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Hydro Politics of Indus Water Treaty: A Critical Perspective of India and Pakistan

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Abstract

The World Bank facilitated the making of the Indus Waters Treaty (IWT) in 1960 and long considered it one of India's and Pakistan's most successful trans-border water-sharing agreements. The treaty has been put into practice and has enabled the distribution of water for a stable framework throughout the Indus Basin, in spite of political tensions. In 21st century, it is, however, facing greater difficulties and has become a strategic and political concern as a result of climate change, population growth and rising geopolitical competition. The study is qualitative secondary data by using academic literature, policy reports and treaty documents and employs an interpretative and critical analysis in examining hydro-political dynamics of the region. The research will cover the analysis of the increasing politicization of water in India–Pakistan relations, especially on the project of dams at the source in India and on the consequences of the Hindu Kush melting down for water resources. The results show that water insecurity in Pakistan is increasing with the utilization of upstream water and the rate of climate change such as irregular river flow and reduction in glaciers. In addition, the fixed grant scheme of the IWT seems to be more and more unsuitable to face the current environmental and political challenges. The study suggests that while the treaty likely to remain feasible in the near term, institutional arrangements, adaptive water management, and improved bilateral cooperation are key to ensuring the continued viability of the treaty and avoiding increased hydro-political tensions in the region.

Keywords: Indus Waters Treaty, Hydro Politics, India Pakistan Relations, Water Security, Climate Change, Dam Construction, Water Scarcity, South Asia.

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Introduction

Water is a natural resource that is universally accepted as crucial for human survival, but it also becomes a very political and strategic issue in the context of South Asia. With the high population densities, agriculture dependence and climate sensitivity of the region, water issues are not only a developmental issue but are also closely related to economic stability, food security and the national survival (Ali, 2008).

The Indus River system is one of the world's largest and most significant river systems made up of 6 major rivers Indus, Jhelum, Chenab, Ravi, Beas and Sutlej. The water sources are primarily the glaciers and seasonal snow melting in the Himalayan and Tibetan ranges. They run through the adjoining Indian and Pakistani territories and end up discharged in the Arabian Sea and provide livelihoods to millions along the way. It is the system of rivers on which India and Pakistan's agriculture has been greatly dependent (Barrett, 1994). The Indus Basin Irrigation System is the world's largest contiguous irrigation system and irrigates wheat, rice, cotton and sugarcane in Pakistan in particular. In India too, the rivers play crucial roles in the provision of irrigation, generation of hydropower and provision of potable water in the north states (Bhatti, 2019).

This river system is vital not only for the environment but also for civilization as well. Established on its banks is one of the oldest urban civilizations in the world, the Indus Valley Civilization (at around 3300 BCE - 1300 BCE). The river was essential for agriculture, for planning of drainage systems and urbanization in the cities of Mohenjo-daro and Harappa. This continuity indicates that human habitation of this area always becomes dependent on the availability of the water (Biswas, 1992). In colonial British days Indus Basin had been turned into a much more engineered irrigational system. Canal irrigation was developed on a large scale to increase productivity from land especially in Punjab and Sindh. The Upper Bari Doab Canal, Sir hind Canal and Triple Canal Project transformed what were once semi-arid lands into highly productive agricultural. This system rendered Punjab as one of the most fertile areas in colonial India (Briscoe, 2006).

An artificial dependence on river control structures instead of natural flow patterns was, however, brought about by this colonial irrigation development. The whole was conceived as a single hydraulic unit by the British for a hydro-system and frequently, water from one part of the basin was vital for agricultural lands far downstream. Political partition later estranged the two, and this interdependence was a point of contention (Burgess, 2016). Post Partition of the British India in 1947 immediately a huge and urgent water problem emerged. The hastily-drawn Radcliffe Line precipitated the bifurcation of Punjab without keeping hydrological facts and figures in mind. Thus, the river-headworks and canal sources were transferred to India and large areas of agricultural command were transferred to Pakistan, upsetting existing patterns of irrigation.

This abrupt split resulted in immediately arising difference between India and Pakistan regarding water allocation. Pakistan, the downstream country, became increasingly dependent of the upstream flows by the control of the Indian government. Any slight alterations in water releases posed significant threats to agriculture, and fears for water security and economic stability were widespread. The World Bank was called in to facilitate negotiations which led Prime Minister Jawaharlal Nehru and President Ayub Khan to sign the Indus Waters Treaty on 19 September 1960 in order to defuse the mounting tensions. This accord has long been regarded as one of the most successful cases of international water diplomacy (Chandrasekharan, 2017).

As per the treaty, then there were two categories of 6 rivers. The eastern rivers (Ravi, Beas, Sutlej) were given to India for free use, western rivers (Indus, Jhelum, Chenab) were largely reserved for

Pakistan. Under strict design, however concluded that India was left with limited rights on the western rivers for non-consumptive purposes like hydropower generation, navigation, irrigation, etc (Immerzeel, 2010). The treaty has overcome many geopolitical hurdles despite having survived for over six decades, wars (1965, 1971, 1999), nuclearization of both parties, and continued political hostility. Nevertheless, the treaty has been held up, and it is considered one of the few instances of long-term collaboration between two unfriendly states.

In the past decades, however, new challenges have arisen which were not envisaged when the treaty was drawn up. The manipulation of the flow of western rivers in India through the implementation of hydropower schemes, including Kishanganga and Rattle, has led to concerns of potential violations in terms of the design of the treaty in Pakistan (Immerzeel, 2010). Meanwhile the impact of climate change is a significant dis-stabiliser in the Indus basin. Climate change has caused glaciers in the Himalayas to melt faster, with consequences of potential short-term flooding and long-term impacts on water availability. Uncertainty in river flows has been further compounded by the seasonal variation in rainfall patterns (Iyer, 2003).

Pakistan, whose economy relies heavily on agriculture, is one of the most water-stressed countries in the world as it is highly dependent on the Indus River system. Loss or disruption of water supply have a direct impact on food security, rural livelihood and economic stability. Apart from environmental and infrastructural stresses, the water demand has also risen owing to growing population and industrialization in both India and Pakistan. This growing need has led to increased mutual competition among users for water resources, which makes water resources management more challenging (Mehsud, 2020).

Even though a legal structure exists with the treaty, handshakes on water related issues do not match the extent of cooperation required due to mutual distrust between India and Pakistan. Water has hence turned into an issue of national security, national sovereignty, and regional stability in South Asia, as well as purely technical and environmental issues (Michel, 1967).

Further, the changing south Asian hydro-political scenario underscores the complexities of water governance in Indus basin. Besides tending to be utilized as a natural source for agricultural and domestic purposes, water has currently turned out to be a strategic possession which is tightly associated with national security and regional stability (Briscoe, 2006). With doubts by India towards Pakistan, and Pakistan's unilateral infrastructure projects, the concerns about equitable water sharing have grown. The lack of transparency, limited data sharing and different interpretation of treaty provisions add to the difficulties of cooperative mechanisms and risks escalating conflict.

Furthermore, a renewed focus and reinforcement of the already existing institutional setting have become more visible and urgent than ever. The IWT, a treaty that has withstood the test of time, needs to be modernized in order to tackle current problems like climatic variability, environmental sustainability, and a growing demand for water. Adaptive governance mechanisms that can be integrated with climate resilience, technological innovations and collaborative water management approaches are urgently needed. Bilateral dialogue, trust building exercises, and joint scientific research can have a pivotal role in securing long-term water security and stability in the region (Chandrasekharan, 2017).

Theoretical Framework

The Hydro Hegemony Theory conceived by Zeitoun and Warner in studying the dynamics of power of the Indus waters Treaty are applied in this study. The theory suggests that upstream states

have a structure to make it more likely for them to influence management and governance of shared water resources. This is secondary study and identified literature from different academic sources as well as reports submitted by government institutions, treaties and the international arbitration given by the international experts to evaluate the influence of the presence of India in upstream water security and their influence in hydro-political dynamics in Indus Basin (Mehsud, 2020).

Moreover, by applying institutional theory, the working of the Indus Waters Treaty can also be understood better in terms of the formal rules, norms and organizations which play a part in the management of transboundary water resources. The treaty itself is also a well-designed institutional setting that has traditionally provided a means for managing conflicts between India and Pakistan despite the political tension (Michel, 1967). But when new pressures (climate change, population growth, and higher water demand) are put on the system, institutional limitations come into the picture. This shows the importance of understanding that institutional mechanisms with regard to water sharing should sometimes be evaluated along with the power dynamics of the arrangement and the flexibility and efficiency of the mechanisms. This means that the study widens its analysis to consider the importance of institutional resilience and governance systems on ongoing cooperation and stability in the Indus Basin (Ali, 2008).

Literature Review

Briscoe (2006) The Indus River Basin and the Indus Waters Treaty (IWT) primarily set the stage for water as a political and strategic issue and a security concern, and not a natural resource. Most studies seem to concur that power imbalance, geopolitical tensions and environmental pressures all play a role in influencing the water relations between India and Pakistan.

Ali (2008) Others say that the IWT merely paved way to cement asymmetry in power by providing India an advantage on water security of Pakistan with hydroelectric project such as Kishanganga and Rattle. Further argues that the treaty is interpreted by some to restrict India's hydro-political flexibility and is even discussed in terms of what it ought to be revised or modified.

Rasul (2014) Conversely, Rasul and Ali stress that water complexities cannot be reduced to technical matters, and that the treaty has lost some of its effectiveness in today's context due to political, security, and climate change issues. Mehsud and Niazi also note that poor governance, population growth, and internal water issues in Pakistan have undermined water security, exacerbating the water scarcity situation.

Burgess (2016) Research, such as Qamar and Mahla, target the impacts of climate change, including glaciers melting, rainfall variability, and growing demand, which are all indirectly putting stress on Indus Basin.

Salman (2007) Overall, the literature reveals that although IWT is a successful case in terms of water cooperation, it is facing the pressures of climate change, political distrust and increasing water demands, and has to move towards new cooperative and adaptive governance.

Research Gap

Literature reviewed shows that most reviews either focused on the successful implementation of the treaty in the past or on the legal clauses or adaptation to aspects of climate change in the treaty. But the effects of the above on the water security of Pakistan and sustainability of the treaty have not been effectively studied. The objective of this study is to therefore fill this gap by integrated analysis of legal, environmental and political aspects in the Indus Basin.

Research Questions

- What is the significance of the water resources in the relation-political equation of India and Pakistan and what is the significance of Indus water Treaty?
- Does the treaty have relevance to the 21st century problems like climate change and an ever-growing water demand?
- What changes in the availability and flow of water in seasonal water flows are likely to be observed in Indus Basin due to climate change?

Research Methodology

This article uses a qualitative research approach to explore the hydro-political aspects of water governance in the Indus River Basin (IRB). The data used in this research consists of secondary data with secondary data analysis techniques namely document analysis and thematic analysis. A large number of academic journal articles, reports, and policy documents of various governments, international organization reports, treaties, arbitration awards, and publications from various think-tanks have been collated on the Indus Basin.

Historical Background of Indus Water Treaty

The history of the Indus Waters Treaty (IWT) dates back to the transformation of the Indian subcontinent with respect to the political, geographical and hydrological aspect of the region, and most notably after the Partition of British India in 1947. The dual Integrated ecological and irrigation network of Indus River system had developed long before the advent of Partition but was divided into two nation-states India and Pakistan without taking the natural flow of rivers into account (Qamar, 2019). This separation led to one of South Asia's first and most serious water sharing impasse.

By the time of Partition, the Punjab territory was the most intensively irrigated area of farming in the old British India. The irrigation system was well interconnected and relied on water control facilities like headworks outside the Indian boundaries, erected during the colonial period. Most of these irrigated agriculture areas, however, were in Pakistan. This resulted in a structural imbalance, whereby Pakistan was now a 'downstream dependent state', and India had command over the key upstream water holding infrastructure and sources (Sarwar, 2025). This immediately made water a strategic weakness for Pakistan and a potential point of contention between the two countries, as was pointed out (Michel, 1967).

Relations regarding water sharing tensions began to grow quickly in the early years following 1947. Then, water was provided to Pakistan through an Indian controlled headworks and Delhi started withholding supplies to Pakistan's farms which raised concerns about the economic and food security of Pakistan. Minor changes in water flow led to huge interruptions in farming activities and further emphasized the fragility of the inherited irrigation system (Chandrasekharan, 2017). These early confrontations proved that water has become a technical, political and even security problem.

The international community saw a danger of the conflict escalating and so stepped in. World Bank is instrumental in negotiating between India and Pakistan. The two countries almost ten years after the initial discussions, technical studies and diplomatic work, declared the Indus Waters Treaty on 19th September 1960 (Swain, 2001). Among the most notable successes in water diplomacy, the treaty was signed by Indian Prime Minister Jawaharlal Nehru and Pakistani President, Ayub Khan.

This was the principle behind the treaty: dividing the Indus River system into two sections, one by river allocation and not one by territory. The allotment of three eastern rivers named Ravi, Beas, and Sutlej for the unrestricted use of India. The three western rivers: Indus, Jhelum and Chenab were assigned mostly to Pakistan, with the country being handed control of the bulk of the resources in the basin. This was meant to provide long-term stability by making the water rights issue mutually comprehensible between both the countries (Briscoe, 2006).

But the treaty also gave India certain limited rights of use of the western rivers in "non-consumptive" use, like run-of-the-river hydroelectric power generation, for navigation and limited irrigation, subject to strict adherence to technical design norms. The intent of this compromise was to accommodate the need of Pakistanis for utilization of water from western rivers and the developmental needs of Indians (Thatte, 2008).

The main institutional development as a result of the treaty was the creation of the Permanent Indus Commission (PIC) to facilitate constant communication between the two countries. Commission is made up of one commissioner from each country and is tasked with exchanging hydrological data, as well as to solve minor technical problems and hold regular meetings. Moreover, its status continues to be a working link of India and Pakistan even during a state of political tension or during the two wars (Warikoo, 2005).

The Indus Waters Treaty has proven to be extremely resilient in the last few decades. It has survived three wars (1965, 1971 and 1999) between India and Pakistan, constant political ups and downs and both countries' nuclearization. Although these obstacles exist, it has not failed to uphold and is considered one of the most successful treaties of international conflict resolution via law and institutional mechanisms (Thatte, 2008).

But it is clear that the treaty, too, has its strengths and weaknesses in the light of its history. The agreement was drafted at a time when variability of climate, population growth and large-scale environmental degradation was not a focus. It had been mainly oriented towards provisions of fixed water allocation instead of adaptive basin wide management. This meant that, although it was successful in resolving conflicts regarding the mainly post-Partition issues, it could not be expected to recognize hydrological and ecological changes in the longer term (Rasul, 2014).

Traditional history of the IWT documents a process of colonial irrigation integration into post-Partition geopolitical division, and ultimately to a formal legal framework for shared irrigation. It is a diplomatic achievement, and a system now being put under greater stress by the evolving environmental, political and developmental landscape in South Asia (Qamar, 2019).

Discussion

The findings of this study indicate that the Indus Waters Treaty (IWT) is a highly successful international water agreement in preventing large scale water conflict between Pakistan and India and constitutes one of the most enduring in international water diplomacy. But it is now more under threat due to climate change, melting of glaciers, irregular monsoons and increasing demand for water which has made availability unpredictable particularly for Pakistan downstream of the dam. The treaty primarily addresses predetermined water divisions rather than flexible integrated water resources management meaning it is less flexible when facing contemporary environmental concerns (Mumtaz, 2023). Meanwhile, water has become a strategic and political question: hydropower projects and the activities done upstream are often seen from a security perspective and there is considerable mistrust between the two countries in this regard, which leads to hydro-hegemonic dynamics. The existing institutional frameworks, such as the Permanent Indus

Commission, and international arbitration have been helpful for peaceful settlement of disputes, but they are not well prepared to safeguard the upcoming ecological and climatic issues. In general, IWT is still a successful model of cooperation; however, to remain viable and effective in the future, it needs to be modernized via its capacity to adapt itself to the changing climate situation, better sharing of data, and more flexible and cooperative water governance (Michel, 1967).

Water as a Geopolitical Instrument

The water from the Indus Basin has gradually transitioned from a natural resource to a potent geopolitical weapon and a significant element in India's and Pakistan's strategic dynamics. Water is in principle a shared resource that can be managed with cooperation and mutual benefit, but in reality, it has slowly turned into a means for competing for strategic advantage, political influence and security (UNEP, 2010). This change is evident in the context of the Indus Waters Treaty (IWT), in which technical issues are sometimes ignored in the light of wider geopolitical tensions.

Advised use of water as an applicative tool is one of the major aspects of this change. Most of the major rivers of the Indus Basin having their sources in India give India a strategic edge on upstream control of the river. It is situated upstream which gives it the power to affect the flow timing, quantity and flow regulation to downstream areas in Pakistan. Despite limits on direct diversion of the water in the western rivers, even non-consumptive uses like electricity generation by hydropower can lead to perceived or real uncertainties in water flows at downstream locations (Qamar, 2019). Then, water emerges as an indirect and strategic tool of communication and negotiation between the two countries.

The notion of Hydro-hegemony is pertinent in these regards. The concept of hydro-hegemony refers to the potential for one state (usually an upstream user) to wield disproportionate control over a water system shared with other states, through physical geography and infrastructure. This structural asymmetry gives India the upper hand in the bargaining with Pakistan; Pakistan has a high need of stable water flows down-streams while India does not (Rasul, 2014). This imbalance does not necessarily suggest that there will always be conflict, but it does mean that there is always an underlying calculus of water governance involving power politics not just technical or legalities.

Pakistan's dam-building fears have been increased even more by India's dam and hydropower projects on western rivers. Projects like the run-of-the-river hydropower schemes are under the treaty and are allowed to be built; they are also considered as a means of strategic pressure from the point of Pakistan. This is not just about the supply of water, but also about the regulation of the timing of water. This is not simply a matter of volume of water but also of its control for timely delivery that is essential for an agricultural economy of Pakistan (Rasul, 2014). Any real or perceived changes in the flow patterns are issues of concern in terms of food security, irrigation security and economic sustainability. As such, any infrastructure that is “okay” becomes a security issue very much.

This contributes to the increasing securitization of water in South Asian context. Water is no longer viewed simply as an instrument of economic or environmental develop but more and more as part of national security. In both countries, policy debates and media reporting tend to center the issue of water on salience, survival, sovereignty and strategic vulnerability. Water insecurity in Pakistan directly relates to the survival of the country as it is agriculture dependent, based on water from the Indus Basin (Sarwar, 2025). Water management in India is not only associated with development requirements, but also with energy generation and regional stabilizing. This

securitization hinders providing room for neutral technical discussions and generates mistrust between the two countries.

An important issue is the imperceptible evolution of the weaponization of water. While neither country has officially invoked militarization of water sources, the concept has been in use as a rhetorical and strategic messaging tool. Statements made relating to the use of water to pressure during tense times have raised concerns about the possible use of water to exert pressure when tensions are high (Warikoo, 2005). symbolic threats or policy talk on water flow alone can have psychological and diplomatic effects and make the already fragile relationship more unstable.

In general, the water in the Indus Basin is now playing at the junction of geography, politics and security. Its upstream qualities, infrastructural growth and the political uncertainty have turned it into a geopolitical tool rather than simply a natural resource that could be shared. Although the Indus Waters Treaty (IWT) is an enabling regime, there is a power imbalance and greater securitization between the two countries, which undermines its effectiveness (IUCN, 2016). The absence of more robust cooperative mechanisms, along with trust-building measures, makes it probable that water will remain a sensitive, potentially destabilizing factor in the India–Pakistan relationship, and not just a technical problem of resource management.

Legal Mechanisms & Case Studies in the Indus Waters Dispute

The legal structure of the Indus Basin, especially relating to India and Pakistan, is one of the most highly-developed systems of transboundary water management in the world. The cruxis of all this is the Indus Waters Treaty (IWT) of 1960 mediated by the World Bank. The World Bank facilitated the negotiations between the two parties and even designed the treaty to be politically robust (Michel, 1967). But unlike normal diplomatic a gaming mechanism was also incorporated into the treaty, which one of the main pillars is technical, not political and thus minimizing the risk of escalation into armed conflict.

Permanent Court of Arbitration

One of the salient points in this legal framework is the establishment of the Permanent Court of Arbitration (PCA) for impartial and independent resolution of disputes when bilateral machinery fails to resolve disputes (Rasul, 2014). The Permanent Court of Arbitration (PCA) offers a venue for both sides to present technical and legal issues related to disputed hydroelectric and water diversion projects. This avenue of relief is especially critical now with increased investments in water infrastructure development in the region, and, it is thought, greater interpretations' conflicts regarding treaty provisions.

Baglihar Dam

This most illustrative case study is the dispute on Baglihar Dam. In this instance, the Pakistani complaints were against the design and use of the dam on a river called the Chenab, because India could control the flow of water by varying the water holding capacity and the spillway design of the dam. However, the treaty provided for the transfer of the dispute to a 'Neutral Expert' (Sarwar, 2025). The expert's finding found in favor of India to build the dam but suggested that the dam design be adjusted to prevent potential flow control and to meet technical issues stipulated in the treaty. This case has been regarded as an example of the ability of technical adjudication to settle very “sensitive” cases without increasing political tension.

Kishanganga Hydroelectric Project

Kishanganga Hydroelectric Project dispute is another landmark case. Pakistan's complaint had been against India diverting water from upstream the Kishanganga river a tributary of Jhelum for generating hydroelectric power which would impact Pakistan's Neelum-Jhelum project downstream. The case was forwarded to the Permanent Court of Arbitration which gave a balanced verdict (Mumtaz, 2023). The PCA gave India the green light for the project with one caveat: it must have an environmental flow requirement to guarantee there is always water flowing downstream. The importance of that ruling lay in that it admitted the developmental rights as well as the principle of environment protection and the concept of international water law should not be one-sided.

Rattle Hydroelectric Project

The Rattle Hydroelectric Project controversy is another ongoing project within the treaty set-up that is challenging: Pakistan has voiced its concern on the design and storage of the project as they are afraid of the impact of the project on the availability of water downstream at critical times of agricultural activities. The problem has been discussed using mechanisms of neutral experts and arbitration procedures, which are still a favorite over unilateral action (Warikoo, 2005). While this case is not yet settled like Baglihar or Kishanganga, it shows that legal tools remain to be relevant in addressing the new and evolving hydro-political demands.

These case studies demonstrate that the legal regime to which the Indus Waters Treaty refers is a very significant mechanism in preventing escalation among two nuclear armed neighbors. Conflicts are addressed through formal, legal, and technical processes such as tribunals where professional judgments are given importance and instead of resorting to political confrontation or military pressure (Sarwar, 2025). Although it has still had problems primarily delays, mistrust and contrasting interpretations of treaty stipulations the institutional structure has generally held up well to preserve stability. It has turned water issues into somewhat workable legal-technical matters, helping to act as a pivotal buffer in the fragile geopolitical landscape of South Asian nations.

Climate Change and Environmental Vulnerability

Climate Change and Environmental exposures have emerged as one of the most severe and prominent issues in the climate change era for water governance in Indus River Basin, both for India and Pakistan, under the umbrella of Indus Waters Treaty (IWT). Glaciers and seasonal snow melt serve in the basin as natural water storage systems and the basin is highly dependent on these. But with the increase of temperature all over the globe, glacier melting is going rapidly (Biswas, 1992). This results in short-term benefits such as enhanced flows in rivers, flood risk and sudden water discharges; in the longer term it presents a serious risk of water scarcity as glacier water reserves slowly diminish. The two combined effects lead to an exquisitely unstable hydrological situation in which water becomes unpredictable and problematic to manage for both riparian and downstream water users (UNDP, 2006).

A second climate change related challenge is the more erratic arrival of monsoon rains. The monsoonal system in South Asia plays an important role in filling the surface and ground water tank of Indus Basin but in this era of global climate variability, it is seen to be more erratic. Records show that some years' experience high rainfall resulting in big floods and other years leave extended dry periods and drought (Ali, 2008). This volatility undermines agriculture planning, irrigation plan and water storage management. Both India and Pakistan are agriculture dependent

for food security and economic stability; thus, such fluctuations have direct implications on socio-economic vulnerability particularly of the populations living in rural areas where they depend on regular water supply (Barrett, 1994).

There have also been many more frequent and intense extreme weather events. The floods have become more destructive, such as in recent decades' huge monsoon rains coupled with glacier melting has resulted in lot of inundations in the downstream areas. However, drought is an increased reality in some places, resulting from diminished seasonal flows and imbalanced rainfall distribution (Immerzeel, 2010). Such alternating extremes impose heavy stress on water installations like dams, barrages and irrigation canals which were built based on past hydrological conditions no longer valid in the climate context. The sedimentation of reservoirs in addition, loss of storage capacity and damage to irrigation network add to the crisis (Chandrasekharan, 2017).

Amongst the most ecologically sensitive parts of the basin is the Indus Delta, which relies on regular inflows of fresh water upstream. Due to diversions, dams and variations in climate there is reduced river discharge which has caused severe deterioration of the ecological value of the delta area. Amongst the direst implications is sea water intrusion due to the less flow of fresh water, leading to salination of precious agricultural lands (Thatte, 2008). Consequences have been significant reductions in agricultural productivity, which has led to the abandonment of farming livelihoods. Furthermore, mangrove forests are important buffers protecting coasts from erosion and providing habitat for marine biodiversity, but they are also seriously threatened as a result of the shortage of sediments and fresh water. The resulting loss of these ecosystems has many negative consequences, including environmental fragility and heightened risk for coastal communities to storms and sea level rise (Mehsud, 2020).

Nevertheless, the Indus Water Treaty still does not have a well-rounded climate adaptation strategy. Developed in 1960, the main emphasis of the treaty is to distribute water and resolve issues between India and Pakistan, little considering the coming of climatic changes like glacier retreat, variation in monsoons, and extremes in hydrology (Bhatti, 2019). As a consequence, it lacks provisions for adaptive water sharing, environmental flows, or co-planning of climate resilience. The institutional gap prevents a joint response to new environmental dangers from both countries. There are arrangements in place to exchange data via the Permanent Indus Commission, but these are not adequate for real-time climate monitoring or integrated forecasting in the basin (Mumtaz, 2023).

Climate change and environmental vulnerability is generally changing the hydrology in which the Indus Basin operates and tests the sustainability of current water governance institutions. In the absence of these adaptive changes, improved cooperation, and water management in line with climate change realities, the region can be expected to experience worsening situations of water insecurity, ecological degradation and growing geopolitical conflicts over water resources (Bhatti, 2019).

Conclusion

The Indus Waters Treaty is a significant and successful treaty between India and Pakistan, and it has been in effect for over 60 years, ensuring a peaceful and stable allocation of water resources from the Indus River system. Though in the time of wars and political tension, the disputes of both countries have been settled peacefully through its institutional mechanisms like Permanent Indus Commission and international arbitration.

But today, the treaty has come into trouble. The increased variability and uncertainty in water availability have been a result of climate change changing the natural flow in the Indus Basin, with impacts of glacier melt, irregular monsoons and flooding and droughts. Simultaneously, the growing population, food production needs, and infrastructure development are putting further strain on restricted water resources. One is a change in the environment which could not be foreseen when the treaty was framed in 1960 and makes it inadequate to meet the present scenario. Furthermore, since the Indo-Pak relations are becoming highly volatile society and politics are now increasingly suspicious of water-related projects, hydropower projects and upstream activities are viewed more as strategic developments and less developmental initiatives. This has resulted in the securitization of water and failure to build trust on both sides.

Finally, while the Indus Waters Treaty is a key element confronting the challenge of water security in the region, it has to be updated urgently. If the treaty is to be relevant and effective in the future, strengthening the climate adaptation measures, better data sharing, implementation of environmental flows and increased cooperation will be paramount.

Findings

- Indus waters Treaty has proved to be an effective mechanism between India and Pakistan to avoiding large scale water war.
- Climate change contributes to disruption of the Indus Basin with glaciers melting, irregular rainfall, floods and droughts, leading to uncertainty of water supply.
- Security and political tension are closely associated with water problems, not only technical water management.
- The treaty does well in water division but is not strong enough for the environmental dimension and climate adaptation requirements.
- Pressure and mistrust exist between both countries to increasingly meet water needs and with plans to produce hydropower upstream.

Limitations

- There is a lack of primary data (books, articles and reports) and the study is based on secondary data only.
- Limited access of real-time and transparent hydrological data between India and Pakistan could have an impact on accuracy.
- Most of the analysis is based at the macro-level and does not adequately consider community (local) water issues and impacts.
- Some of the findings may be out of date over time due to changing climate and political conditions.

Recommendations

- The Indus Waters Treaty needs to be revised to encompass climate related phenomena like glacier melt, unpredictable monsoons, floods and droughts.
- A joint water management body of India and Pakistan should be strengthened or set up for real time coordination and sharing of data.
- There is a need to introduce environmental flow requirements to conserve the environment such as the Indus Delta and minimize ecological degradation.

- Development of transparent and modern hydrological monitoring systems should be promoted to create trust and improve decision making.
- There is a need for on-going discussion and collaboration between both countries via the international fora to minimize mistrust and the politicization of water.

Conflict of Interest

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