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ASSESSING HISTORICAL EVOLUTION OF THE INDUS WATERS TREATY AND CONTEMPORARY WATER SECURITY CHALLENGES

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Abstract
The Indus Waters Treaty (IWT), a 1960 World Bank-facilitated agreement between India and Pakistan on sharing river waters, is considered one of the longest lasting and most successful transboundary water-sharing treaties in modern international relations. More than 60 years, since the last war, treaty has continued to be in effect, offering an institutional mechanism for water allocation, management and peaceful dispute resolution related to waters of Indus River Basin. But the current water-security situation is quite different from what it was when treaty was formulated. Climate change, the retreat of glaciers in Hindu Kush–Karakoram–Himalayan (HKH) region, water scarcity, high population growth, depletion of groundwater resources, environmental degradation, and urbanization and expansion of hydropower projects have added hurdles not foreseen by the original treaty designers. This study explores the genesis of Indus Waters Treaty in the political and legal landscape of post-partition South Asia and analyses its significance in the twenty first century water security scenario. The study utilizes a qualitative research design with the support of primary sources such as text of Indus Waters Treaty, World Bank documents, official reports, and International legal instruments as well as secondary sources such as scholarly books, peer-reviewed journal articles and policy studies. This paper contends that treaty has proven very resilient as an institution, but that its viability into future relies on adaptive governance that can address new climatic, environmental, technological and geopolitical realities.

1. Introduction:

Fresh water is now one of the most critical 21st century natural resources. Population growth, urbanisation, industrialisation, expansion of agricultural land and climate change have raised demand for transboundary water resources, which has increased competition for these resources worldwide. Cooperative governance is critical to regional stability, sustainable development and environmental security, as more than 310 international river basins are shared by two or more states. (Nations, 2023) Climate change has transformed the governance of transboundary water into a matter of paramount importance in international relations and international law, as it can impact water cycles and raise likelihood of both floods and droughts. The Indus River Basin is a unique river basin in realm of major international river systems in terms of its hydrological importance and geopolitical sensitivities. The basin is home to almost 300 million people, irrigated by one of world's largest continuous irrigation systems (Food and Agriculture Organization (Organization, 2011) and flows through nations of *Tibetan Plateau* and into nations of China, India and Pakistan and

finally into Arabian Sea. The basin is home to six major rivers—Indus, Jhelum, Chenab, Ravi, Beas and Sutlej—which are essential for agriculture, food production, hydropower generation and industrial development and water supply for both India and Pakistan. Hence, water resource management is seen as a strategic issue for these shared water resources, as it has long been considered. The division of British India in 1947 changed the political geography of Indus Basin to a great extent. *Radcliffe* Boundary Commission, which split up territory of India and Pakistan failed to provide a proper definition of how water from the shared rivers was to be allocated or controlled. The new international boundary that came into being split upstream irrigation headwork from downstream canal systems, and at once brought uncertainty about irrigation supplies and agricultural production. (Michel, 1967) Basin's vulnerability and need for a permanent institutional solution were exposed when canal waters were temporarily disrupted in April 1948. The next Inter-Dominion Agreement of 1948 did not deal with extent of water rights dispute, but simply established a temporary solution. World Bank began mediation in early 1950s, knowing that conflict had strategic significance. Two countries reached a settlement, Indus Waters Treaty, in Karachi on 19 September 1960 after almost ten years of negotiation, which World Bank was one of signatories to include clauses on. In treaty, three Eastern Rivers (*Ravi*, *Beas* and *Sutlej*) were assigned to India and three Western Rivers (*Indus*, *Jhelum* and *Chenab*) were assigned to Pakistan with limited water uses for India for domestic water supply, non-consumptive uses and run-of-the-river hydropower (World Bank, 1960). Moreover, Treaty created a Permanent Indus Commission and procedures for appointment of Neutral Experts and Courts of Arbitration for technical and legal issues.

Much scholarly interest has been focused on durability of IWT. Treaty has never been suspended and has been in force since wars of 1965, 1971 and 1999, despite recurring border crises and changing diplomatic relations, is cited as one of most successful examples of institutionalized water cooperation. (Wolf, 1998) However, treaty is now operating in a different context. Rapid melting of glaciers is influencing hydrological variations in Hindu Kush–Karakoram–Himalayan (HKH) region, impacting sustainability of river flows in long-term. (Change, 2023) At same time, high population growth rates, over-appropriation of water resources, worsening groundwater quality and greater demand for hydropower have created pressures, which have surpassed initial boundaries of treaty. The recent controversies over Baglihar, Kishanganga, Ratle and Tulbul project provides a glimpse of changing dynamics of water relations between India and Pakistan. While engineering and legal issues are discussed in treaty, there is no specific reference to climate adaptation, to groundwater governance, to ecosystem protection or to digital hydrological monitoring. This means that many scholars have insisted that treaty be interpreted adaptively and strengthened not renegotiated. (McCaffrey, 2019) The article traces history of IWT from its inception in immediate aftermath of Partition to present day in context of water governance in South Asia. It investigates how treaty's legal structure and design evolved over time and ability of current mechanisms to deal with water security issues in twenty-first century.

2. Literature Review

The Indus Waters Treaty (IWT) has been the focus of much interdisciplinary research in fields of history, international law, political science, hydrology, environmental studies and international relations. The literature available generally falls into five categories: Historical background, legal and institutional aspects of treaty, hydropolitics and interstate relations, climate change and water security and institutional reform. All of these studies acknowledge the IWT as one of the most resilient transboundary water agreements in world and point to emerging issues on environmental change and regional geopolitics. In history of the word, primary attention has been given to origins of treaty. Michel (Michel, 1967) describes Indus Basin dispute in most detailed historical account. He says that conflict was not over water resources,

but due to political partition of an integrated irrigation system, after British India was divided in 1947. Likewise, Talbot (Talbot, 2015) argues that partition rendered the rivers as weapons of war and, thus, a national asset that add to geopolitical and security tensions between India and Pakistan in the long term.

Salman and Uprety (Salman S. M., 2002) from a legal perspective, consider IWT to be one of most sophisticated bilateral water agreements as it integrates technical cooperation, institutional dialogue and binding dispute-resolution mechanisms. They stress on need to have Permanent Indus Commission in background, so as to protect technical water dispute from political friction. Similarly, McCaffrey (McCaffrey, 2019) states that Treaty is prior to United Nations Convention on Law of Non-Navigational Uses of International Watercourses of 1997 but its institutional structure is consistent with current international water law. The treaty, however, only pays scant attention to environmental protection and climate adaptation, he notes.

Hydro-political research deals with relationship between water resources and interstate relations. In his work (Wolf, 1998), Wolf refutes idea of "inevitable water wars" by arguing that in between a conflict and cooperation in international river basins, there are a lot of options in between. He says IWT is one of most successful cases of hydro-cooperation. In contrast, Zeitoun and Warner (Zeitoun, 2006) propose term hydro-hegemony, which suggests that transboundary water governance is determined by political, economic and military inequality. International relations theory holds that problems in common create interdependence and cooperation, which is demonstrated by Keohane and Nye (Keohane, 2012) through application of theory of international relations. IWT has been continuing to function despite political issues and problems that have occurred over years and theory of international relations is used here to support the hypothesis that problems in common create interdependence and cooperation.

As the effects of climate change are becoming more of a focus in recent scholarship, so are implications on Indus Basin. According to IPCC (Change, 2023), South Asia is one of most vulnerable regions to climate change, where glacier melt and alteration of monsoon patterns and hydrological variability pose risks to long-term water security. Likewise, ICIMOD (ICIMOD, 2019) projected significant glacier retreat in Hindu Kush–Karakoram–Himalayan region and Immerzeel et al. (Immerzeel, 2010) emphasized on effects of glacier changes and alteration in snowmelt on river flow and water availability. While considerable research has been carried out, there are still substantial research gap. The literature on treaty's negotiation and early implementation is mostly historical while contemporary studies tend to focus on climate change or on hydro-politics individually. Limited research combines an understanding of how treaty has developed into the present-day challenges to water security. In addition, there is a lack of an integrated approach to legal and climatic aspects in existing legal analysis and often there is a lack of legal and institutional foundations in climate-oriented studies. To fill these gaps, this article offer an integrated historical, legal and hydropolitical examination of the Indus Waters Treaty in this day and age of water security concerns.

3. Historical Evolution of Indus Basin:

3.1 Geography and Hydrology of Indus River Basin:

Indus River Basin is one of world's largest and most strategically important transboundary river basins. The basin encompasses almost 1.12 million square kilometres, with Pakistan having the highest amount of basin and relying the most on basin water (FAO 2011; World Bank 2005). The river starts from Tibetan plateau close to Lake *Manasarovar* and then runs northwest through Himalayas and Karakoram mountains reaching disputed territory of Jammu and Kashmir, then running south through Pakistan and finally entering Arabian sea near Karachi. (Michel, 1967) There are six main rivers in basin such as Indus, Jhelum, Chenab, Ravi, Beas and Sutlej. Together, these rivers support one of the world's longest continuous irrigation systems, referred to as Indus Basin Irrigation System (IBIS). The system consists of over 60,000 km of canals, over 100,000

watercourses and several large barrages and reservoirs that irrigate about 18-19 million hectares of agricultural land in Pakistan. (Briscoe, Pakistan's Water Economy: Running Dry, 2009). It is generally accepted that it was one of the greatest engineering achievements in history of irrigation. What makes Indus Basin unique amongst international river systems is the fact that it is provided by several sources, such as glacier melt, seasonal snowmelt, monsoon rainfall and groundwater recharge (Immerzeel, van Beek, & Bierkens, 2010). Approximately 40–50 percent of annual river discharge originates from snow and glacier melt in Hindu Kush–Karakoram–Himalayan (HKH) region, making basin particularly vulnerable to climate-induced changes in cryospheric processes (IPCC, 2023).

The basin is home to almost 300 million people and is one of densest populated river basins in world (Organization, 2011). It supports agriculture, human consumption, industry, hydroelectric generation, fisheries and ecosystem services. Irrigation plays a key role in regional food security, as it accounts for about 90 percent of all water withdrawals in both India and Pakistan (World Bank, 2021). Basin is also home to fragile ecosystems from the environmental point of view such as alpine glaciers, wetlands, riverine forests and Indus Delta etc. As freshwater flows decline, seawater intrusion, pollution and sediments build up these systems are becoming progressively challenged by ecological degradation, which is a threat to sustainable water governance. (WWF-Pakistan, 2019). The above considerations make Indus basin more than just a hydrological phenomenon; it is a socio-political and ecological system in which water resources are inextricably linked to development of the country and the stability and sustainability of region.

3.2 Historical Development of Indus Irrigation System under British Rule:

Modern history of India-Pakistan water relations can be linked to irrigation policies of British colonial regime. Before British, irrigation within Indus Basin was done mostly through canals that flooded in each season and small-scale water management practices. The colonial regime began to change basin in mid-nineteenth century into one of world's largest integrated irrigation networks, with significant investment in hydraulic infrastructure. With annexation of Punjab in 1849, British engineers realised that agriculture potential existed in Indus Basin. Colonial administration embarked on an ambitious programme of canal building under inspiration of economic goals, revenue generation and political consolidation, which had a significant impact on region's topography. (Gilmartin, 1994) Major projects included Upper Bari Doab Canal (1859), Sirhind Canal (1882), Lower Chenab Canal (1892), Lower Jhelum Canal (1901), Upper Chenab Canal (1912) and Sutlej Valley Project (1930s). With help of these canals millions of acres of what was once desert land became fertile which made Punjab the heart of agriculture of British India. Colonial engineers planned canal system as an integrated network, not as regional projects, (Michel, 1967). Water from one river may be pumped to other rivers through inter river channels and used to irrigate several districts. This engineering approach increased productivity of agriculture, but also resulted in structural interdependence of river systems. British policy of irrigation also helped in formation of Canal Colonies especially in western Punjab. These colonies attracted migrants from densely populated districts, increased commercial agriculture and wheat and cotton production significantly. (Ali, 1988) The irrigation system was closely tied to rural settlement, land ownership and economic modernization. By 1940s, Indus Basin Irrigation System was one of most advanced hydraulic systems in world. Its built-in design, however, made assumption of a unified political administration. British planners had not thought about possibility of partition of India and division of irrigation systems between two sovereign states. As a result, new national borders at independence in 1947 ran across rivers and canals, and across headwork without any institutional structures to manage their water supplies. This is still a colonial inheritance that influences present relations between India and Pakistan. The hydraulic geography of British India was root of many legal,

technical and political disagreements that arose after partition.

3.3. Partition of British India (1947) and Emergence of Water Dispute:

The partition of British India in August 1947 was one of the most momentous geopolitical events in South Asian history. The territorial demarcation, population transfers and communal violence were major political preoccupation but partition also severed a unified river basin, which had been administered as a single unit. Radcliffe Boundary Award was issued on 17 August 1947 with eastern part of Punjab coming under jurisdiction of India and western part under that of Pakistan. While concept of territorial sovereignty was based on boundary, management of shared water resources was not covered by this. (Michel, 1967) A key effect of partition was location of control of upstream water and irrigation networks downstream. There were important headworks, such as *Madhopur* on Ravi River and *Ferozepur* on Sutlej River, within Indian frontier territory, with numerous canal systems that relied on these headworks irrigating agricultural lands in Pakistan. This situation immediately led to strategic issues. Pakistan as a downstream riparian, was placed under a debt trap of water releases that depend on infrastructure in India. This is a situation that scholars have often referred to as one of the most important structural compromises that has been passed on from partition. (Mustafa, 2010) At first, two Dominions agreed to continue with water supplies as they already did, by using temporary administrative arrangements. But these were not in nature of legally binding pledges and they were an expression of general political uncertainty prevalent at that time in early years of India–Pakistan relations. Water issues soon became linked to broader issues surrounding Kashmir issue, refugee resettlement, finances and border boundaries. Technical issues thus became more and more political.

3.4. Inter-Dominion Water Crisis and Inter-Dominion Agreement (1948):

The first big interstate water dispute arose in April 1948. On 1 April 1948, water supply from *Ferozepur* Headworks was suspended temporarily to Pakistan's Dipalpur Canal and Central Bari Doab Canal, on expiry of temporary administrative arrangements (Michel, 1967). The interruption was seen as Pakistan's serious concern to its agricultural economy and the upstream control over shared rivers was suggested as an instrument of political pressure. Indian officials, however, argued that Pakistan had to negotiate a legal settlement with India for future water allocation and maintenance of infrastructure instead of following colonial inheritance rules. This suspension brought tremendous worry as millions of acres of crops were reliant upon continuous canal watering. While interruption was only brief, it underscored strategic significance of water in larger bilateral context. Both governments considered situation to be urgent and representatives of both parties negotiated Inter-Dominion Agreement, which was signed in New Delhi on 4 May 1948. As per agreement, India has agreed to resume water supply to Pakistan. Pakistan pledged to provide short-term financial assistance to operations and maintenance expenses. Both sides pledged to negotiate a lasting deal. The agreement restored water supplies, but neither side saw it as a solution to problem. Pakistan saw arrangement as transitory and as a downstream country, Pakistan insisted on rights recognized at international level. India stressed on principle of territorial sovereignty and highlighted need to have arrangements that are a result of negotiations and not colonial administrative legacy. The issue of water changed its nature from a purely technical administrative problem to an integral part of India-Pakistan diplomacy during 1948 dispute.

3.5. World Bank Mediation and Negotiations (1952–1960):

Bilateral talks failed to reach a lasting resolution, thus leading to growing international attention on the issue. Significant progress was made when *David E. Lilienthal*, chairman emeritus of Tennessee Valley Authority and chairman of US Atomic Energy Commission intervened. After visiting two countries in 1951, Lilienthal wrote a significant article for Collier's Magazine that

suggested that Indus dispute was more engineering/ development than political. (Lilienthal, 1951, 4th August) He called for international mediation, and offered to use World Bank to help with negotiations. The idea caught the eye of *Eugene R. Black*, President of World Bank, who in 1952 formally offered Bank's good offices. Both governments welcomed the offer and began one of the longest and most complicated negotiations in history of international water diplomacy. Duration of negotiations was almost eight years (1952-1960) and included engineers, economists, lawyers, hydrologists and diplomats from both countries. Instead of trying to solve water rights problems, the World Bank chose to go with a more practical engineering solution using physical division of river systems. The first round of discussions was on competing legal principles, such as absolute Territorial Sovereignty (linked to Harmon Doctrine), absolute Territorial Integrity, equitable and reasonable utilization and no significant harm. Politically it was hard to reconcile these competing principles. This led to World Bank adopting a working approach to the allocation of rivers, rather than abstract legal principles. (Salman S. M., 2002) According to Bank's scheme, Eastern Rivers (Ravi, Beas and Sutlej) would be given mainly to India. Western Rivers (Indus, Jhelum, Chenab) would be distributed mainly to Pakistan. The big infrastructure projects, such as link canals, barrages and storage reservoirs, would make up for loss of water from eastern rivers for Pakistan.

These replacement projects needed unprecedented international cooperation for financing. Indus Basin Development Fund was formed using funds from various donor countries including United States, United Kingdom, Canada, Australia, New Zealand, West Germany and others. (World Bank, 2005). Money was used for large-scale infrastructure initiatives such as Mangla and Tarbela dams, multiple link canals and irrigation infrastructure. The bilateral talks culminated in signing of Indus Waters Treaty at Karachi on 19 September 1960 by Jawaharlal Nehru, Indian Prime Minister, Field Marshal Ayub Khan, President of Pakistan and Eugene R. Black, president of World Bank. Since then, treaty has been one of longest-lived instances of institutionalised transboundary water cooperation. Its success was not in eradication of political differences, but in establishing a lasting legal and technical structure that can be used to address political differences. Its survival during wars, diplomatic crises and even during periods of deep political tension proves the significance of institution building to reduce conflict over shared natural resources.

4. Indus Waters Treaty (1960): Origins, Structure and Legal Framework:

Indus Waters Treaty (IWT), signed on 19 September 1960 between India and Pakistan under auspices of World Bank, is widely regarded as one of the most durable and successful agreements governing transboundary water resources. Despite prolonged political hostility, three full-scale wars (1965, 1971 and 1999), recurring border crises and intermittent suspension of diplomatic dialogue, treaty has remained operational for more than six decades (Salman S. M., 2002) This remarkable resilience has led many scholars to describe IWT as a model of institutionalized cooperation in international water law. (Wolf, 1998) The treaty emerged in response to the severe uncertainty created by partition of British India in 1947, which divided an integrated irrigation network between two sovereign states. The 1948 suspension of canal water supplies exposed vulnerability of downstream Pakistan and underscored urgent need for a legally binding framework to regulate allocation and management of Indus River system. (Michel, 1967) Facilitated by World Bank, negotiations spanning eight years culminated in an agreement that allocated the basin's six rivers between two countries while establishing permanent mechanisms for technical cooperation and dispute resolution. Although negotiated in a specific historical context, IWT continues to shape contemporary India–Pakistan relations. It remains central to debates on water security, hydro-politics, climate resilience and international law. One of most enduring and effective treaties on transboundary water resources is the Indus Waters Treaty (IWT) that was signed on 19 September

1960 between India and Pakistan under the auspices of World Bank. Even after 60 years of political tension, three full-scale wars (1965, 1971 & 1999) frequent border disputes and periodic cessation of diplomatic communication, Treaty has been in operation for over six decades. (Salman S. M., 2007) This has been an incredible resilience and many have called IWT a model of institutionalised cooperation in international water law. (Briscoe, Pakistan's Water Economy: Running Dry, 2009) The treaty was born out of the acute ambiguity that ensued after partition of British India in 1947, when a unified irrigation system had to split between two independent nations. When canal water was cut off in 1948, it was discovered that downstream part of Pakistan was exposed and it was urgent to devise a legally binding arrangement to regulate allocation and management of Indus River system. (Michel, 1967) Over eight years, facilitated by World Bank, negotiations ended in an agreement that divided basin's six rivers between two countries and created permanent forums for technical cooperation and resolution of disputes. IWT may be negotiated in a historical context but still remains as a sign of current time in India–Pakistan relations. It is still a key issue in water security, hydropolitics, climate and international law.

4.1. Historical Context of Treaty:

The immediate roots of treaty are in water implications of partition. Pre-1947, Indus Basin Irrigation System was a single engineering system under British control. Partition established an international boundary and divide headworks from canals in downstream areas, but did not establish proper legal structures for water allocation. (Michel, 1967) India then withheld water from Madhopur and Ferozepur headworks on 1 April 1948 for a period of time as a result of lapse of temporary administrative agreements. The event brought water as a significant bilateral issue, as supplies were restored under Inter-Dominion Agreement of 4 May 1948, but it also emphasised need for Pakistan's water supplies to rely on upstream infrastructure of India. In 1952, World Bank took initiative of favouring bilateral negotiations, which proved to be deadlocked. Further, under leadership of Eugene R. Black, Bank stoked both governments to think in pragmatic terms about engineering a solution, instead of toying with historical claims or disputes of sovereignty. Treaty was signed in Karachi in September 1960 by Prime Minister of India, Jawaharlal Nehru, the President of Pakistan, Field Marshal Ayub Khan and President of World Bank, Eugene Black after nearly eight years of technical, financial and diplomatic negotiations. Michel suggests that treaty was successful because it was pragmatic rather than trying to achieve joint ownership of all waters of basin, it clearly allocated or apportioned rivers and thus minimised scope for ongoing conflict over allocation of water for day-to-day use.

4.2. Objectives of the Indus Waters Treaty:

The treaty aimed to accomplish a number of related goals (i) To make the water division between India and Pakistan fair and predictable. (ii) To reduce the likelihood of conflict between states over water issues, (iii) replace infrastructure of Eastern Rivers in sufficient numbers to provide Pakistan with replacement infrastructure, (iv) create permanent technical cooperation and information exchange institutions. (v). To establish legally binding processes for future conflicts, and (vi) Promote long-term development of both irrigation and hydropower facilities. Instead of developing a river basin authority, the treaty embraced a piecemeal approach, granting exclusive rights to specific river segments while allowing the other state some of water under highly specific conditions. (Briscoe, Pakistan's Water Economy: Running Dry, 2009)

4.3. Structure of the Treaty:

Indus Waters Treaty has a Preamble, 12 Articles (Articles I–XII) and 8 Annexures (A–H). The articles outline institutional arrangements, water allocations, financial commitments, dispute-resolution mechanisms and process for amendment. The annexures contain detailed technical specifications on storage, hydropower development, engineering standards and arbitration procedure. (Bank, Indus Waters Treaty 1960., 1960) Treaty stands out for its technical accuracy. IWT differs from most international

river treaties, which are mostly based on general principles of law, because it includes specific engineering standards for allowed infrastructure, reservoir sizes, spillway designs and operational rules. This engineering particularity has eliminated the ambiguity but at same time has created a controversy to decipher the engineering stipulations in the projects like Baglihar and Kishanganga.

4.4. Allocation of Rivers:

The central feature of treaty is allocation of six major rivers of Indus Basin. From eastern rivers, India received unrestricted use of Ravi, Beas and Sutlej. These rivers together account for approximately one-fifth of average annual flow of the basin. India may utilize these waters for irrigation, domestic supply, industrial purposes, hydropower generation, and storage, subject to treaty provisions during transition period. (Michel, 1967) On the other hand, from western rivers, Pakistan received primary rights over Indus, Jhelum and Chenab. These rivers contribute roughly four-fifths of basin's annual flow and constitute principal water source for Pakistan's irrigation system. However, India retains limited rights on Western Rivers for domestic consumption; non-consumptive uses (navigation and fisheries); run-of-the-river hydroelectric generation; and limited irrigation within specified treaty limits. The allocation reflected both geographical realities and political compromise. Pakistan obtained larger share of total water flows because its economy and agriculture were overwhelmingly dependent on Western Rivers, while India accepted restrictions on upstream development in exchange for unrestricted use of the Eastern Rivers.

4.5. Rights and Obligations of the Parties:

Each of the states assumes reciprocal obligations under treaty. According to this treaty, India may have some rights as it can develop run of river hydropower projects on western rivers as per Annexures D and E and can build some storage facility within treaty limits. India can also use certain amounts of water for irrigation purposes and carry out flood control and navigation works. India should make sure such projects do not encroach on Pakistan's rights to downstream water. Careful regulation of technical aspects of dam design, pondage, spillways and storage capacity. On the other hand, under this treaty, Pakistan may have some rights as Pakistan enjoys exclusive consumptive rights over Western Rivers. Pakistan lacks protection from upstream interference, which is not in accordance with treaty obligations. There is availability of access to hydrological information in relation to projects of India for Pakistan. Pakistan has the right to raise objections against projects which it considers infringing treaty obligations. Pakistan might have ways to resolve dispute. These measures were intended to safeguard Pakistan's needs from basin while acknowledging India's developmental needs.

4.6. Financial Arrangements and Indus Basin Development Fund:

Requirements for implementation of treaty was large investment in infrastructure, particularly in Pakistan. The replacement of the Eastern Rivers for irrigation had to be made via other canals, reservoirs and barrages from Western Rivers, as otherwise Pakistan would be deprived of access to these rivers. For financing these works, Indus Basin Development Fund was created with financial contribution from World Bank, United States, United Kingdom, Canada, Australia, New Zealand, West Germany, Pakistan and India (under settlement). The Fund was able to finance large scale engineering works, such as building of Mangla Dam, Tarbela Dam, link canals, barrages and irrigation infrastructure. This was one of biggest international development financing programmes to date and has much improved the longterm irrigation capacity of Pakistan, according to World Bank (2005).

4.7. Legal Principles Underpinning Indus Waters Treaty:

Indus Waters Treaty (1960) is sometimes considered a sui generis (unique) agreement since it was drawn up before the principles of international water law were formulated and includes some of principles, which later became widely accepted. The treaty does not depend on

customary international law solely, but is a self-contained legal regime that regulates the use, management and resolution of disputes over use of Indus River Basin. The treaty is successful because of its detailed technical provisions and institutional mechanisms, not because of any abstract legal doctrines, as Salman (Salman S. M., 2007) notes. IWT's approach is different from many water-sharing agreements of today, which emphasize common management of basin; IWT takes a river-partition approach, dividing three Eastern Rivers (Ravi, Beas and Sutlej) between India and three Western Rivers (Indus, Jhelum and Chenab) between Pakistan. However, there are some principles in context of treaty that subsequently entered in main stream of international water law. Perhaps one of most significant legal cornerstones of treaty is the rejection of absolute territorial sovereignty, which has been linked to Harmon Doctrine. That principle would give an upstream state unlimited rights to use waters within its borders that would not be affected by use of waters downstream. India never had such unqualified powers under IWT. Instead, it respects sovereignty of India and at same time has legal restrictions meant to protect interests of downstream Pakistan. Projects for Western Rivers development in India will therefore be based on a number of specific technical constraints, including storage capacity, pondage, spillway design and operating instructions. (Bank, 1960) This is the international law rule that sovereignty of jointly owned natural resources is limited by mutual responsibilities.

The treaty also includes safeguards for existing water usage patterns. During negotiations, it was clearly admitted that Pakistan is dependent on Western Rivers and it was discussed that continuity of irrigation supply would be maintained by creating replacement infrastructure with funds of Indus Basin Development Fund. One of essential principles of international water law is the protection of existing use, as sudden changes to how water is used could endanger food security, economic stability and human welfare, as McCaffrey (McCaffrey, 2019) argues. In this regard, IWT brings long-term legal certainty to Pakistan about waters of Western Rivers. The treaty is based on principle of "*pacta sunt servanda*" (Article 26 of Vienna Convention on Law of Treaties, 1969), which requires that treaties in force be observed in good faith. It's important to note that Vienna Convention is a treaty that comes after IWT, but the principle itself was a part of customary international law at the time, IWT was reached. In good faith performance, both parties must exchange information, inform each other of relevant engineering projects and exchange constructively in dispute resolution processes, not in unilateral action. Another hallmark of IWT is its complex consensus building process. Treaty sets out a graduated procedure, which starts with technical discussions within Permanent Indus Commission and if applicable moves to appointment of a Neutral Expert or a referral to a Court of Arbitration. This multi-layered design has been a major factor in the treaty's longevity and has been indicative of overall principle of UN Charter to solve international disputes peacefully. (Nations., 1945)

4.8. Indus Waters Treaty and International Water Law:

The IWT is a precedent to several prominent international legal instruments, but is often studied in terms of the development of international water law.

4.8.1. Helsinki Rules (1966):

International Law Association's 1966 adoption of principle of equitable and reasonable utilization as a norm for international rivers as part of Helsinki Rules on Uses of Waters of International Rivers. (Association, 1966) Article-IV provides that: "Each basin state is entitled, within its territory, to a reasonable and equitable share in beneficial uses of waters of an international drainage basin." The IWT, however, does NOT try to equitably share water like Helsinki Rules do. Rather, it assigns whole rivers to each state and allows for exception to be made. Many scholars believe that the treaty was a pragmatic political compromise and not an example of equitable utilization. (Salman S. M., 2002)

4.8.2. Convention on Law of Non-Navigational Uses of International Watercourses (1997):

UN Watercourses Convention of 1997 is the most comprehensive international agreement on shared water resources. It is based on two complimentary principles; Equitable and reasonable use (Article 5) and Obligation not to cause significant harm (Article 7). The principles of Convention have had a bearing on current understanding of international water governance, though neither India nor Pakistan is a signatory to Convention. Increasingly, there are scholarly examinations of controversies over Baglihar, Kishanganga and Ratle projects in their light. (McCaffrey, 2019)

4.8.3. Berlin Rules (2004):

In 2004, International Law Association adopted Berlin Rules on Water Resources, (Association, The Berlin Rules on Water Resources., 2004) which further developed previous water laws with a focus on protection of environment, public participation, conservation of ecosystems and sustainable development. IWT does not contain similar provisions to Berlin Rules regarding ecological flows, conservation of biodiversity, groundwater management, climate adaptation and environmental sustainability, etc. This omission is due to historical circumstances involved in negotiation of treaty, before environmental law had emerged as its own discipline within international law.

4.9. Climate Change and the Treaty's Legal Limitations:

The most notable caveat of IWT is that it was formed prior to the acknowledgment of climate change as a key policy issue. Hindu Kush–Karakoram–Himalayan (HKKH) region is undergoing significant environmental changes that are impacting river flow in Indus Basin (Change, 2023). The major climate related problems are fast melting of glaciers, modification of snow melt, variation in monsoon pattern, frequent floods, long dry spells, rise in temperature and ground water depletion. These changes create hydrological uncertainty not considered in treaty negotiations. Treaty also assumes relatively stable river flows and does not have explicit mechanisms to facilitate adaptive allocation in times of extreme climatic variability. Immerzeel, van Beek and Bierkens have suggested that South Asia may experience significant changes in availability of water in different seasons as a result of glacier retreat, which may necessitate more flexible governance arrangements. (Immerzeel, 2010) In the same sense, Laghari (2013) notes that treaty is overwhelmingly based on engineering infrastructure and comparatively ignores IWRM, ecosystem resilience and adaptation to climate change. (Laghari, 2013) As such, many scholars have called for modernization (not replacement) of treaty with additional protocols on climate resilience, glacier monitoring, drought management, flood forecasting, groundwater governance and environmental flow needs.

4.10. Scholarly Assessments of Indus Waters Treaty:

There are three main schools of thought on academic evaluation of IWT known as Success School, Reform school and critical political ecology school. The treaty is widely considered by many scholars to be one of best models that can be used for transboundary water cooperation. Wolf contends that treaty should be viewed as evidence of how institutions can help to maintain cooperation even in face of ongoing geopolitical rivalry. (Wolf, 1998) The agreement has also offered much stability in face of numerous military conflicts, as concluded by Briscoe and Qamar (Briscoe, 2009). It is in this sense that primary advantage of treaty is to have separated technical water management from wider political conflict. A second set of scholars recognize historical successes of treaty but proposes that present-day needs for institutional reform. Mustafa (Mustafa, 2010), Iyer (Iyer, 2005) and Salman (Salman, 2007) argue that it is important to include following elements in treaty; Climate change adaptation, Groundwater management, Ecological sustainability, Integrated basin planning and enhanced data sharing. These scholars, instead of rejecting treaty, propose gradual modernization in line with evolution of

international environmental law. Political ecologists say treaty is too engineering-focused and too interstate-focused and fails to take account of local communities, environmental justice, or ecosystem health. Water governance, however, is not just about interstate diplomacy but also about social equity, livelihood security and environmental sustainability, as scholars Molle, Mollinga and Wester stress. (Molle, 2009) This is a different perspective that encompasses farmers, indigenous communities, provincial governments and ecology.

5. Institutional Mechanisms and Hydropolitics of India–Pakistan Relations:

Indus Waters Treaty (IWT) 1960 has also a unique feature in that it not only shares the Indus waters but also creates a permanent institutional mechanism to implement, monitor and enforce it. The drafters knew that there would be disagreements about engineering design, hydrological data and interpretation of treaty that would arise, and established a multi-stakeholder dispute-resolution process that would work on technical issues before they turned into political or military crises. (Salman S. M., 2002) The institutional framework of treaty is mainly that of the Permanent Indus Commission (PIC), backed by procedures for appointing a "Neutral Expert" and, as needed, a Court of Arbitration. During times of armed conflict and even when there was a diplomatic deadlock, these institutions had kept the Pakistan and India in touch with each other. The robustness of these institutions has often been described as one of successes of international law regimes to promote cooperation in face of high political tension. (Wolf, 1998) However, these institutions have become more complex in their operations due to climate change, growth of hydropower and strategic competition. The treaty has been effective in averting breakdown of bilateral water cooperation, but case of *Baglihar, Kishanganga, Ratle* and *Tulbul* Navigation (Wullar Barrage) projects highlights fact that broader hydropolitical tensions exist in India-Pakistan relations that cannot be completely overcome through institutional mechanisms.

5.1. The Permanent Indus Commission:

Article VIII of Indus Waters Treaty (IWT) created Permanent Indus Commission (PIC) as main bilateral institution for execution of treaty. One Commissioner is appointed by each government for Indus Waters as representative of his state. The PIC is a permanent body, as compared to temporary negotiating committees which are brought on to table, because it is recognised that transboundary water governance needs a permanent conversation, not episodic diplomacy. (Bank, Indus Waters Treaty 1960., 1960) Commission has a number of key functions, including support of treaty implementation; exchange of hydrological and engineering data; inspection of hydraulic infrastructure; technical consultations; dispute resolution; periodic meetings and field visits; and transparency on future projects, including questions process. Commissioners hold annual meetings every year in alternate years in India and Pakistan, though special meetings are held as needed. PIC has been active despite fact that diplomatic engagement was interrupted in other areas, which shows its institutional autonomy. Michel (Michel, 1967) saw this continuity as one of strengths of treaty, due to the fact that it kept technical cooperation away from political confrontation.

5.2. Exchange of Hydrological Information:

One of treaty's most significant confidence-building measures is obligation to exchange hydrological information. Data on river discharge is published regularly by both countries, as are data for reservoir levels, planned engineering projects, flood forecasts, canal operations and storage facilities. Information sharing decreases uncertainty and enables technical specialists to determine if intended infrastructure is Treaty-compliant. As per Grey and Sadoff (Grey, 2007), transparency is among best methods for diminishing mistrust in transboundary river basins. Governments are less inclined to see routine engineering as a strategic attack, where they have reliable information. Quality and timeliness of information has been affected at times by political tensions. Pakistani officials have spoken on a few occasions about late provision of

technical documentation for project, while Indian officials have said that all their treaty obligations regarding notification have been met.

5.3. Multi-Tiered Dispute Resolution Mechanism:

The framework of treaty is one of its most innovative elements – a graduated dispute-resolution process. Treaty does not call for all disagreements to be submitted immediately to international arbitration, but provides for three types of disagreement. Minor technical problems are discussed in Permanent Indus Commission. This can be in form of engineering specifications, hydrological measurements and operational procedures. In past, vast majority of normal differences of opinion have been settled at this level. In event of a technical disagreement, the Commission may call upon either government to appoint a Neutral Expert to settle the issue. The Neutral Expert has responsibility to decide compliance of engineering designs with treaty provisions. Neutral Expert's role differs from that of an arbitrator in the political arena, in that it is most mainly concerned with technical matters. The World Bank helps to organize appointment but the substantive dispute is not decided by it. Matters relating to interpretation of law or application of treaties can be referred to an international Court of Arbitration. The Court is composed of independent international judges and professionals who make binding decisions. The multi-layered character of treaty helps to differentiate between technical and legal disagreements, which minimises potential for unproductive political confrontation. This institutional structure is one of most advanced systems for resolving water disputes in international water law, Salman (Salman S. M., 2007) says.

6. Major Water Disputes under Indus Waters Treaty:

Indus Waters Treaty (IWT) has been termed as one of the most successful water-sharing treaties among nations, but it has not been without its controversies. Since its coming into effect in 1960, India and Pakistan have had differences of opinion on the interpretation of certain clauses in treaty regarding hydropower generation, storage capacity, engineering designs and uses of Western Rivers. However, unlike other transboundary river basins where conflicts have ventured into violent form, conflicts under IWT have largely been mediated through institutions set up by treaty, such as Courts of Arbitration (Bank, Indus Waters Treaty 1960., 1960) Neutral Experts and Permanent Indus Commission (PIC). These disagreements illustrate the advantages and disadvantages of the treaty. On the other hand, they show the strength of a legal system that is able to deal with technical issues even as broad political disputes continue. However, they point to the growing complexities of transboundary water governance in the context of climate change, rising energy demand, growing hydropower development, and rising geopolitical competition.

6.1. Baglihar Hydroelectric Project Dispute:

Baglihar Hydro Electric Project in Indian Union Territory of Jammu and Kashmir on Chenab River was the first large technical issue referred to a Neutral Expert under framework of the Indus Waters Treaty. India started work on run-of-the-river project in late 1990s and Pakistan has protested that some design aspects of the project—such as height of the dam, gated spillways, and reservoir storage capacities—would allow India to manipulate flows downstream during critical agricultural seasons. (Salman S. M., 2002) Since Permanent Indus Commission could not reach an agreement, Pakistan asked for appointment of a Neutral Expert under Article IX of the treaty. In 2005, World Bank commissioned the Swiss engineer, Prof. Raymond Lafitte to study the technical problems. In his 2007 determination, Lafitte accepted some of India's design elements and requested changes to some of its technical elements, such as lowering the freeboard and correcting calculations for storage. (Lafitte, 2007) The decision underscored possibility of a treaty's dispute-resolution provisions to allow for different technical interpretations without compromising the legal structure. The Baglihar case is considered important precedent in sense of engineering standards established for future hydropower

projects and reaffirmation of authority of the institutional mechanisms established under the treaties. (Mustafa, 2010)

6.2. *Kishanganga* (*Neelum*) Hydroelectric Project:

Kishanganga Hydroelectric Project is one of biggest litigations under Indus Waters Treaty. The project consists of taking some water out of Kishanganga River—also called *Neelum* River in Pakistan—to produce hydroelectric energy, before sending water back downstream. The diversion was opposed by Pakistan for several reasons. It had said that proposed Neelum–Jhelum Hydropower Project, agriculture and ecology would suffer if flows are reduced at downstream. Hence, Pakistan requested arbitration under Annexure-G of treaty. Court of Arbitration that was formed under Permanent Court of Arbitration (PCA) reviewed two main questions in 2010–whether India had legal authority to divert water from Kishanganga for hydropower generation. Whether minimum flows should be maintained downstream. As per Partial Award of Court (2013), India could continue with diversion provided it fulfilled treaty obligations. Notably, Court also acknowledged, for the first time, principle of environmental protection as an important one in international law of water. It therefore called on India to ensure a "minimum environmental flow" of nine cubic metres per second to safeguard downstream environmental flows. (Arbitration, 2013) This was a historic move as it brought with it the environmental aspect of treaty into current context of international law, which had not yet gained a central place in its practical application, being considered for decades.

6.3. The Ratle Hydroelectric Project:

The dispute about interpretation of treaty has also arisen in case of Ratle Hydroelectric Project located at site of Chenab River. In case of *Ratle* Hydroelectric Project, located on Chenab River, a new conflict has arisen about interpretation of treaty. However, Pakistan asserts there are a number of design features, such as gated spillways and storage structures, which allow for too much control during operation, which could impact downstream irrigation and hydropower production. India, on the other hand, contends that project meets all conditions of treaty for run-of-the-river hydroelectric projects. The disagreements about Ratle are not the same as those in past, but have been linked to wider procedural issues around how to interpret Article IX of treaty. While Pakistan wanted formation of a Court of Arbitration, India wanted matter to be referred to a Neutral Expert arguing that matter was mainly technical and not of a legal nature. This procedural dispute led to parallel processes, some of which led the World Bank to suspend process before restarting it both under a carefully managed process. The Ratle case exemplifies the increasing overlaps between technical and legal issues and treaty implementation in a political context.

6.4. *Tulbul* Navigation Project (Wullar Barrage):

Tulbul Navigation Project (also called *Wullar* Barrage Project) is a project of building a Navigation Control Structure at the outlet of Wullar Lake, on Jhelum River in Pakistan. India says the project's purpose is largely to ensure a proper water depth for navigation purposes throughout the year. Pakistan argues that this design would allow India to store more water on Western River than treaty allows, which would allow for control of river flow in a downstream area at times of agricultural requirement. Construction was halted in late 1980s due to Pakistani objections but talks have taken place in an intermittent manner without a comprehensive settlement. *Tulbul* dispute highlights that even without major engineering projects, conflicting interpretations of terms of agreement (such as navigation, storage and operational control responsibilities) can lead to diplomatic disagreements.

6.5 India's 2016 Review of Indus Waters Treaty:

After attack on India by Uri in September 2016, political debate on future implementation of Indus Waters Treaty (IWT) increased in India. Senior Indian officials said they are reviewing how country uses its treaty waters and that “blood and

water cannot flow together" was a political statement. Such comments sparked a lot of concern in Pakistan, but India did not pull out of treaty or suspend its application. Instead, India has stepped up attempts to make the best use of its legitimate use of Eastern Rivers and to speed up contractually approved hydropower projects in the auspices of the treaty. The episode did, however, highlight how water-related challenges can be connected to other political challenges, thus underscoring need for functioning technical cooperation that is agnostic to political relations. (Bhasin, 2018)

6.6 Pakistan's Concerns Regarding Hydropower Development:

The water level in Pakistan has consistently been a point of contention as with multiple hydropower projects, water availability will decrease during crucial agricultural seasons. Operational flexibility arising from "gated spillways" and delayed data sharing are concerns for Pakistani scholars and policymakers for cumulative storage effects and reduced transparency about design of projects. Indian experts tend to dismiss such worries, noting that treaty also includes "run of the river" hydropower projects on Western Rivers, with engineering restrictions defined. This difference highlights how much of current conflicts are not about violation of treaty obligations, but rather, interpretation. There are a number of important lessons that can be learned from more than six decades of treaty implementation. One is the institutional arrangements set in place by IWT have effectively prevented any technical disputes from spiraling into an armed conflict. India and Pakistan have tried to resolve their issues and have not stopped doing so, even in face of multiple crises, under Permanent Indus Commission and dispute-resolution mechanisms provided under treaties. Second, development of dams and hydropower has posed problems in part not foreseen in 1960 because of advances in technology. Modern projects entail engineering complexities which are becoming increasingly complex with regard to technical evaluation. Third, there are new dimensions to treaty implementation due to climate change. The fluctuating river flows, glacier retreat, extreme weather and weather variability makes reservoir management more complex and the need for hydrological information sharing more strategic. Last but not least, conflicts illustrate the institutional durability of a treaty, while also highlighting the need for modernisation in the areas of science cooperation, digital hydrology, environmental monitoring and climate adaptation

7. Climate Change and Contemporary Water Security Challenges: Reassessing the Indus Waters Treaty in Twenty-First Century:

During this time, transboundary water governance was largely concerned with allocation and use of river water for irrigation, agriculture and economic development and Indus Waters Treaty of 1960 was negotiated. The scientific knowledge on climate change, glacier dynamics, environmental sustainability and ecosystem-based water management etc. was limited at time. As a result, treaty focused on fair sharing of Indus system and how it would be technically handled, instead of long-term uncertainties about climate and environmental conditions (World Bank, 1960). The situation in Indus Basin has now undergone a complete transformation in more than 60 years. Climate change has become one of the biggest challenges to water security in region, impacting river flow, glacier stability, precipitation, groundwater recharge, agricultural productivity, and hydropower production. At the same time, pressure of growing populations and urbanization, industrial development, pollution and environmental degradation has been increased on already strained freshwater resources. South Asia is among regions most vulnerable to climate change, according to Intergovernmental Panel on Climate Change (IPCC) (2023). Countries sharing Indus Basin are facing extreme challenges due to rising temperature, changing monsoon pattern, floods and droughts and accelerated glacier retreat. The changes have raised concerns among researchers and policy makers about institutions of IWT's ability to meet new water security challenges of the twenty-first century.

7.1. Climate Change and Indus River Basin:

The Indus River Basin (IRB) is one of the world's most climate-sensitive river basins, as hydrology relies on the three interconnected sources that are glacier melt, seasonal snow melt and monsoonal precipitation. The basin is situated in Hindu Kush – Karakoram – Himalayan (HKH) mountain range, known as "Third Pole" as it holds bulk of ice outside Arctic and Antarctic (ICIMOD, 2019). The IPCC Sixth Assessment Report (2023) reports that over last century the average temperature of South Asian countries has risen considerably, which has led to an accelerated melting of glaciers and changes in seasonal runoff. Glacier melt can lead to increased river discharge in the short term, but may lead to decreasing river discharge in long term, especially during dry seasons. Under relatively optimistic GHGs emission scenarios, Hindu Kush Himalaya Assessment projects significant glacier mass loss by the end of twenty-first century. (ICIMOD, The Hindu Kush Himalaya Assessment: Mountains, Climate Change, Sustainability and People, 2019) This will impact seasonality, quantity and timing of water reaching downstream communities in India and Pakistan. The climate changes pose threats to IWT, which was negotiated within framework of relatively stable hydrological conditions.

7.2. Glacier Retreat and Hydrological Uncertainty:

Winter snowfall on glaciers of the Karakoram, Himalaya and Hindu Kush acts as a natural reservoir, which melts slowly during hot seasons. This seasonal control has been the major factor in agriculture production in Indus Basin in past. But recent scientific research shows that there is significant variability in glacier response in region. Many glaciers in Himalayas are shrinking at high rates due to these temperature-influenced precipitation changes, whereas some are relatively stable in Karakoram region—a phenomenon referred to as "Karakoram Anomaly"). (Bolch, 2019) Fast glacier retreat poses multiple related issues, including an increased risk of glacial lake outburst floods (GLOFs), alterations to seasonal river flow conditions, long-term low availability of freshwater, increased sediment loading to reservoirs and increased uncertainty in hydropower planning. These developments are a challenge to reservoir management, irrigation scheduling and disaster preparedness for both the countries.

7.3. Changing Monsoon Patterns:

The climate change is also impacting South Asian monsoon system. As the climate warms up, amount of water that atmosphere can hold has also gone up, which causes more moisture to be retained in atmosphere and therefore more intense rainfall events, but also the risk of longer dry spells between rainfalls. (IPCC 2023). Thus, Indus basin has higher hydrological variations than uniform increase or decrease in rainfall. The changes have a number of implications, including increased flood frequency, longer dry spells, irregular agricultural seasons, reservoir management problems, and increased disaster risks. Pakistan's catastrophic floods in 2010 and 2022 highlight impacts of extreme precipitation on existing water-management systems and the associated humanitarian and economic consequences.

7.4. Water Scarcity and Population Growth:

Demographic pressures add to regional water insecurity due to climate change. The population of India is over 1.4 billion as per report of United Nations Department of Economic and Social Affairs (2024). The number of people in Pakistan has crossed 240 million. This high rate of population growth significantly drives need for irrigation water, drinking water, sanitation, industrial production, hydropower generation and municipal services. Since independence, due to population growth, availability of water at per capita level has fallen significantly in Pakistan, estimates World Bank (Bank., 2019). So water scarcity also represents governance problems, lack of efficient irrigation practices, lack of water storage facilities, unsustainable groundwater use, etc., connected to climate change.

7.5. Groundwater Depletion:

Groundwater is now an essential part of water security in India and in Pakistan. In recent years,

reliance on tube wells for agricultural production has been on rise during water shortages of canal water. However, over-pumping of groundwater has led to a fall in water levels, higher cost of pumping, groundwater salinity, decreased drought resilience and lower water quality. Transboundary aquifers were not a major concern when IWT was negotiated, so there are no specific provisions in Indus Waters Treaty containing specific rights over them. Modern researchers therefore maintain that future water cooperation should not only be based on surface water allocations, but also on monitoring of groundwater, scientific assessment of groundwater resource and sustainable groundwater management. (McCaffrey, 2019)

7.6. Environmental Degradation and Water Quality:

Water security now covers water quantity as well as water quality. The water quality of the Indus Basin has deteriorated due to rapid industrialization, untreated municipal effluents, agriculture runoff, and poor environmental legislation. The major pollutants are untreated sewage, industrial effluents, pesticides, fertilizers, heavy metals and plastic wastes. Drinking water, aquatic biodiversity, fisheries, irrigation and ecosystem health are all impacted by environmental degradation. IWT does not contain many provisions on pollution control or ecosystem conservation, unlike today's international environmental agreements.

7.7. Hydropower Development and Emerging Challenges:

Hydroelectric energy is playing an increasingly significant role in energy strategies of both countries–India and Pakistan. In India, run of river hydroelectric projects have been expanded on Western Rivers such as *Baglihar; Kishanganga; Ratle* and *Pakal Dul*. Pakistan has also been spending huge amount of money on other major infrastructure projects like *Diamer-Bhasha, Dasu* Hydropower Project and Mohmand dam. Hydropower may be a facilitating component of renewable energy generation, but natural dynamics of river flow make reservoir management and production complicated. Additionally, ongoing conflicts over engineering design illustrate need for increased technical cooperation and transparency in developing more infrastructure.

7.8. Is the IWT Climate Resilient?

A major discussion in current research is if IWT has the institutional flexibility to meet the challenges of climate change. Backers say treaty has proven to be highly resilient, due to its legally binding water allocation, institutional dialogue on water, dispute resolution and technical cooperation. Critics argue treaty is more of a product of 1950s, not 21st century. There are gaps in monitoring of climate adaptation, glacier monitoring, ground-water governance, ecosystem protection, environmental flows and water-quality management and digital hydrological monitoring. Most scholars believe in adaptive implementation of treaties through supplementary agreements, greater scientific cooperation and enhanced institutional capacity. (Salman S. M., 2002) Adaptive management principles need to be included in future water governance in the Indus Basin. Shared glacier monitoring, climate risk analysis, sharing of real time hydrological data, flood forecasting, drought early-warning system, groundwater mapping, environmental impact assessment, ecosystem restoration, integrated river-basin management and scientific cooperation under Permanent Indus Commission are the priority projects. These measures would have an impact on regional resilience and would further boost India-Pakistan ties.

8. Hydro-politics, International Water Law and Future of Indus Waters Treaty:

Transboundary river governance is one of the most vibrant fields of current international law and international relations. The shared river basins are experiencing a growing scarcity of freshwater, climate change, population growth, increased energy consumption and environmental degradation and thus are becoming not only a potential source of tension between states but also a potential source of cooperation. In this larger picture, Indus Waters Treaty (IWT) model of

water governance is unique and despite years of political animosity, military confrontation and diplomatic crises, it has been a successful one for two countries. The geopolitical and environmental context, in which treaty was negotiated, however, has been dramatically different since 1960. Institutional architecture of treaty needs to be reconsidered in light of modern international water law and changing principles of environmental governance and growing importance of climate resilience. It looks at the competitive, negotiating and cooperative dynamic between states in transboundary river basins regarding shared freshwater resources (Elhance, 1999). Indus Basin is a classic example of hydropolitical system, as there are six major rivers that cross international borders, interests of upstream and downstream communities often conflict and irrigation is still a vital part of agriculture sector with water having strategic, economic and political importance.

The transfer of control of upstream infrastructure was closely coupled with national security after partition of British India. After partition of British India, control of upstream infrastructure was closely coupled with national security. The upstream status of India on the various rivers meant an expansion of its geographical power and downstream status of Pakistan meant that water security and sustainable agriculture raised concerns. Yet, IWT was able to turn a potentially volatile hydro-political situation into one of legal commitments and institutional collaboration, despite structural asymmetries. Hydro-hegemony theory developed by Zeitoun and Warner (2006) is one of the influential theories on transboundary water relations. The theory suggests that hydrologic control is determined not only by hydrology, but also by other asymmetries in political influence, economic capacity, military power, bargaining strength and technological capabilities. In Indus Basin, India has upstream benefits and has better economic and technical resources. In contrast, Pakistan relies more heavily upon Western Rivers for irrigation, food and drinking water. In Pakistan, some scholars said that rise of ROR hydropower projects in Indian sub-continent is a sign of the growing influence of India upstream and this could pose a risk to water availability in the downstream regions. (Mustafa, 2010) This interpretation is not accepted by Indian scholars who state that the terms of the treaties explicitly give authority to such projects, with certain engineering conditions. IWT, however, is far more difficult to explain through lens of Hydro-hegemony Theory, which presents some insights into imbalance of power. Both countries have been functioning for over 60 years within institutional structure set up by treaty, even with disparities in their abilities.

8.1. Complex Interdependence and Water Cooperation:

According to Complex Interdependence theory, developed by Robert Keohane and Joseph Nye (2012), the issue lies with balance of power in their relationship. This view is a multi-faceted political, economic, environmental and institutional mechanism of interaction between states. In some instances, military force is not the first option of policy. International institutions help mitigate uncertainty and promote cooperation. These principles are well embodied in IWT. The Permanent Indus Commission, annual technical meetings, data sharing, and dispute resolution are other avenues of communication outside diplomatic arena. Technical cooperation on implementation of treaties remained largely unabated during military conflict such as the wars of 1965, 1971 and 1999. This Indus experience thus shows that environment dependency can lead to functional cooperation even in the face of ongoing geopolitical competition.

8.2. The Indus Waters Treaty and International Water Law:

IWT was negotiated many years ago prior to creation of many modern international water law instruments, but shares many core principles of international water law. Equitable and reasonable utilization is one of the main principles of customary international water law and is included in the 1997 United Nations Convention on Law of Non-Navigational Uses of International Watercourses (UN Watercourses Convention). The IWT is different from Convention as it does

not seek to share water equitably between India and Pakistan, but goes on to suggest a system of river allocation, whereby Eastern Rivers are allocated primarily to India and Western Rivers primarily to Pakistan. Both conceptually aim at creating a predictable and peaceful management of shared watercourses. McCaffrey (McCaffrey, 2019) notes that treaty is a negotiated and more reasonable approach to 'accommodation' that suits political situation in South Asia. The principle of abstaining from causing "significant" transboundary harm is another fundamental principle of international water law. This principle is indirectly included in IWT via technical restrictions on storage capacity, reservoir operation, engineering design and hydropower construction. The current confusion over *Baglihar, Kishanganga* and *Ratle* projects, by both sides, shows that they are still assessing their future investment options based on downstream effects. International water law calls for ongoing cooperation between riparian countries. IWT formalizes this commitment in Permanent Indus Commission, exchange of hydrological data, inspection visits, notification and dispute resolution processes. These are still one of strongest features of treaty.

8.3. Emerging Norms in International Water Governance:

International water governance has evolved since 1960 and has gone beyond water allocation and water engineering issues. Ecosystem protection, environmental flow, conservation of biodiversity, climate adaptation, governance of groundwater, sustainable development and public involvement are more and more acknowledged as important elements in contemporary approaches. This encompasses Convention on Law of Watercourses adopted by UN in 1997, Berlin Rules on Water Resources adopted by International Law Association in 2004 and SDG 6 (Clean Water and Sanitation) adopted in 2030 Sustainable Development Goals. IWT's provisions on environmental sustainability and climate resilience are far more limited than those in these instruments.

8.4. Climate Change and the Evolution of International Water Law:

The current governance of water is in an entirely new form due to climate change. Today, adaptive management; precautionary approaches; ecosystem resilience; integrated river-basin management and climate-risk assessment are all recognized as key concepts in legal scholarship. Protection of environment is now increasingly recognized as a part of transboundary water governance in International Court of Justice, international arbitral tribunals and regional river commissions. *Kishanganga* Arbitration (2013) is in line with this general principle, and it stated that there was a need to ensure minimum flows in the environment even though treaty had no specific reference to it. This decision reflects the way the interpretation of treaties can change over time according to the norms of international environmental law.

8.5. Hydro-Diplomacy as Future of Indus Basin:

Hydro-diplomacy has become a viable approach to address more intricate transboundary water relations. Hydro-diplomacy is a blend of international law, scientific cooperation, technical dialogue, environmental governance and conflict prevention. Hydro-diplomacy considers water as a tool for cooperation, not only for its strategic value, but also for cooperation in areas of sustainable development, disaster mitigation, food security and regional stability. (Islam, 2013) It is a chance for India and Pakistan to further improve confidence building measures even in the absence of their broader political relations.

9. Conclusion:

Indus Waters Treaty (IWT) of 1960 is one of the most remarkable success stories in the history of international water diplomacy and transboundary resource governance. Treaty was negotiated by the World Bank over a long and complex diplomatic process, preventing a potentially destabilizing dispute that has been institutionalized over the past more than 60 years governing the allocation and management of the Indus River system. Despite repeated wars, political disagreements, diplomatic tensions and military skirmishes

between India and Pakistan, treaty has proved to be a successful legal agreement to manage one of the world's most geopolitically significant transboundary river basins. Its durability shows that even in countries with significant political mistrust, effective dispute-resolution processes and clear legal commitments to cooperation can promote long-term cooperation through well-designed international institutions. This research has highlighted that without mapping geopolitical impact of partition of British India in 1947, origin of Indus Waters Treaty cannot be comprehended. The reconstruction of Punjab irrigation system in to its various divisions caused unprecedented problems and water became a national security issue with upstream headworks separated from downstream canal systems. In 1948, canal water crisis was a test of vulnerability of newly formed states, and it became clear that there was a need for a secure institutional structure. In the end, India and Pakistan negotiated with each other through the World bank and managed to chalk out an agreement which ensured balance of other national interests and resulted in one of the most extensive bilateral water-sharing regimes in international law. The article has also demonstrated importance of institutional framework of treaty, such as Permanent Indus Commission, rules for appointment of Neutral Experts and creation of Courts of Arbitration, which have contributed significantly to avoidance of technical quarrels turning into wider conflicts. Indus Waters Treaty stands out from other trans-boundary water agreements that have been unable to withstand test of time amidst long-standing geopolitical tensions. The study also shows that nature of treaty today is different than in 1960, in an environmental, technological and geopolitical way. The treaty was negotiated at a time when issues mainly revolved around irrigation development, river allocation, engineering design. Modern water governance is significantly more complicated. An unprecedented climate change, accelerated glacier retreat in Hindu Kush–Karakoram–Himalayan region, change in monsoon pattern, frequent flooding and droughts, groundwater depletion, environmental degradation, deterioration of water quality, rapid urbanization, population growth and growing demand for renewable energy, have completely transformed hydrological reality in Indus Basin. The challenges are not limited to the scope of the treaty itself, and need to be addressed by adaptive governance approaches that include environmental sustainability, scientific cooperation and climate resilience.

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