing or divergent interests, endeavoure to deny each other the achievement of desired objectives leading different outcomes or disagreements on the means to attain the same end resulting into tensions . Perceived goal incompatibilities and efforts to control each other choices result into conflictual

situation. If the causes and sources of discontent are left unresolved and unaddressed then the conflict has latent potential to affect negatively interdependent relationships which otherwise would be advantageous to both the parties (Lulofs and Cahn, 2000).

Water is the foundation of human life. Water is a finite and scarce resource. Water is a shared resource which is divided based on the availability(Haftendorn 2000). Over 300 rivers, 100 lakes and yet to be determined number of aquifers are shared by two or more countries in the world(Salman 2007). Indus River System (IRS) is the lifeline for regional economies of Pakistan and western India. Any threat to its existence is considered challenging for both the countries. Utilization of IRS waters is governed by IWT, brokered by the World Bank since its signing by both the countries in 1960(Nazakat Ali 2015). According to IWT, India has exclusive rights on the waters of eastern rivers whereas waters of western rivers are available to Pakistan with an exception of specified amounts of water for domestic, non-consumptive, agriculture and hydro power generation uses to India. The treaty has inbuilt mechanism of information and data sharing, monitoring and implementation through Permanent Indus Water Commission (PIWC). Although the technical, legal and administrative arrangement of the treaty is keeping it functional and buoyant yet its inadequacies and lackings do create conflictual situations between India and Pakistan when the internal mechanisms of IWT fail to resolve the issues and the doors of international mediators are knocked for the solution.

International Water Law

At global level, to regulate the shared waters through a set o rules and regulations, there are three international organizations which have crafted set of rules for effective governance and

management of common water resources across the globe. Institute of International Law (IIL) and International Law Association (ILA) are two scholarly non-governmental organizations whereas International Law Commission (ILC) belongs to United Nations. Besides other general offerings related to water issues, IIL and ILA have immensely contributed in crafting the set of rules for transboundary water resource. The resolutions of IIL revolve around the emphasis of not to cause significant harm to lower riparian while applying the right of water utilization. On other hand, ILA framed famous Helsinki Rules in 1966 which established the principle of "reasonable and equitable utilization" as basic principle of international waters law. For determining the reasonable and equitable share of water for each riparian state, Helsinki Rules have specified certain factors which need to be considered. Some of the important factors to be considered include geography and hydrology of the basin, climate affecting the utilization of water, past water utilization, the economic and social needs of each dependent state, dependent population, comparative cost of meeting economic and social needs of dependent population through alternate means and the availability of other resources, avoidance of unnecessary waste for utilization of common waters, compensation for conflict adjustment and the probability of harm or damage avoidance to other co-basin state while applying the right of water utilization (Rules 1966).

ILC under the United Nations (UN) Watercourse Convention framed a set of rules which aim at ensuring the utilization, development, conservation, management and protection of international watercourses. The framework also promotes optimal and sustainable utilization of shared water resource. The Convention was adopted by United Nations General Assembly (UNGA) and opened for signatures on 21 May 1997 and closed on 20 May 2000 with only 16 signatories in three years as most of the upper riparian countries were reluctant to join since their status of unbridled interventionist has been streamlined in it. It entered into force on 17 August

2014. Similar to Helsinki Rules, the Convention also identifies the principle of reasonable and equitable utilization of shared water resources as the leading principle. The Convention almost considers the same factors for determining reason and equitable water utilization as has been considered in Helsinki Rules. The Convention also focuses on the principles of not causing significant harm to other riparian sates while utilizing its water and advocates appropriate measures by the watercourse states for preventing damage and harm to co-basin sates(Fitzmaurice 1997). Notwithstanding little difference in expression and the language, like Helsinki Rules, the Convention also subordinates the principle of not causing harm to the principle of reasonable and equitable utilization of water. Convention advocates undertaking of appropriate measures to avoid damage or harm to other co-basin states and in case the harm has happened to other riparian state, then the Convention creates space for the compensation for the affected riparian(Salman 2007).

After issuance of Helsinki Rules in 1966, the ILA continued its work on the subject unabated. From 1966 to 1999, the ILA adopted various sets of rules and articles which related to Flood Control and Rules for Administration for International Water Courses. Scholarly work by ILA on international watercourses has been revealing through Conferences at Belgrade in 1980, Montreal in 1982 and Seoul in 1986 which clarified the Helsinki Rules. Although ILA is non-governmental organization and its rules do not have binding over the national states for implementation yet its wide acceptance at global level kept encouraging the Association to refine their work on the subject. In 2000, ILA issued Campione Consolidated Rules consisting of 67 rules in one instrument which did not bring anything new rather it consolidated the work in one document. Meanwhile adoption of almost complete set of Helsinki Rules by ILC under UN Watercourse Convention in May 1997 raised the scholarly status of ILA and in year 2000, it

decided to revise the Helsinki Rules which took the form of Berlin Rules as issued in 2004(Salman 2007).

Berlin Rules heavily drawn from existing Helsinki Rules and UN Watercourse Convention comprise 73 Articles which are quite comprehensive as these incorporate the experience of over four decades after issuance of Helsinki Rules in 1966. The document is divided into 14 chapters which cover wide range of related issues on water resources. The aspects covered are beyond the rules as enunciated in Helsinki Rules and UN Watercourse Convention. The most significant aspect where Berlin Rules differ from Helsinki Rules and UN Watercourse Convention is in establishing relationship of two basic principles of international waters law which relate to 'reasonable and equitable utilization' and 'obligation not to cause harm'. According to Helsinki Rules, UN Watercourse Convention and its endorsement by International Court of Justice (ICJ), the principle of obligation to cause harm is subordinated to reasonable and equitable utilization whereas in Berlin Rules, this status has been altered other way round(Bourne 2004). The Helsinki Rules and UN Watercourse Convention establish and emphasize equal right of each riparian state to reasonable and equitable utilization whereas on other hand Berlin Rules emphasizes to manage the shared water resource on reasonable and equitable utilization basis. Berlin Rules defines the term 'manage' in Article 3(14) as "the development, use, protection, allocation, regulation and control of waters". After elevating the principle of obligation not to cause significant harm over the principle of reasonable and equitable utilization in Article 12, the Berlin Rules addressed the significant harm separately in Article 16. The Article 16 requires the riparian states, while managing international waters, should refrain from and prevent acts or omissions within their territory that cause significant harm to co-basin states having due regard for right of each riparian state to make reasonable and equitable use of the waters(Gerhard Lioble 2004).

Besides paradigmatic shift in basic two principles of International Water law, Berlin Rules have also made environmental provisions which are quite comprehensive. Although it does not address the aspect of climate change with that totality yet provisions related to environmental sciences fairly addresses the issues emanating from the current phenomenon of climate change. Chapter V of Berlin Rules deals with protection of aquatic environment and advocates the measures for ecological integrity necessarily required for ecosystem dependent on waters of a particular river. Besides, there are provisions in Berlin Rules which cover qualitative aspects of shared water courses in an adequate and clear manner. Rules also outline the provisions to control pollution and harm to the aquatic environment and not to introduce alien species and hazardous substance which can cause harm to existing ecosystem. Two more aspects which relate to IRS are extreme situations and ground water which have been amicably covered in Chapter VII Berlin Rules. In this chapter, the Article 34 on 'Floods' outlines that states shall cooperate in developing and implementing measures for flood control and sharing the data and information in a manner that interests of other states is looked after. In the same chapter Article 35 stipulates that states should cooperate in the management of waters to prevent, control or mitigate the drought like situation in areas of riparian states. In an environment where water quantity is likely to be further stressed due to steady increase in population, urbanization, industrialization, hydrological variability and environmental degradation, the detailed and specific rules as laid out in Berlin Rules can provide adequate guidelines for addressing the voids in existing bilateral or international transboundary water treaties between the states(Salman 2007).

Climate change – Impacts

A brief overview of historical perspective of sub-continent that how the political divisions and geographical partition with disregard to hydrological boundaries and infrastructure led to

tensions between newly borne states of Pakistan and India. Subsequent events and the process through which the Indus River Basin (IRB) was divided under the auspices of the World Bank leading to signing IWT between India and Pakistan in 1960 has contextualized the perspective issue for further discussion. The IWT seen from the aperture of conflict as well cooperation reveals varying tones from one stakeholder to the other. Picking up cooperative tone of IWT rather than conflictive one in the past but its turning into a conflictive mode under the environment of transgressions into disputed peripheries and observations of concerns thereof is a worrisome phenomenon and a challenge to be reckoned with. Prevailing voids and inadequacies in IWT are transforming cooperative instrument into a conflictual tool and need to be timely and properly addressed lest the conciliatory mode turns into a confrontational one. There are international bodies which deal with the subject that how transboundary water resource can be effectively governed, regulated and managed by the set of rules under international water law as outlined by scholarly non-governmental and UN organizations. Lot of work by national scholars and experts of India and Pakistan and international experts has been done on IWT and its multifarious technical, legal, environmental, economic and social dimensions have been exhaustively analyzed and deliberated, however, a meaningful work for establishing relationship of climate change with IWT for its subsequent climate proofing is not visible on academic or intellectual arena which is an unavoidable necessity for its sustainability. In line with the topic, telescoping IWT through the lens of climate change with a view to undertake its climate proofing, subsequent discussion shall revolve around climate change, its impact on IRB and IWT and the prospects of climate proofing IWT before main argument for further research inquiry is developed.

According to IPCC Fourth and Fifth Assessment Reports published in 2007 and 2013-14 respectively, it is established with high degree of certainty that climate change, a global

phenomenon resulting from global warming, is a reality. Emissions of Green House Gases (GHG) mainly dominated by Carbon Dioxide (CO_2), after industrial revolution and both the World Wars, due to fossil fuel burning and other human induced activities have disproportionately increased. These gases with large warming potential are the major reason for increasing global temperature. The increased global temperature has resulted into fast glacial melting and disturbed meteorological systems. These glacial and metrological fluctuations have ushered an era of climate change and variability which the world was not aware before. Glacial melting, an indicator or a pre-cursor of climate change and varying global weather systems have resultantly distressed the water balance in different regions and river basins particularly where this resource is shared and involves transboundary jurisdictions. According to Goldenman who noted in 1990 that " one of the major challenges ahead for the international community will be to develop the principles, procedures and institutions for managing and protecting shared resources such as watercourse systems at the same time that Earth adapts to climate change"(Cooley, Christian-Smith et al. 2009).

The rise in global temperature, mainly due to anthropogenic reasons, is catalyst in exacerbating climate change phenomenon. With routine development business across the globe, the triggers like continuous emission of GHG have not changed and therefore the increase in global temperature is also continuing unabated. Against recorded increase of 0.76^0C in 20th century, an increase of 0.6^0C in first decade of 21st century is alarming. According to World Metrological Organization (WMO) statement in 2011, out of 16 warmest years recorded, 9 top years were from first decade of 21st century(Rasul, Mahmood et al. 2012). During 21st session of Conference of the Parties (COP) in Paris from 30 November to 11 December 2015 under the auspices of UNFCCC, it has noted with concern that emission of estimated aggregate GHG from 2025- 2030 resulting from the Intended Nationally Determined Contributions (INDC) does not fall within the

limits of least cost 2^0C scenarios rather it lead to a projected level of 55 gigatonnes in 2030. The COP has also noted that in order to hold the increase in the global average temperature to below 2^0C above pre-industrial levels by reducing emission to 40 gigatonnes or to 1.5^0C above pre-industrial level, much greater emission reduction effort will be required than what has been indicated in the INDCs by different nations across the globe(Jayaraman 2015).

Climate change phenomenon is under a continuous research by international organizations like IPCC and UNFCCC, experts from related national and internal departments, researchers and academicians. With a very high degree of certainty, it is established that surface run off is projected to increase in the high latitude and wet tropic regains whereas in mid latitude and parts of the dry tropics it is projected to decrease. There is also a general agreement that climate change will affect the timings, intensity, magnitude and duration of water flows. In snow dominated basins as that of IRB, higher temperature will result in earlier peak flows, lower summer flows whereas winter flows will increase. In rain dominated basin, runoff will be affected more than warming temperatures. Similarly, the ground waters will also be affected by the climate change. Presently understanding about the ground water while estimating freshwater quantities is very rare and is seldom included in transboundary water resources whereas it is an important source which has bearing on water quality and quantity where extraction from aquifer is a common phenomenon. According to IPCC, recharging rate of groundwater is though site specific yet will be affected by climate change. Due to higher temperatures, evaporation rate will become higher which will lead to salinization of groundwater. As a result of reduced surface runoff, the demand on ground water may increase in some regions which will cause aquifer depletion putting further pressure on transboundary water resource(Salman 2007).

According to climate models researched, it reveals that higher or warmer temperatures will cause greater climate variability leading to extreme hydrological events like floods and droughts. Frequency, intensity, duration and magnitude of both floods and drought are likely to increase. Increase in intensity of precipitation will increase the risk of flood and in dry regions the increase in intensity of precipitation may reduce the frequency which may lead to drought like conditions. Warmer temperatures will cause more rainfall than snow which will lead to more floods in winters whereas higher temperatures in winter also mean that what falls as snow will quickly melt and will not turn into ice thereby creating a drought like situation in summer(Meehl 2007). The impact of climate change on water quality is rarely known. Normally water quantity remains in focus when in general the impacts of climate change on water resource are discussed. Due to climate change, the temperature of rivers, reservoirs and lakes are expected to increase which will lead to lower dissolved oxygen concentrations and more algal and bacterial bloom(Backlund, Janetos et al. 2008). With temperature rising and oxygen declining, the cold water species may be denied existence by the habitat and other species of warm water may increase instead resulting into deteriorated water quality. Likewise, intense rainfalls may result into increase in soil erosion and wash more pollutants and toxins into water way, leading to a serious risk to freshwater species and humans. To make such water cleaner, more treatment cost will be entailed resulting into more water consumption rates or degraded output where same low quality water will be used. Similarly with reduction in summer flows, the water quality concerns are likely to be further accentuated. On coastal side as well, the rise in sea level is expected to push saline water into the rivers, deltas and coastal aquifer, thereby threatening their quality and reliability(Cooley, Christian-Smith et al. 2009).

Climate change has direct bearing on water demand. With increased population growth, urbanization, industrialization and improved quality of life, in warmer temperatures, water demand will increase. Similarly, water demand for climate sensitive sectors like agriculture will also increase as plants will require more water to grow in higher and warmer temperatures. Globally agriculture is leading sector which accounts for about 70% of consumption of water; more demand in this sector will apply maximum pressure on water resource. It has been observed that most of the treaties and international agreements do not incorporate economic, social and political impact which climate change has on transboundary water resources. Particularly in those treaties which were framed during the time period when knowledge about climate change was either nonexistent or rudimentary, the absences of factors relating to climate make those treaties short of meeting standards as laid out for examples in international water law document like Berlin Rules. Significance of the impacts of climate change is so glaring that its incorporation in transboundary water treaties is unavoidable (McCaffrey 2003). According to Fischhendler, legal and institutional adaptation to climate change uncertainties in transboundary watercourse treaties is essentially required to make it sustainable(Fischhendler 2004).

Climate Change - Consequences

After having seen the impacts of climate change in terms of rising temperatures in summer and winter, variable precipitations in form of snow or rainfall, melting and retreating glaciers, erratic monsoon with its variable timings, duration and intensity and variable weather systems, water quantity changing in magnitude, volume and duration, deteriorating water quality of surface, sub-surface ground water and aquifers, water demand swelling due to multifarious climatic and

non climatic reasons and inadequacies of transboundary water treaties to incorporate climate related factors , there is need to discuss the consequences which impact of climate change will have on different sectors in physical, social, economic, political and environmental walks of life. This picture about impacts will facilitate contextualizing adaptation and mitigation measures in IRB and IWT in the light of climate change. This process will subsequently help in evolving recommendations and a way forward for climate proofing of IWT.

Observational records held by concerned national and international concerned departments and climate projections established by modeling and researches provide immense evidence that freshwater resources are vulnerable to climate change with numerous wide ranging consequences on societal and ecological structures(Bates, Kundzewicz et al. 2008). This IPCC finding is easily understandable as almost all natural and human environments are intimately linked to hydrological cycle(Vivekanandan and Nair 2009). As impacts of climate change projections on water resources are variable so are the consequences unpredictable in magnitude and severity(Field, Barros et al. 2014). Increased precipitation can trigger devastating floods whereas decreased rainfall can lead to protracted droughts both impacting differently yet with the same outcome of social, economic and environmental disorder. Uncertain climate change related variability expected in availability of freshwater in face of growing water demand due to enhanced agriculture production, economic development, power generation, human health, population growth and the environment is a challenging scenario for both policy makers and managers alike(Kundzewicz, Mata et al. 2008). That is the reason that climate change proponents and experts are now warning the world that severe fresh water crises are in the offing (Jury and Vaux 2007).

Uncertainties of climate change models notwithstanding, their findings are overwhelmingly consistent. Temperatures, precipitations rate and consistency of precipitation

events around the world will be impacted by climate change which in turn will bring more climatic variability and change leading to extreme hydrological events like floods and droughts(Lehner, Döll et al. 2006). Experts are of the view that annual average river run off and water availability in sub tropics and mid latitudes will fall by 10 – 30 % by mid of 21st century whereas an increase of 10 – 40 % is expected in tropical regions and higher altitudes(Kundzewicz, Mata et al. 2008). As anticipated by IPCC, if global average temperature rises by 2^{0}C, then it will cause 20 – 30 % more flooding of the land area as is being inundated by current seasonal deluges(Solomon 2007). Glacial and snow pack melting due to warmer temperatures will cause variation in availability of water which will result into more flows in rivers and lead to flooding as a result of two-fold effects. Firstly, due to decreased accumulation and increased melting periods, there will be more water in the rivers and secondly warmer temperatures will cause precipitation as rainfall instead of snowfall which will deny rebuilding of glaciers and snowpack. This indeed will again result into more melting thereby leading to more flooding. It is expected that for initial half of the century, it will have more flooding whereas subsequently more drought like situations will emerge as the snowpack would have been exorbitantly already melted. The consequences of floods and drought will impact water, food and energy securities which have wide ranging social, economic, political and environmental implications(Field, Barros et al. 2014).

Agriculture and food security are closely interlinked. Agriculture production is highly dependent on regularity and reliability of hydrological cycle as human needs have become accustomed to it. The functions of this dependence regime include spatial and temporal distribution and availability of water by rains, snow, glaciers, rivers and aquifers variability in which can threaten the agriculture production thus compromising food security. Over one sixth of world population lives in basins and during dry season their dependence on glacial melting is critical.

Any change in the sensitive hydrological balance can adversely affect the ability of farmers and the nations to produce sustainable level of food and fiber to meet their routine dietary needs(Vivekanandan and Nair 2009). Crop growing cycles and seasons are linked with timings and volume of availability of water, a variation in both will affect the sowing, growing, maturing and yield of the crops which can have deep social and economic impacts for the country. In South Asia, crops yields are expected to reduce by 30% as a result of climate change(Solomon 2007). By 2050, world is likely to house 9 billion people. Their food needs would multiply and similarly water demand would increase. The variable water flow projected under climate modeling makes the situation doubtful. Extraordinary adaptation measures to mange water in future will be required otherwise the food security will not remain a sustainable attribute(Initiative 2012).

Another worrisome consequence of impact of climate change relates to human health. As expected by scientist and United Nations experts, human health maladies including deaths can develop due to variable hydrological cycle ensuing from climate change especially in lesser developed countries(Furth 2010). Flooding events result into explosion of existing sewer and treatment system which cause water borne and vector borne diseases. According to World Health Organization (WHO), annual deaths of 5.62 million children occur under the age of five due to malnutrition while 1.8 million young children die every year due to diarrheal diseases which will get exacerbated due to variation in water quantity and quality under climate change environment. Similarly about three million deaths annually occur due to inadequate and improper water, sanitation and hygiene conditions. Experts opine that rise in temperature can cause vector borne diseases like malaria and dengue fever even in those areas which had been inhospitable to them before. Similarly extreme flooding and drought conditions have potential to adversely affect the health of people. Heat wave in summer is yet another phenomenon which has increased due to

climate change and is responsible for large number of deaths world over(Haines, Kovats et al. 2006).

Ecosystem and habitats are also vulnerable to climate change. Predictions reveal that in next 50 years, 15% to 37% species from terrestrial biodiversity will become extinct. (Keith, Akçakaya et al. 2008). A study predicts that by 2070, loss of fish biodiversity in 52 rivers around the world would be as high as 75% due to reduction in river water flows(Xenopoulos, Lodge et al. 2005). Projected climate change consequences for ecosystems, habitats and species are wide ranging and catastrophic which may include disturbance in physical, chemical and biological characteristics of fresh water ecosystem, retreating ice cover leading to elimination of cold water species and intrusion of warm water spices instead resulting into habitat disintegrations and drastic effect on flora and fauna especially harming those species which are environmentally sensitive and lack ability to migrate or adapt resulting into extinction(Bates, Kundzewicz et al. 2008). IPCC projects that warmer water temperature and more rainfall will result into water pollution due to sedimentation, nutrients, agricultural chemicals and dissolved organized substances altering sensitive balance of ecosystems and habitats. Intense rains and fast voluminous flows will result into soil erosions which will transport pathogens and dissolved pollutants to surface and sub surface aquifer water which will further deteriorate its quality leading to social, economic and environmental implications(Jeppesen, Kronvang et al. 2009).

Water, national security and peace make probably the most significant matrix which becomes threatened due to the impact of climate change on transboundary freshwater resource. Water and national security are intimately linked. Transboundary freshwaters resource has always remained a potential source of international conflict(Boute 2016). Due to its shared, unequally divided and distributed, finite and scarce nature and potential of being mismanaged, the freshwater

has always created a competition in riparian states to achieve incompatible goals in its utilization. There has been no choice except to go for a conflict or cooperate in utilization of water resource(Dinar, Katz et al. 2015). Mostly it has been managed with cooperation than a conflict. United Nations realized its importance well in time and had been highlighting the vulnerability of freshwater resource to climate change at different global forums. UN Secretary General, Kofi Anan in 2001 had warned the world that "fierce competition for freshwater may well become a source of conflict and wars in future" and on 24 January 2008, the present UN Secretary General Ban Ki-moon cautioned the world that water scarcity could lead to an increase in future conflict and added that "Population growth will make the problem worse. So will climate change? As the global economy grows so will its thirst. Many more conflicts lie just over the horizon"(Michel 2009). Incompatible water demand and availability template, will adversely impact nation's ability to ensure social and economic development resulting which their living standards will be compromised. Reduced water availability could lead to low agriculture productivity, poor public health, migration and settlement issues, livelihood constraints and diminishing wellbeing. Moreover, intense rains and more water flows in rivers will cause catastrophic floods that would adversely affect human lives, their properties and assets, destroy crops and habitats, force migration and relocations and disturb social fabric of the society. Consequently, a race for acquisition of water resources could initiate confrontation and competition for survival. This could take the shape of a conflict, severity of which would depend upon the strength and capabilities of the involved riparians(Eckstein 2009, Europe 2009).

Climate Change and Pakistan

Pakistan due to its generally warm climate is more vulnerable to climate change than other courtiers as it lies in a geographical setting where expected increase in temperature is likely to be

higher than global average. About 60% of its land area is arid which receives less than 250 mm rainfall, 24 % semi-arid area receives rainfall between 250 – 500 mm whereas remaining area generally mountainous receives more than 500 mm rainfall annually. Main source of its fresh water is rivers of IRS those are predominately fed by Hindukash-Karakorum-Himalayan (HKH) glaciers which are reportedly retreating due to global warming. Pakistan's economy is largely agrarian drawing water from rivers, rainfall and groundwater all of which are highly sensitive to climate change. Due to increasingly large risk of variability in monsoon, Pakistan is exposed to protracted drought and voluminous floods. Pakistan coastal areas due to rise in sea level, saline sea water intrusion, coastal erosion and increased cyclone activities are equally vulnerable to climate change. Pakistan due to its peculiar geographical and climatic location is expected to experience an increase of 4^0C by turn of 21^{st} century against the global anticipated average increase is 2^0C. All these factors accumulatively seriously threaten Pakistan's water, food and energy securities(Rasul, Mahmood et al. 2012).

At time of partition, Pakistan has about 5200 cum per capita availability of water but now by 2015 with changed demand profile, the water availability has decreased to less than 1000 cum per capita rendering it a highly water stressed country. With gradual rise in average global temperature, both precipitation and thermal regimes in Pakistan have also experienced sharp changes in last two decades. Pakistan has diverse landmass which ranges from ice capped HKH Mountains in the north, descending through arable plains, desert and semi desert in the center and south, and the coastal belt of Arabian Sea in the south. IRB is the only source of freshwater for Pakistan. It draws 80% of its water from glacial melting which is complemented by rains from monsoon or westerly weather systems for meetings its agriculture, power generation, industry and domestic needs. Due to climate change impacts, visible variations in hydrological cycle of Pakistan

have been observed. These variations include changed thermal regimes and fluctuating precipitation patterns resulting into rapid glacial retreat, frequent and intense floods(Since Floods-2010, there has been no break), protracted droughts, variable water quantities in terms of timings, duration and magnitude, deteriorating water quality, disturbed cropping patterns with increased crop water requirement, frequent and intense heat waves, rise in sea level, saline water intrusion, coastal erosion, frequent cyclones and above all ground water depletion as a result of intense extractions. In given climate change scenario, in future as well, in Pakistan the temperature is expected to rise as anticipated and precipitation patterns will also remain disturbed as the adaptation and mitigation measures to arrest deteriorating trends causing climate change have not come in place and are not expected to be in place in near future as well(Rasul, Mahmood et al. 2012).

The Necessity to Factor in Climate Change into the Treaty

Climate change is a global phenomenon. Its impact on a basin is similar in neighbouring countries in a particular region. India and Pakistan both are water stressed countries. Melting glaciers in HKH region are equally impacting India and Pakistan because the rise in temperature in both the countries is almost similar. Precipitation patterns particularly in western part of India and Pakistan which are directly related to IRB are similar because of common source of HKH glacier melting and monsoon rains emanating from Bay of Bengal and Arabian Sea. Both countries are extracting ground water to meet their deficiency of freshwater for intensive crop cultivation for boosting food production for their growing population. Due to exponential population growth

in India and Pakistan, water resource of IRB has come under intense stress and relentless pressure. Due to absence of modern irrigation techniques in both India and Pakistan, about 90% of freshwater is being utilized by agriculture sector, huge part of it is wasted due to mismanagement. Water scarcity is impacting both the countries may be with slight variation due to allied reasons like availability of multiple sources of freshwater to India as compared to Pakistan. Annual per capita availability of water in India and Pakistan before partition was over 5000 cum which has reduced to 1170 cum in India in 2010 and less than 1000 cum in Pakistan in 2012(Yang, Brown et al. 2014). Interestingly, the condition of water utilization in India and Pakistan may be same but the impact of water scarcity and variability for both India and Pakistan are quite different as India has over a dozen basins to feed its land where Pakistan has only IRB on which its population, economy and environment are dependent. Secondly being an upper riparian country, the flexibilities and leverages which India can exercise are much more than Pakistan therefore stakes of Pakistan in IRB are much higher and deeper than India particularly under climate change environment when water availability has become uncertain on spatial and temporal scales.

Water of Indus Basin is being regulated between India and Pakistan on the basis of IWT. IWT was negotiated in 1950s and signed on 19 September 1960. According to that time, it was probably one of the best solutions to resolve a lingering water dispute which had started just after the partition between newly born states of Pakistan and India. From hindsight, one can assume that the best available knowledge of that time was applied in framing IWT. In last half a century, there has been immense technological and educational advancements in the field of hydrology, water resource management, transboundary watercourse management, conflict resolution, environment, monitoring techniques, data acquisition, storage, sharing techniques and archiving and above all new paradigm of climate change has emerged which was not heard of at that time. Moreover, the

water demand has increased due to more population, economic development and improved living standards whereas on other hand due to climate change, the availability of freshwater has become uncertain, unpredictable and reduced. Consequently, freshwater a finite commodity has become a source of tension and conflict between the states which share common transboundary water course. The extreme meteorological events have added yet another dimension to the adversity, that water resource management inadequacies have started revealing more vigorously than before. Besides other solutions at user end for efficient water resource management, the basic solution lies in reviewing IWT to incorporate current knowledge particularly of climate change which is missing from the document and is causing tension between India and Pakistan and also has the latent potential to turn it into a conflict if existing gaps in IWT are not timely managed.

As alluded earlier, while framing IWT, the quantity attribute of the shared water was only focused in 1950s and that too without incorporating the impact of climate change. Even the ground water and aquifer which are integral part of a basin and now have attained a relevant position in water utilization were not included in the Treaty. Provisions regarding water quality, pollution, environment, aquatic life, ecological systems and extreme events which have immense social, economic, political and environmental implications are all together missing from the Treaty. In 1960, when IWT was framed, it was a standalone effort. There were no internationally established and accepted transboundary watercourse rules under international water law. Whereas now an effective framework under international law is available in the form of Helsinki Rules-1966, UN International Watercourse Convention - 1997 and Berlin Rules - 2004 which need to be applied on IWT as well for making it more efficient and effective. Climate change has impacted every facet of human life which needs to be accurately measured for precise and timely response. For that purpose, water mapping, data acquisition and monitoring through GIS and Remote Sensing

for accurate water analysis and response is an essential component of response strategy which needs to be incorporated in IWT for effective management by the riparian states. Moreover, for complex transboundary water management where bilateral monitoring and implementation mechanisms are not very effective, for making the process more transparent and responsive, there is a need to constitute mutually consented external body for monitoring, data acquisition and subsequently information and data sharing to all stakeholder with a view to make the response strategy more efficient particularly for extreme events like floods. In this way IWT will be climate proofed and would become sustainable under climate change scenario. The current climate change knowledge induction in IWT will become recourse to future transboundary water conflict management between India and Pakistan.

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