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CLIMATE CHANGE: A GROWING THREAT TO THE INDUS WATER TREATY

Rameez Mohd Bhat
Research Scholar, Department of Political Science, Aligarh Muslim University, Aligarh

Abstract
The partition of British India in 1947 not only created new boundaries, but also divided the water resources in the Indian subcontinent and cut off the waterways. Since the flow does not follow political lines and dictations and flows across the boundaries, as a result, the division and sharing of rights over the flowing waters between the newly established states (India and Pakistan) have generated conflicts at political level. Since independence, they remain at an undeclared state of war with varying degrees of uncompromising issues, particularly over water. Although water is not technically a fundamental problem between the two countries, differences over the utilization of river water is one of the key issues. The Indus Water Treaty, signed between India and Pakistan in 1960, is a water-sharing agreement through which the two countries attempted to resolve water crises in the post-independence period. This treaty has been proclaimed internationally as a success story and is often quoted as an example of a successful and peaceful resolution to the water dispute. It has proved very successful for the two countries over the past six decades and has survived various ups and downs. But it has not remained without having loopholes and with the passage of time it has come under strains. The treaty remains the governing body, but there are areas in which it can be improved. One such area is how the treaty will respond to climate change. This paper argues that due to changes in environmental conditions, what made the contract successful in the past will not matter in the future. In addition, this study addresses the need for climate change mitigation through enlightening the impact of climate change on the ecosystem and infrastructure of the Indus River Basin. To this end, this paper provides some suggestions about the changes that could be included to update the Indus Water Treaty that would successfully mitigate the effects of climate change.

Keywords*: Climate Change, India, Pakistan, Water Resources, Indus Water Treaty, Water Crises, Renegotiation.*

United Nations Ex-Secretary General Ban Ki-moon has warned that "lack of water resources could lead to increased conflicts in the future. Population growth will make the problem worse. And so will climate change. As the global economy grows, so will its thirst. Many more conflicts lie just over the horizon."[i]

The vulnerability of the Indian subcontinent to the effects of climate change is of vital importance since the main impact of climate change in the subcontinent would be on the hydrology, affecting water resources and the agricultural economy. However, very little work has been done in India on the impact of climate change on hydrology. The main river systems in the Indian subcontinent, Brahmaputra, Ganga and Indus, which originating in the Himalayas, are expected to be vulnerable to climate change due to the significant contribution of snow and glaciers into these river systems. It is clear that global warming and its impact on the hydrological cycle and the nature of hydrological phenomena would pose an additional threat to the Indus Basin. Basically, the climate change has a direct emphasis on floods and drought disasters. Additional impacts of global climate change that have significant impact on water resources include an increase in evaporation rate, a higher proportion of rain rather than snow, earlier and shorter runoff seasons, higher water temperatures, and lower water quality. An increased in evaporation rate is expected to a decrease in water supplies in many areas. The largest deficit is expected to occur in the summer, leading to lower soil moisture levels and more frequent and severe agricultural

droughts. More frequent and severe droughts caused by climate change will have serious management implications for users of water resources.

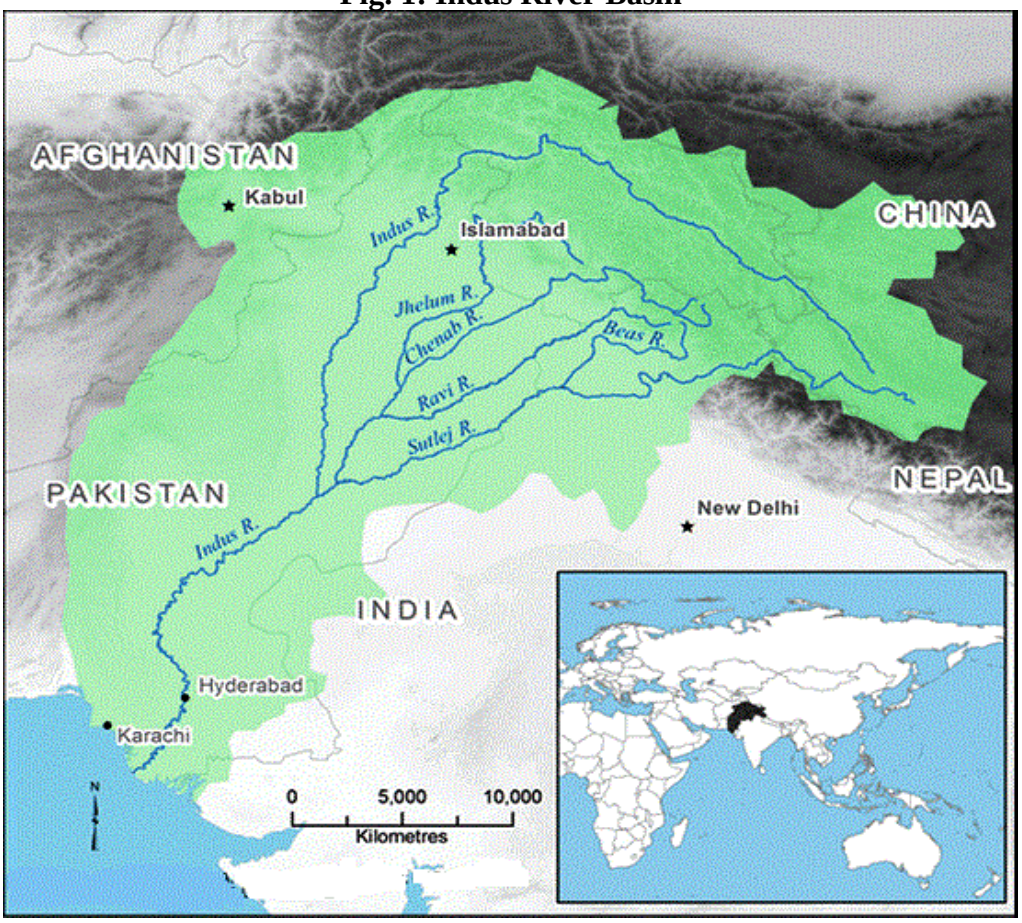
The Indus Water Treaty (IWT) is under pressure due to increased water scarcity in India and Pakistan, and the environmental threat of the Indus river system. This has led to a heated water debate in India and Pakistan where hawks on both sides talk about water wars and the abrogation of the IWT. The fact is that the IWT was signed as a permanent resolution to the problem of water allocation between India and Pakistan, when there was a large quantity of water in the Indus and its tributaries. In view of the on-going climate changes, water insecurity in the basin has increased, which led to the politicization of the water issue between the two countries. There is scientific evidence that climatic factors affect the flow of rivers. Low flows often lead to allegations that India is stealing Pakistani waters. Flooding in rivers also leads to claims that India is deliberately flooding the other side. Poor understanding of climatic factors can lead to misunderstandings and misperceptions. Accordingly, due to its political, emotional and divisive structure, water sharing can become an acute conflict, or the benefits of water sharing principles can act as a catalyst for strengthening further cooperation.

The Indus Waters Dispute

Water dispute between India and Pakistan owes its origin to the partition of the country with the division of Indus basin into two units. As a result of partition, the province of Punjab was divided between India (East Punjab) and Pakistan (West Punjab) and the irrigation system of the province stood divided between the two countries. This division was bound to result in future disputes as most of the head works were in India while the canals were in downstream Pakistan. To overcome the situation, temporary agreements were signed by East and West Punjab for water supply to Pakistan's canals. These agreements expired on 31 March 1948 and on 1st April 1948 water flow was stopped by East Punjab compelling Prime Minister Jawaharlal Nehru to personally intervene. This incident also highlighted the need for a permanent and stable arrangement.[ii] To ride over the situation, Inter-Dominion Agreement was signed on May 4, 1948, which clarifies the need for cooperation between the two countries and continuation of bilateral talks. However, in the next three years, bilateral talks failed to resolve the river water conflict. Pakistan wanted to refer the dispute to the International Court of Justice, but India refused. To add to this, the countries also began to disagree over the interpretation of the 1948 Agreement, further complicating the situation.[iii]

The Indus River and its five tributaries - Ravi, Beas, Sutlej, Jhelum and Chenab originate in the Himalayas and their foothills and flow west and southwest through Jammu & Kashmir, Indian and Pakistani Punjab. Finally, the tributaries join the Indus and the main river flows through Pakistan to end up in the Arabian Sea.[iv] Out of these six rivers, Ravi, Ravi, Beas and Sutlej are considered the Eastern Rivers, while the Indus, Jhelum and Chenab are identified as the Western Rivers of the Indus river system. The Indus and the Sutlej originate from Lake Manasarovar in Tibet (China) and flow initially through India. The Jhelum originates in the Kashmir Valley in India and flows into Pakistan. The Chenab, again, originates in Himachal Pradesh in India and then flows to Pakistan. The Beas also originates in India.[v] In this river system, India is the upper riparian and Pakistan is the lower riparian.

Fig. 1: Indus River Basin

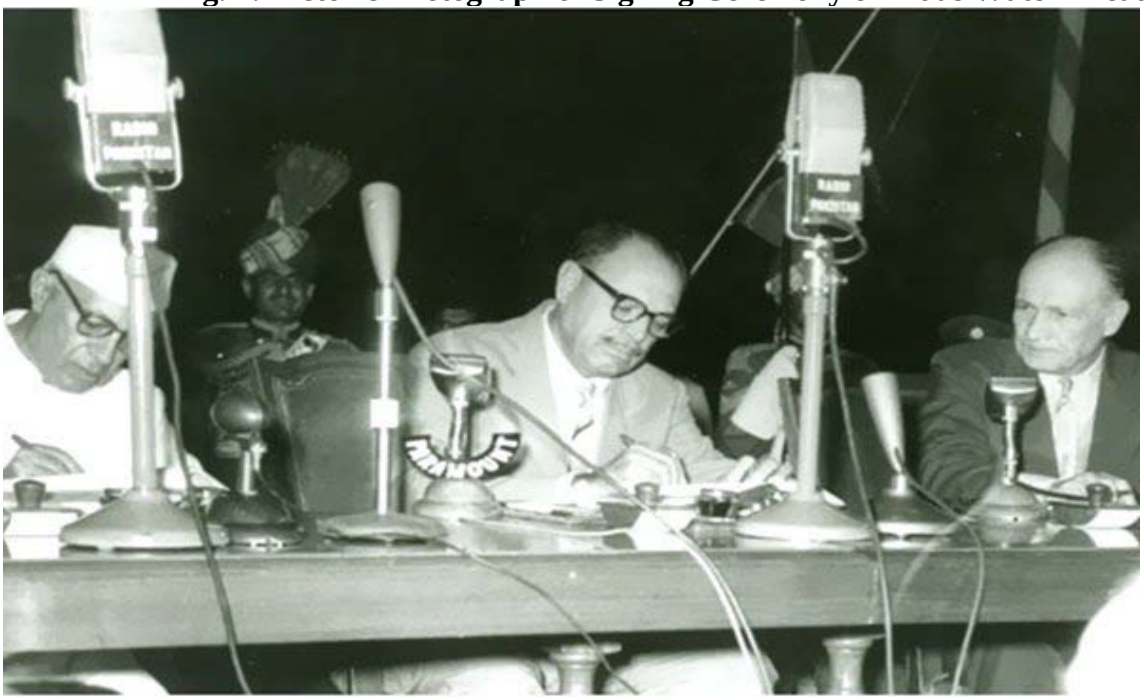


Source: United States Geological Survey

The Indus Waters Treaty

After the failure of the bilateral talks, the growing tensions between India and Pakistan prompted the World Bank to offer its "good offices" to resolve the water dispute. Meditation began in May 1952 in Washington DC, at the World Bank headquarters. After prolonged talks, "The Indus Water Treaty 1960" was signed on 19th September 1960.[vi] The Treaty was signed by Prime Minister Jawaharlal Nehru on behalf of India and President Muhammad Ayub Khan on behalf of Pakistan and W.A.B. Iliff on behalf of the World Bank. Upon ratification on January 12, 1961, the Treaty comprising of three parts - the Preamble, 12 Articles and Annexes A to H - entered into force retrospectively from 1st April 1960. The Preamble to the treaty outlines the objective of the treaty as the necessity of "fixing and delimiting in a spirit of goodwill and friendship, the rights and obligations of each in relation to the other, concerning the use of these waters". Annexes A to H cover the following areas amidst other subject – agricultural use of certain tributaries of Ravi by Pakistan; agricultural use of the upper reaches of the western rivers by India; dispute resolution system; hydropower generation and storage by India.

Fig. 2: Historic Photograph of Signing Ceremony of Indus Water Treaty



The signing of the Indus Water Treaty, Sept 19, 1960: (L-R) Prime Minister Nehru of India, President Ayub Khan of Pakistan and World Bank VP Sir William Iliff. The treaty decided on the use of six rivers and has been largely successful in ending water-related conflict between the two neighbours for ensuing decades. Photo Courtesy: World Bank

Water Sharing Arrangement

The arrangement of water sharing under the treaty is relatively simple. Under the treaty, three eastern rivers – the Ravi, Beas and Sutlej - are given to India for exclusive use,[vii] while the three western rivers – the Indus, Jhelum and Chenab - are given to Pakistan.[viii]

Article II of the IWT provides that India shall exclusively use Ravi, Beas and Sutlej. It can dispose of their water at will while limiting the amount of withdrawal during the transition period.[ix] Pakistan has the right to use the waters of these rivers for domestic and non-consumptive use, and agricultural use as defined in Annexure B excluding hydropower.[x] Article III provides that India will "let flow" all the waters of the western rivers and that Pakistan shall receive "unrestricted use of all waters of the Western Rivers". India has the right to use water for limited purposes for domestic use, non-consumptive use,[xi] and agricultural use provided in Annexure C; hydroelectric power generation as provided in Annexure D;[xii] also, except as provided in Annexure D and E, India will not store water or build any storage work on the western rivers.[xiii]

Moreover, the IWT provides that any non-consumptive use made by each party should not materially change the flow in any channel to the prejudice of the other party.[xiv] Besides, each party has to maintain the natural channel of the rivers and shall avoid, as far as possible, any obstruction to the flow in the water channel which is likely to cause material damage to the other party.[xv]

The IWT allowed for a transitional period of 10-13 years. During this time period, Pakistan constructed dams and other structures to transport 14 Million Acre Feet (MAF) of water from the western rivers to the parts formerly irrigated by the eastern rivers. To this end, the Indus Development Fund[xvi] was established with a sum of a billion dollas with contributions from the World Bank, Australia, Canada, Germany, New Zealand, the United Kingdom, the United States and India.[xvii]

The Principle of Cooperation

Articles VI and VII of the IWT lay down the principle of cooperation. Article VI provides for "exchange of data". The regular exchange of data concerning daily flow and use of water is provided for in the Treaty. Article VII provides for future cooperation and recognizes the "common interest" of both the parties in the "optimal development of rivers". To the fullest extent possible, the two countries shall cooperate by mutual agreement. Article VII (2) also provides for specified cooperation and exchange of information about planned engineering works on any of the rivers.

Dispute Resolution Mechanism

Article IX of the IWT provides for the resolution of disputes. Disputes between the parties can either be termed as questions, differences or disputes. The conflict in the first place is a "question" and must be referred to the Permanent Indus Committee (PIC). If the PIC is unable to resolve the "question", it will become a "difference". A "difference" is referred to a neutral expert.[xviii] The decision of the neutral expert is final and binding. Arbitration[xix] can be used if the difference does not fall within the purview of the neutral expert or the neutral expert rules, in which the "difference" should be regarded as a "dispute".

Disputes arising under the Treaty

Disputes under the treaty began arising when India started constructing a number of hydroelectric projects on the western rivers.[xx] As mentioned earlier, Pakistan has the right to exclusive use of the waters of the western rivers subject to some limited rights of India. Under the Treaty, India has the right to hydropower generation over these rivers subject to conditions specified in Annexure D.[xxi] The right is a restricted right, and India is forbidden to use the western rivers to generate hydropower in a way that affects the amount of water or interfere with the timing of the flow. As mentioned earlier, even the storage of water is not permitted except as provided in Annexures D and E.[xxii]

Annexures D and E provide the technical details for undertaking such projects. Most of these technical specifications are such that can allow for multiple viewpoints. Thus, what may seem feasible for engineers representing India may not be the same for technical experts of Pakistan, making Pakistan to come up with allegations of violation of Treaty by India.[xxiii] This is the reason that majority of the objections raised by Pakistan have been technical in nature.

Pakistan's complete dependency on the western rivers and their apprehensions as a lower riparian also adds to the process. The IWT stated that India provides all the details of projects to Pakistan and Pakistan can object to any plan going against its treaty rights. This makes India's position vulnerable and India has to meet Pakistanis disapproval before going ahead with any hydroelectricity generation plan.[xxiv]

The Indus Waters Treaty is highly admired as a successful mechanism for conflict resolution.[xxv] It has worked well for more than half a century, despite having the political hostilities between India and Pakistan, and has survived three wars between the two countries.[xxvi] Despite its success in water conflict

resolution, there is a body of opinion in both countries that the division of water under the treaty was unfair, but the alleged injustice in India is the exact opposite of that alleged in Pakistan.[xxvii] Although a government-level agreement has been reached on the matter, public opinion still seems to be fuelled by nationalist sentiments. The current allocation of water from the Indus Basin is that the lower riparian Pakistan receives 80% of the water while India - the upper riparian get only 20%. Many Indians believe that this is an unfair compromise, and has been foolishly accepted by Indian negotiators. On the other hand, the prevailing public opinion in Pakistan is that the land that went to India because of the partition used only 10% of the waters of the Indus Basin. Due to the IWT, India now receives 20% of the Indus basin water.[xxviii]

Impact of Climate Change on the Indus Water Treaty

Climate change will have a major impact on water resources and its predictions are fraught with uncertainties around the world. It affects the globe and the hydrological cycle. It also affects the availability of surface and subsurface water. These changes increase the vulnerabilities of the ecosystem and of human society. Climate change is causing the water supplies of Indus Basin to have an uncertain future. Although, the forecasts of the future water supplies in the Indus Basin by climate models are disturbingly critical for the short-term. Most agree that water flows will reduce by the end of the century as the Himalayan glaciers retreat, specifically based on the assessment of temperatures changes being consistent with global climate change projections.[xxix]

This study argues that the IWT is out-dated and does not take into account the environmental changes due to climate change. In its defence, climate change was not a prevalent topic during the adoption of IWT. However, the changing circumstances of the rivers justify the revision of the IWT. We are currently linking India-Pakistan relations with a dispute over ownership of Kashmir. In fact, most violent conflicts between the two countries have been over Kashmir dispute. Because it is so widespread, water conflict is probably not their main concern. However, what makes the water conflict so unique is that environmental and anthropogenic conditions affect water resources. Two large countries, such as India and Pakistan, will use much more water than two smaller countries. This water cannot be renewed, unless it is replenished with a hydrological cycle.

However, climate change will significantly change that cycle. As climate change continues, conflicts over water will continue. Climate change is a stressful factor and "although the potential for outright war between countries over water is low, cooperation is also often missing in disputes over transboundary resources".[xxx] The longer the climate change problems are overshadowed by the situation in Kashmir, the worse the situation will be when it is finally addressed. Both India and Pakistan are in extreme situation regarding water availability. Both countries are facing shortage of water and are expected to continue to experience this. Therefore, "it would be beneficial if both countries recognized their cooperative potential and combined their resources and expertise to make mutually beneficial decisions".[xxxi]

The Indus Basin is heavily dependent on glaciers in the western Himalayas. Mountains act as reservoirs that hold water and release it over time. These ice reservoirs actually form the primary river flow in dry periods. These glaciers are now at the mercy of climate change and that does not bode well for the Indus Basin. The Indus River basin covers an area of 1.12 million square kilometres and is shared by 300 million people in Afghanistan, India, Pakistan and China. Glacial melting from the Western Himalayas provides more than 40% of the annual water flow in the Basin.[xxxii] Nevertheless, according to forecasts, in the next 50 years the number of glaciers will decrease, which will lead to an increase in river flow.

The depletion of glacial reserves will be followed by a 30-40% decrease in water flow in the Indus River - the main river in the Indus Basin.[xxxiii] Scientists predict that climate change will also significantly affect average rainfall in the coming years, leading to more severe droughts or more severe floods.[xxxiv] For example, in Pakistan a decrease in the number of rainy days is expected but with an increase in severe precipitation events.[xxxv] One of the most devastating effects of climate change is that it can reduce access to freshwater and lead to conflict.[xxxvi] The treaty ought to be adjusted to reflect climate change because low water availability causes cumulative effect in all areas of life.

Climate change crosses the verge of irreversibility, which means that even if the contextual factors such as political and economic causes are resolved, climate change will remain a burden on society.[xxxvii] Eventually, climate change can dramatically change the effectiveness of a treaty if it does not adapt to future changes. This may "affect the ability of basin states to meet their water treaty commitments" when the treaties are not set up to respond to variability.[xxxviii] Climate change may have adverse effects that can reduce availability of food. This will affect people's lives, the economy, health and environmental safety.

The IWT is obviously an example of effective mediation, but it has not remained without having loopholes. The unexpected threat of climate change casts doubt on the credibility of IWT. What may have worked well in the past may not work in the future, as climate change is changing the conditions the environmental conditions of waterways. The threat of climate change calls for the need to update the IWT in support of these changing circumstances.

Climate Change as a threat to Water Availability

Climate and water has a close relationship with each other. They depend on each other. Since, if there is any change in climate, it affects water resources. The change in water level also depends on the climate. During the summer, the climate is very hot, and in countries like Asia the temperature is around 40 degrees Celsius. In this season, the rate of evaporation of surface water as well as groundwater rises to a peak. Thus there is a decrease in water resources. But in the monsoon season, the climate changes rapidly from very hot to very humid and causes immense monsoon rains. It may also cause a flood.[xxxix]

Climate change affects hydrological phenemena such as precipitation patterns and runoff, which increases the vulnerability of some regions. For instance, the volume of runoff from winter snowmelt will be determined primarily by fluctuations in winter precipitation.

On the other hand, the production of glacier melt water will vary depending on the availability of energy (temperature changes, mainly during the summer) during the melting season at the glacier surface.[xl] Scientists have predicted a decrease in precipitation over the lower Indus Basin leading to drought-like conditions and an overall warming effect. Although the forecasts of climate change in this region cannot be reliable, it is predicted that trends will continue towards this pattern.[xli] Extreme flooding in the Basin will lead to chaos on farms and in communities along riverbanks. Flooding transforms the soil and makes surrounding areas more vulnerable to erosion and degradation, resulting in pollution of waterways and reducing agricultural productivity.[xlii]

The analysis of the melting rate of glaciers entering the Indus River basin is limited due to the inaccessibility of the severe Himalayan mountains and high altitudes, but the forecasts obtained using the hydrological modeling approach in combination with the calculation of the mass balance of the glacier showed the most probable glacial scenario as a result of a "decrease in mean upstream water supply from the upper Indus".[xliii] It is assumed that the bulk of the glacial melt water into the rivers of

Indus Basin occurs in the ablation zone. This represents 18% of the total flow of 110 MAF from the mountain sources of the Indus River to Pakistan. The most likely source of the remaining 82% of runoff is melting from the winter snowpack.[xliv] In a measurement conducted using the Normalized Melt Index (NMI) from 2001 to 2007, it was found that melting snow and glaciers "is 151% of the total discharge naturally generated in the downstream areas of the Indus"[xlv] and a recent Dutch study predicted that a reduction in glaciers would reduce the Indus flows by 8% by the year 2050.[xlvi] This reduction in water flow is detrimental because the water flow of Indus River acts as the main source of water for the downstream part of the Indus Basin.[xlvii] Moreover, about one third of the renewable water resource is groundwater. The average accessibility is estimated at 287 km^3, with about 1,329 cubic meters available per capita. Climate change is projected to shrink renewable water availability to below 750 cubic meters per capita by 2050.[xlviii] The impacts in the Indus Basin are likely to be severe due to the large population of 300 million people and dependence on agriculture within the Indus River Basin.[xlix]

Climate Change as a threat to Agriculture Production

Agriculture has a major impact due to climate change. It causes loss of crops and income with the occurrence of severe weather events. Climate change mainly causes the polar ice to melt, which in turn increases the sea level and inundates coastal areas. It also increases the rate of precipitation, leading to heavy rainfall. Although increased precipitation increases water resources that also results to rapid movement of water from the atmosphere to the oceans reducing our ability to store and reuse it further.[l] The Intergovernmental Panel on Climate Change (IPCC) has concluded that freshwater systems are more vulnerable to to the effects of climate change because it is predicted that increased precipitation and its variability would increase the risk of floods and droughts, which would affect food stability and water infrastructure.[li]

This is dangerous to Pakistan, since it relies entirely on the Indus River System and has no other alternatives if the Indus runs short. Agriculture makes 23% of Pakistan's national income and about 68% of the rural population depends on agriculture as a source of their livelihood.[lii] The Indus River System, which brings about 154.3MAF of water annually,[liii] is a necessary component for irrigation and agriculture for 300 million people within the Indus River Basin.

On the other hand, India that got the raw end of the deal by getting access to only 20 per cent of the entire Indus Basin's water, clearly has good reason for dissatisfaction with the IWT. The Treaty also sternly limits India's ability to build hydroelectric power plants in Kashmir. This is important for India because it suffers from severe water stress. Nearly 300 million people in India face water shortages, and severe droughts have caused a high rate of peasant suicide. In India, the agricultural sector contributes only between 15-17% in GDP, but 50% of its population depends on agriculture for their livelihoods.[liv] It is interesting that India uses the maximum groundwater in the world. Although the Indus River Basin contributes only 7% of total water possession, it irrigates most fertile land of India which includes Punjab, which alone contributes 12% of the 230 million tons of food grains in India.[lv]

It is important to highlight that water stress will continue to increase in these two countries because although the population and their demand for water will continue to grow, the supply is not increasing. There are significant possibilities of reduced water availability for irrigation due to the reduction or reallocation of the flow of water. This can happen through the following: first, reduction in ground water resources; second, decline of reservoir storage due to sedimentation; third, rise in environmental flows; and fourth, growing urbanization will increase domestic and industrial demand for water. Furthermore, it is estimated that the number of people living in the Indus Basin is likely to grow up to 400 million in

2050 as compared to 300 million people today. In addition, the intensification and development of industrial agriculture will also create more pressure on the smaller farmers and ground water resources. Moreover, according to NASA's GRACE satellite, the aquifers in Pakistan and northern India are amongst the most stressed and increasingly declining in the world.[lvi]

Need of Amendment in the IWT to adapt to Climate Change

The challenges emerging from climate change, environmental degradation and changing demographics call for closer cooperation between India & Pakistan for strengthening IWT in order to preserve the ecology and hydrology of Indus river basin. The ecological concerns, its impacts on people across borders and their needs, compensation, etc. has been totally side-lined by the IWT. The treaty has not taken into account the related social and environmental factors, and has not involved ordinary and local residents in the management of shared water resources, despite the fact that they were the most affected party. Moreover, in the framework of the IWT, the replacement works for diverting water from western rivers resulting from this water logging and siltation of adjacent areas and its impact on a large section of the people who had to give up their traditional water rights were not taken into consideration.[lvii]

A successful treaty meets potential problems. In the case of the IWT, any changes made should mitigate for water availability, flooding, and its corresponding impacts. There are four categories of mechanisms that can be incorporated into existing treaty to make it more responsive to these issues associated with climate change. These are: (i) flexible allocation strategies; (ii) drought provisions; (iii) amendment and review procedures; and (iv) joint management of the basin.[lviii] The scope of these mechanisms can provide the flexibility to accommodate climate change.

Flexible Allocation Strategy

To successfully accommodate climate change, the treaty must be flexible and resilient. DeStefano et al. (2012) emphasizes that a flexible treaty responds to two main factors: allocation and variability management. The treaty should have a mechanism for determining the amount of water, since it provides some certainty in the uncertain future of climate change. The IWT dictates an allocation agreement; however, the problem is that the agreement is not sustainable for the growing population and resource reduction. Hence, many agree that those treaties which "shows flexibility are likely to be more appropriate to deal with water variability".[lix] A treaty with flexible distribution mechanisms recognizes that water allocations may need to be reduced to match water availability.[lx]

Drought Provisions

An active treaty should also have a variability management system in place. "Variability management stipulations are designed to deal with climatic extremes such as droughts and floods or other specific variations".[lxi] Thus, the Treaty can respond to this in the same way as it reacts to distribution. The treaty must be flexible in order to deal with a reduction in available water due to drought.

Amendment & Review Procedures

This mechanism already exists in the IWT. A successful treaty must be included a dispute resolution system, such as third party involvement or arbitration, to review the actions of parties. It provides a forum for communication and information, which is invaluable when there are differences over the interpretation of the treaty.[lxii] Dispute Resolution increases the level of confidence of the parties, ensuring that their needs will be heard in a fair environment.[lxiii]

Article VII on 'Future Cooperation' of the IWT provides that its provision can be modified by a duly ratified treaty by the two governments, which stated that "the two parties recognize that they have a common interest in the optimum development of the rivers" and "they declare their intention 'to cooperate by mutual agreement', to the fullest possible extent."[lxiv] There is a need to use Article VII on "Future Cooperation" for sustainable management of the Indus Basin in optimal manner.

Joint Management of the Basin

There is no doubt that the treaty needs management institutions that facilitate conflict resolution. Joint commissions such as the Indus Commission and other river basin organizations can contribute to the effective management of the parties.[lxv] The IWT was unique in the sense that rather being a water sharing treaty, it was a water partition treaty. The division of water under the Treaty as discussed earlier- was quite simple. Out of six rivers, three were allocated to India three to Pakistan. This division was unknown to any international custom. Rather, was reflective of the then prevailing tensions between the two countries. The initial proposal of the World Bank harped on joint development of the resources of the Indus Basin. Both, David E. Lilienthal (on whose idea World Bank took up the issue of mediating the Indus Water Treaty) and Eugene R. Black, the then President of World Bank were in favour of joint development of the basin. Lilienthal stressed that;

"Her (Pakistan's) present use of water should be confirmed by India, provided she works together with India… in a joint use of this truly international river basin on an engineering basis… . This objective, however, cannot be achieved by the countries working separately; the river pays no attention to partition-the Indus, she 'just keeps rolling along' through Kashmir and India and Pakistan. The whole Indus system must be developed as a unit, as is the seven state TVA System back in the U.S. jointly financed (perhaps with the World Bank help) an Indus Engineering Corporation, with representation by technical men in India and Pakistan and the World Bank, can readily work out an operating scheme for storing water wherever dams can best store it, and for diverting and distributing water."

Integrated water resource management is becoming extremely important, given the fact that physical separation of the tributaries of Indus has hampered the possibilities of efficient integrated basin management. Due to growing demographic changes that are exacerbating water scarcity, it is the responsibility of both countries to ensure internal water resources management by following the principles of Integrated Water Resources Management (IWRM) & share best practices in water conservation techniques in agriculture, industrial & domestic uses.

Besides using the abolition of Article 370 during the election campaign for the recently concluded assembly elections, Prime Minister Narendra Modi reinforced his national rhetoric and promised voters in Haryana that he would stop the flow of the Indus River into Pakistan, instead redirecting its waters into the state.[lxvi] The Pakistani government responded to Modi's claims, stating that any attempt to divert the flow of the Indus would be considered an act of aggression. Tensions between the two neighbours have become increasingly strained since the decision to split Jammu and Kashmir into two union territories—diplomatic ties have been downgraded, foreign envoys have been sent back, and bilateral trade has also reduced. However, this is not the first instance that the Indus Water Treaty (IWT) has been threatened during times of increased tension. Scrapping of the IWT was discussed by the Indian government after the attack on Parliament in 2002, and also after the Uri skirmish in 2016, when Modi famously said that "blood and water cannot flow together."[lxvii]

Sherry Rehman, Parliamentary Leader of the left-wing opposition Pakistan People's Party (PPP) in the Senate, in an interaction with media told, "Water security, especially in South Asia, has become a regional security threat. It has become a matter of survival", She continued , "We are now facing challenges brought about by climate change which were not a primary focus during the negotiations for the Indus Water Treaty,…. Aside from the lack of formal dialogue, the rhetoric floating around suggesting a possible water war is particularly alarming".[lxviii]

Abrogation of the treaty is an absurd proposition. Besides sending a wrong signal to India's other neighbours with whom India has entered into treaties to define water-sharing arrangements, the measure will also be not taken kindly of by the world community which has invested a substantial amount for financing the replacement work undertaken by Pakistan under the treaty arrangements. Also, even otherwise the treaty, Pakistan stands in the position of lower riparian state and is entitled to water rights under international water law. Even abrogation of the treaty, Pakistan has its rights secured under international law. Also, abrogation of the treaty will make alive the rights presently waived by Pakistan over the Eastern rivers. Hence, abrogation of the treaty does not seem to be sound proposition.

Though abrogation of the treaty is not an option, at the same time, there are legitimate concerns which need to be addressed, most importantly the effects of climatic change.

Environmental threats have nothing to do with political and regional borders. Over the past three decades, the Indus watersheds have been severely degraded. To restore the basin's water resources, it is necessary to work together on such issues as climate change, water quality, reduction of glaciers and groundwater usage. These problems are common to both countries. Both are currently on the verge of water shortages as a result of climate change and the rapid decline of glaciers. These issues are interlinked with population growth, urbanization, and industrialization. Both countries cannot afford to ignore or abandon their duties with regard to environmental degradation in their territory and in vicinity they share the water and other natural gifts and must bear any environmental damage if not taken seriously. Although the IWT does not take these changes into account, the current situation emphasizes the need for joint studies in New Delhi and Islamabad and the establishment of some institutions to monitor these problems.

Conclusion

The Indus Water Treaty has been a sufficient agreement for water disputes between India and Pakistan, but changing conditions are likely to challenge its future success. The treaty continued despite the poor relations between the two countries; but it does not have taken into account the problems associated with the upstream - downstream pollution and, most importantly climate change. As climate change continues, this leads to obvious and radical consequences. The biggest consequence is that the amount of water will decrease. The amount of water available for agriculture and livestock will reduce, the health of the water will diminish, and typical weather conditions will change. The threats of climate change must be taken seriously because water is the backbone of life in India and Pakistan. The impacts of climate change and a strong dependence on water will affect the ecological, social and economic systems within the countries; and these consequences are often exacerbated in countries that have a history of social and political conflicts. In light of this information, this study offers few suggestions on how to improve the IWT. The basics of these improvements depend on collaboration, communication, and education. The best way to achieve these goals is to change the responsibility of the Indus Commission and change the scope of existing agreements.

In fact, climate change and its anticipated impacts, in effect, are pushing for an active revision of the IWT structure. Rather than overtly focusing on technical and technological approaches based on the narrow experience of engineers and state representatives, the new river management agreement in the region will require different social circles and their experience with the Indus waters. Cooperation between countries is essential for the effective management of trans boundary water resources. This is due to the fact that the management of trans boundary water resources requires interaction and confidence-building between the states of the basin. The UN declarations would be welcome if we can take credible and effective steps towards water cooperation at all levels in a fair, sustainable manner and with the participation of local people. This becomes more relevant when water demand increases due to population growth, urbanization, industrialization, increased per capita consumption and increased losses due to climate change. These changing conditions especially climatic pressures are likely to challenge the success of IWT in the near future. Hence, a re-negotiation of the IWT to adopt to these changing conditions and to have a more integrated system will be mutually beneficial to both the parties and is the need of the day.

References

1. Address to a gathering of business leaders at the World Economic Forum at Davos, Switzerland, on 24 January 2008.
2. Tufail Jawed, "The World Bank and the Indus Basin Dispute: Mediation by the World Bank-II", First Quarter, Pakistan Horizon, Published by: Pakistan Institute of International Affairs,Vol. 19, No. 1, (1966), Retrieved from: https://www.jstor.org/stable/i40067822.
3. Ibid.
4. Asma Yaqoob, "International river waters in South Asia: Source of conflict or cooperation?" Regional Studies, vol. XXII, No. 4, (Autumn 2004), p.132.
5. Mary Miner, Gauri Patankar, Shama Gamkhar, and David J. Eaton. "Water Sharing between India and Pakistan: A Critical Evaluation of the Indus Water Treaty." Water International 34, no. 2 (2009): 205. Retrieved from: https://doi.org/10.1080/02508060902902193.
6. "The Indus Water Treaty 1960".
7. Article II, Indus Water Treaty.
8. Article III, Indus Water Treaty.
9. Article II (1), Indus Water Treaty.
10. Article II (3), Indus Water Treaty.
11. The term "Non-Consumptive Use" has been defined under Article I (2) of IWT to mean the use of water for navigation, floating of timber etc., flood control or protection, fishing, wildlife and other like purposes. Agricultural use or use for generation of hydroelectric power has been specially excluded from the definition.
12. Article III (2), Indus Water Treaty.
13. Ramaswamy Iyer, "Was the Indus Waters Treaty in Trouble?", Economic and Political Weekly -Vol. 37, Issue No. 25, 22 Jun, 2002.
14. Article IV (2), Indus Water Treaty.
15. Article IV (6), Indus Water Treaty.
16. Subrahmanyam Sridhar, "The Indus Water Treaty", Security Research Review, Vol I (3), , Available at http://www.bharat-rakshak.com/SRR/Volume13/sridhar.html .
17. Article V(1), Indus Water Treaty provides that India will pay a fixed amount of Pounds Sterling 62,060,000 towards cost of replacement works.
18. Article IX (2)(a), Indus Water Treaty.
19. Article IX (5), Indus Water Treaty.

20. Muhammed Siyad, "Indus Waters Treaty and Baglihar Project: Relevance of International Watercourse Law," Economic and Political Weekly, Vol. 40, No. 29 (Jul. 16-22, 2005), pp. 3145-3154.
21. Article III (d), Indus Water Treaty.
22. Article III (4), Indus Water Treaty.
23. Nirupama Subramanian, "Violation of treaty will damage ties: Zardari", The Hindu, New Delhi, 13 October 2008.
24. Ramaswamy R Iyer, "Was the Indus Waters Treaty in Trouble?", Economic and Political Weekly -Vol. 37, Issue No. 25, 22 Jun, 2002
25. Douglas Hill, "The Regional Politics of Water Sharing-Contemporary Issues in South Asia," in Kuntala Lahiri Dutt and Robert J. Wasson, Eds. (2008), Water First- Issues and Challenges for Nations in South Asia, New Delhi, SAGE, 68
26. Ramaswamy R. Iyer, Water-perspectives, issues, concerns, New Delhi: SAGE (2003), 220.
27. Ramaswamy R. Iyer, Towards Water Wisdom- Limits, Justice, Harmony, New Delhi: SAGE (2007), 65.
28. Ramaswamy R. Iyer, "South Asian Water Concerns," South Asian Journal, 18. Retrieved from: <http://www.southasianmedia.net/Magazine/Journal/ 8_water_concerns.htm>.
29. Akhtar, M., Ahmad, N., and Booij, M. J.: The impact of climate change on the water resource of Hindukush- KarakorumHimalaya region under different glacier coverage scenarios, J. Hydrol., 355, 148–163, 2008.
30. Wolf, Aaron, Shared Waters: Conflict and Cooperation. Annual Review of Environment and Resources. 32:3. (July 2007).
31. Ahmad, Azhar, Indus Waters Treaty A Dispassionate Analysis. Policy Perspectives, Vol 8, No. 2, (2011), pp. 73–83.
32. South Asia Water Initiative Indus Focus Area Strategy: 2013-2017. (n.d.). Retrieved from https://www.southasiawaterinitiative.org/indus
33. Mahe Zehra Husain "The Indus Water Treaty in Light of Climate Change". (2010). Retrieved from http://www.caee.utexas.edu/prof/mckinney/ce397/Topics/Indus/Indus_2010.pdf
34. Cooley, H., Christian-Smith, J., Gleick, P.H., Allen, L., Cohen, M., Understanding and Reducing the Risks of Climate Change for Transboundary Waters. Pacific Institute, Oakland, California, USA,(2009), p. 43.
35. Mahe Zehra Husain "The Indus Water Treaty in Light of Climate Change". (2010). Retrieved from http://www.caee.utexas.edu/prof/mckinney/ce397/Topics/Indus/Indus_2010.pdf
36. Lucia DeStefano, James Duncan, Shlomi Dinar, Kerstin Stahl, Kenneth Strzepek, & Aaron Wolf, eds., "Climate change and the institutional resilience of international river basins", Journal of Peace Research 49(1) (2012), pp.193-209.
37. Homer-Dixon, Thomas F. Environment, Scarcity, and Violence. Princeton, NJ: Princeton UP, 1999.
38. Lucia DeStefano, James Duncan, Shlomi Dinar, Kerstin Stahl, Kenneth Strzepek, & Aaron Wolf, eds., "Climate change and the institutional resilience of international river basins", Journal of Peace Research 49(1) (2012), pp.193-209.
39. Dr.A.S.Kanagalakshmi, K.Sharan kumar, A.Harineshwariya, A.J.Anjali "Impact on Water Resource Due To Climate Changes", IOSR Journal of Mechanical and Civil Engineering (IOSR-JMCE), Volume 15, Issue 5 Ver. I (Sep. - Oct. 2018), PP 10-13. www.iosrjournals.org
40. Yu, W., Yang, Y. C., Savitsky, A., Alford, D., Brown, C., Wescoat, J., & Debowicz, D., The Indus basin of Pakistan: The impacts of climate risks on water and agriculture. World Bank Publications. (2013).
41. Rajbhandari, R., Shrestha, A. B., Kulkarni, A., Patwardhan, S. K., & Bajracharya, S. R., "Projected changes in climate over the Indus river basin using a high resolution regional climate model (PRECIS)", Climate Dynamics, 44(1-2), (2014)., 339–357.
42. Cooley, H., Christian-Smith, J., Gleick, P.H., Allen, L., Cohen, M., Understanding and Reducing the Risks of Climate Change for Transboundary Waters. Pacific Institute, Oakland, California, USA,(2009), p. 43.

43. Immerzeel, Walter W., Ludovicus P. H. van Beek, and Marc F. P. Bierkens. (2010).“Climate Change Will Affect the Asian Water Towers”, Science Vol. 328, No. 5984, pp. 1382–85.
44. Yu, W., Yang, Y. C., Savitsky, A., Alford, D., Brown, C., Wescoat, J., & Debowicz, D., The Indus basin of Pakistan: The impacts of climate risks on water and agriculture. World Bank Publications. (2013).
45. Immerzeel, Walter W., Ludovicus P. H. van Beek, and Marc F. P. Bierkens. (2010).“Climate Change Will Affect the Asian Water Towers”, Science Vol. 328, No. 5984, pp. 1382–85.
46. Mandhana, Niharika. “Water Wars: Why India and Pakistan Are Squaring Off Over Their Rivers.” Time, Accessed April 16, 2012. Retrieved from http://content.time.com/time/world/article/0,8599,2111601,00.html.
47. Rajbhandari, R., Shrestha, A. B., Kulkarni, A., Patwardhan, S. K., & Bajracharya, S. R., “Projected changes in climate over the Indus river basin using a high resolution regional climate model (PRECIS)”, Climate Dynamics, 44(1-2), (2014)., 339–357.
48. “South Asia Water Initiative’s Indus Focus Area Strategy: 2013-2017” citing the Indus Basin Working Group (2013).
49. Immerzeel, Walter W., Ludovicus P. H. van Beek, and Marc F. P. Bierkens. (2010).“Climate Change Will Affect the Asian Water Towers”, Science Vol. 328, No. 5984, pp. 1382–85.
50. Dr.A.S.Kanagalakshmi, K.Sharan kumar, A.Harineshwariya, A.J.Anjali “Impact on Water Resource Due To Climate Changes”, IOSR Journal of Mechanical and Civil Engineering (IOSR-JMCE), Volume 15, Issue 5 Ver. I (Sep. - Oct. 2018), PP 10-13. www.iosrjournals.org
51. Cooley, H., Christian-Smith, J., Gleick, P.H., Allen, L., Cohen, M., Understanding and Reducing the Risks of Climate Change for Transboundary Waters. Pacific Institute, Oakland, California, USA,(2009), p. 43.
52. Bhatti, Muhammad & Farooq, Muhammad, “Politics of Water in Pakistan”, Pakistan Journal of Social Sciences (PJSS), Vol. 34, No. 1, (2014). pp 205-216.
53. Ibid
54. Kakakhel, Shafqat. “The Indus River Basin and Climate Change”, Criterion Quarterly, 1 Aug. 2015.
55. Ibid
56. Aslesha Dhillon, “Water Wars : Climate Change’s Impact On The Indus Water Treaty”, Center Of GlobalAffairs,NewYorkUniversity.Retrievedfrom: https://www.academia.edu/33342257/Water_Wars_Climate_Changes_Impact_on_the_Indus_Water_Treaty
57. Richa Singh, “Transboundary Water Politics and Conflicts in South Asia: Towards Water for Peace,” New Delhi: Centre For Democracy and Social Action, (2009), p.36 Retrieved from: https://in.boell.org/sites/default/files/transboyundary_water_politics_and_conflicts_in_south_asia_towards_water_for_peace.pdf
58. Cooley, H., Christian-Smith, J., Gleick, P.H., Allen, L., Cohen, M., Understanding and Reducing the Risks of Climate Change for Transboundary Waters. Pacific Institute, Oakland, California, USA,(2009), p. 43.
59. Lucia DeStefano, James Duncan, Shlomi Dinar, Kerstin Stahl, Kenneth Strzepek, & Aaron Wolf, eds., “Climate change and the institutional resilience of international river basins”, Journal of Peace Research 49(1) (2012), pp.193-209.
60. Ibid
61. Ibid
62. Lucia DeStefano, James Duncan, Shlomi Dinar, Kerstin Stahl, Kenneth Strzepek, & Aaron Wolf, eds., “Climate change and the institutional resilience of international river basins”, Journal of Peace Research 49(1) (2012), pp.193-209.
63. Ibid
64. The Indus Water Treaty 1960, Article VII

65. Lucia DeStefano, James Duncan, Shlomi Dinar, Kerstin Stahl, Kenneth Strzepek, & Aaron Wolf, eds., "Climate change and the institutional resilience of international river basins", Journal of Peace Research 49(1) (2012), pp.193-209.
66. "PM Modi's water threat to Pakistan", India Today , New Delhi, October 16, 2019, Retrieved from: https://www.indiatoday.in/india/story/pm-modi-s-water-threat-to-pakistan-what-india-can-do-under-indus-waters-treaty-1609883-2019-10-16.
67. "Blood and water cannot flow together", The Indian Express, New Delhi September 27, 2016 - Retrieved from: https://indianexpress.com/article/india/india-news-india/indus-water-treaty-blood-and-water-cant-flow-together-pm-modi-pakistan-uri-attack/.
68. Melanie Hall , "Water wars: Are India and Pakistan heading for climate change-induced conflict?" DW ENVIRONMENT , 25.01.2019 Retrieved from: https://www.dw.com/en/water-wars-are-india-and-pakistan-heading-for-climate-change-induced-conflict/a-47203933.