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CLIMATE CHANGE AND INDUS WATERS TREATY: DEFECTS, CHALLENGES AND WAY FORWARD

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ABSTRACT

The Indus Waters Treaty (IWT), signed by Pakistan and India in 1960, has governed the sharing of river waters despite recurring political tensions. However, climate change and strained bilateral relations, especially post Pahalgam crisis, have exposed weaknesses in its legal and institutional arrangements. This article examines the treaty's defects, the challenges posed by climate change, and possible ways forward. It focuses on glacier melt, changing river flows, irregular monsoon patterns, water scarcity, data-sharing difficulties, and the politicization of water relations. The article uses a post-positivist approach, a qualitative case-study design, and applies qualitative document analysis to assess the IWT, decisions of arbitration bodies and neutral experts, academic literature, policy reports, and official statements. It assesses how the treaty's fixed allocation framework, limited climate-adaptation provisions, technical focus. The articles argues that climate change acts as a threat multiplier rather than an independent cause of conflict, intensifying existing mistrust, strategic competition, and weaknesses in water governance. It concludes that improved climate-related data exchange, stronger flood and drought preparedness, expanded technical cooperation, and adaptable mechanisms are important for the treaty's continued relevance and long-term water security in the Indus Basin.

Keywords: climate change, Indus Waters Treaty, water security, hydropolitics,

1. Introduction

South Asia's shared river systems are not merely geographical features; they are the lifeline of millions of people. These rivers support everyday survival by providing water for drinking, for agriculture, and for hydropower. They are deeply linked to livelihood, food security and economic security for countless communities (Saeed & Ahmad, 2021; Yang et al., 2014). Because of this vital role, water has always occupied a central position in the political and economic dynamics of the region. On the one hand, shared needs can bring countries together in cooperation; on the other, scarcity or uneven distribution can generate tension and conflict (Hafeez & Kausar, 2022; Sarwar & Farid, 2025).

The Indus Basin is one of the most complex and contentious shared water systems in the world and is shared mainly between Pakistan and India (Saeed & Ahmad, 2021; Sato, 2024; Global Water Partnership, 2013). The basin plays a vital role in food security, regional power dynamics and the protection of national interests (Bashir, 2024; Mustafa, 2021).

The roots of the water dispute between Pakistan and India lie in the 1947 partition of British India (Bashir, 2024; Shah, 2025). Punjab and Sindh were divided without paying any attention to how the water system actually worked (Mustafa, 2021). Although new borders were drawn, the river systems and the canal network remained connected. As a result, India gained control over the upstream headworks, while Pakistan was left in a weaker downstream position, relying on waters that flowed from India (Bashir, 2024; Shah, 2025). As a result, what should have been a shared natural resource ended up becoming a source of insecurity, dependence and tension between the two countries. Because of this geographical reality, water quickly acquired strategic value and became a tool of regional politics (Sarwar & Farid, 2025). In April 1948, soon after independence, India temporarily cut off the water supply to Pakistan's canal system, an event that exposed Pakistan's vulnerability and dependence. This

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event also set the stage for long-term tension over water between the two states (Bashir, 2024; Mustafa, 2021). The dispute led the World Bank to intervene and help broker the 1960 Indus Waters Treaty (Biswas, 1992), which became a landmark effort to share water more fairly and to reduce the risk of future conflict.

What began as a technical question of water sharing has turned over time into a highly complex, sensitive and security-focused issue (Rigi & Warner, 2020; Sarwar & Farid, 2025). Recent studies no longer treat water merely as a resource; it is often described as an "existential threat" to the state. For Pakistan this concern is real because its agricultural economy depends heavily on the Indus river system; any perceived threat to the flow of water is seen as a direct threat to national survival (Mirza & Mahmood, 2022; Mustafa, 2021). India's position as the upper riparian state gives it a geographical advantage over the flow of water, a situation some scholars describe as "hydro-hegemony", meaning that one riparian holds greater control over shared water than the other (Zeitoun & Warner, 2006; Bashir, 2024; Sarwar & Farid, 2025). This power imbalance has increased Pakistan's concerns and mistrust. These concerns are especially related to India's upstream hydropower projects such as Baglihar, Kishanganga and Ratle (Hafeez & Kausar, 2022; Raza & Adnan, 2023; Rigi & Warner, 2020).

The presence of nuclear weapons on both sides of Indus Basin further increases its geopolitical significance (Bashir, 2024; Bukhari, 2025). Water is no longer only a developmental issue; it is now connected to military strategy and "nuclear signaling", that is, to the ways in which the two countries display power and send strategic messages to each other (Bukhari, 2025). Growing pressure on water resources makes this worse, turning scarcity into a potential trigger of future conflict (Bukhari, 2025; Shah, 2025). The idea of a "nuclear-hydro nexus" suggests that peace and stability in South Asia depend partly on how the Indus waters are managed: stable and well-managed water sharing supports broader regional stability (Bukhari, 2025).

This hydro-political rivalry has escalated significantly in recent years, and the events of 2025 have brought the dispute to a critical and fragile point (Shah, 2025). Following the 2025 Pahalgam attack, India placed the Indus Waters Treaty in abeyance and suspended its engagement with cooperative mechanisms such as the Permanent Indus Commission (Al Jazeera, 2025). These steps were justified as a response to cross-border terrorism (Shah, 2025). In response, Pakistan warned that any unilateral disruption of water flows would be treated as an act of war; in effect, water had become "weaponized" (Shah, 2025). This shows that the dispute is no longer confined to technical discussions and commissions. It has moved into the political arena, where water is used to send messages and to retaliate, reflecting deeper mistrust and rivalry between the two countries (Farid & Ashraf, 2025).

Furthermore, climate change and other non-traditional security threats are reshaping the dynamics of the Indus Basin conflict (Khizar et al., 2025; Sarwar & Farid, 2025). The Indus Basin is one of the most climate-sensitive regions in the world because rising temperatures in the Himalayan and Hindu Kush ranges are causing rapid glacier retreat. In the short term, melting glaciers increase river flows and flooding, but in the long term they may lead to a permanent reduction in water availability (Hafeez & Kausar, 2022; Khizar et al., 2025). As water becomes scarcer and less predictable, the Pakistan–India water relationship increasingly resembles a "zero-sum" situation, in which any gain by one side is seen as a loss for the other (Sarwar & Farid, 2025). Each country's efforts to protect its own water future, whether by building dams or controlling river flows, are often seen by the other as a direct threat (Irfan et al., 2019; Rigi & Warner, 2020). This has created a cycle of mistrust in which environmental pressures are often interpreted as deliberate acts such as "resource piracy" or "water theft" (Adel, 2017; Sarwar & Farid, 2025).

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1.1 Research Gap, Questions and Argument

Existing scholarship on the Indus Waters Treaty is fragmented. Legal studies concentrate on dispute-settlement procedures and project-specific disagreements such as Baglihar, Kishanganga and Ratle (Raza & Adnan, 2023; Ahmad & Afzal, 2025); political studies focus on hydro-hegemony and securitization (Zeitoun & Warner, 2006; Mehsud et al., 2020; Rigi & Warner, 2020); and environmental studies document glacier retreat and hydrological change (Lutz et al., 2016; Janjua et al., 2021; Khizar et al., 2025). Few studies connect these strands, and fewer still examine how the treaty has performed since the April–May 2025 crisis. Recent commentary by Manhas (2025), Sinha (2025) and Romshoo et al. (2025) shows growing attention to the treaty's future under both political and climatic pressure. This article addresses the gap by asking: How has climate change exposed the structural and institutional limitations of the Indus Waters Treaty, and what implications does this have for its future effectiveness? Three sub-questions guide the analysis: How is climate change affecting hydrology and water security in the Indus Basin? Which institutional and legal limitations prevent the treaty from responding to climate-driven challenges? And what reforms could strengthen its adaptability under changing climatic and political conditions?

The article argues that climate change acts as a threat multiplier rather than an independent cause of conflict. It does not invalidate the treaty's allocation of the rivers, but it magnifies existing institutional weaknesses, namely the absence of climate-adaptation mechanisms, limited data exchange and a reactive dispute-resolution system, under conditions of political mistrust.

1.2 Research Methodology

The study follows a post-positivist approach, which recognizes the importance of legal texts while accepting that political interests and power relations shape how a treaty is applied in practice. It uses a qualitative case-study design, with the Indus Waters Treaty as an example of transboundary water governance, and qualitative document analysis as its method. Qualitative document analysis involves the systematic reading and interpretation of written material to identify patterns and themes. The data set consists of secondary sources: the text of the treaty; decisions of the Neutral Expert and Court of Arbitration; peer-reviewed articles and reports on climate change in the Indus Basin published between 2020 and 2026; and policy reports and official statements. Each treaty provision is assessed against the same criteria: its original purpose, the contemporary problem, the available evidence, the limitation that emerges, and the implication for treaty resilience. The study does not rely on interviews with treaty officials, which is a limitation noted in the conclusion.

1.3 Structure of the Article

Section 2 reviews the literature on climate change and water scarcity and identifies the research gap. Section 3 sets out the theoretical framework. Section 4 analyses the treaty's provisions, and Section 5 examines the post-2025 period as a test of treaty resilience. Section 6 outlines an integrated way forward, and Section 7 concludes.

2. Literature Review: Climate Change and Water Scarcity

2.1 Changing Climate Patterns and Water Availability

Global and regional hydrological systems are significantly affected by climate change creating more uncertainties in water availability. The changes in the seasonal distribution, intensity and frequency of precipitation, the natural cycle of occurrence of extreme events and the rising temperatures have impacted the natural water cycle. The changes are especially important in South Asia because of its dependence on monsoon rainfall and glacier-fed water supply network (IPCC, 2021; Laghari et al., 2022). Consequently, water resources, planning, agriculture and human security are vulnerable to significant impacts from changes in climate, even at local scale.

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For Pakistan and India, climate change is impacting the Indus Basin directly - a lifeline for millions of people. The irregularity of rainfall has resulted in variable streams of water, thus flooding and droughts occur at different times. This uncertainty makes water management more challenging, particularly for nations where river flows are essential for farming and electricity generation (Hussain et al., 2021). The environmental disturbances are indicative of the lack of harmony between the old water management systems and the new climatic conditions.

Furthermore, these transformations cast doubt on the current institutional arrangements, such as trans-border water agreements. The agreements such as the Indus Waters Treaty were negotiated under fairly stable environmental conditions, which were not expected to be so variable. Climate-induced environmental uncertainty is a further challenge to political and institutional uncertainty, particularly in the post-May 2025 scenario (Zawahri, 2021). This demonstrates that climate change is not just an environmental challenge but also a factor that shapes governance and policy processes.

2.2 Water Scarcity in South Asia

Water scarcity in South Asia is one of the world's most pressing challenges which is being exacerbated by climate change. Population growth and urbanization are already straining water resources. This pressure is exacerbated by climate change, which makes water distribution less reliable and makes resources more valuable and competitive (World Bank, 2020; Salman & Uprety, 2003). Water security is closely tied to growth and development, and hydrological variability imposes high economic costs on countries with limited storage and weak institutions (Grey & Sadoff, 2007). This situation presents significant water management problems for sustainable use in the area.

In particular, Pakistan is vulnerable due to significant reduction in its per capita water availability in the last few decades. The country is heading towards absolute water scarcity and its effects on food security, economic stability and social development (Briscoe & Qamar, 2005). Likewise, water scarcity is a problem in India at a regional level where shared river systems are in operation, such as the Indus Basin (Laghari et al., 2022; Mumtaz et al., 2023). Both countries are faced with parallel challenges and are heavily reliant on limited and uncertain water resources.

When considering water scarcity in the post–May 2025 scenario, it becomes increasingly critical. The shortage of water becomes even more crucial as political tensions rise and doubts are cast on the future of the Indus Waters Treaty. The fact that there is lack of water does not change with the framework of the treaty, even if it is disputed or challenged. It underscores the need to consider water problems in the context of defects, challenges and future policy options, not taking-for-granted a stable institutional structure.

2.3 Climate-Induced Resource Pressure

Climate change acts as a pressure multiplier, placing additional strain on resources that are already stretched. As temperatures rise rates of evaporation rise, surface water decreases and groundwater recharge is impacted. Concurrently, the water supply systems are more unpredictable, with higher variability in the availability of water in the country, making long-term planning harder (IPCC, 2021). Together these effects contribute to the growing uncertainty of water supply and growing demands of water.

This pressure has a special impact in the Indus Basin, where access to water is climate-sensitive. Already, water use has put stress on the water resources and climate change is exacerbating demand-supply gaps (Hussain et al., 2021). This imbalance causes excess water usage and mismanagement of water, thereby further stressing the system (International Crisis Group, 2010).

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Importantly, this increasing pressure also highlights the shortcomings of the present water sharing arrangements. Water scarcity can fuel water conflicts due to uncertainty in water supply, which can lead to disputes over water allocation and consumption. The post–May 2025 scenario is more complicated due to the political narratives on the treaty, which have also shifted. This points to the importance of assessing the current frameworks in more than just their design, but also how well they are able to adapt to new environmental challenges.

2.4 Climate Stress in the Indus Basin: Glaciers, Monsoon and Extremes

Glacier and snowmelt are central to the hydrology of the Upper Indus, particularly in summer, when they contribute heavily to river discharge (Lutz et al., 2016). Accelerated melting may initially raise runoff, but this can give a misleading impression of abundance: as glacier storage declines, long-term availability may fall, a "hydrological paradox" in which short-term increases mask long-term risk (Lutz et al., 2016; Khizar et al., 2025). Precipitation is also changing. Projections for the Upper Indus point to warmer and probably wetter conditions but with considerable uncertainty, and the largest effect is on the seasonal timing of flows rather than on annual totals (Janjua et al., 2021; Lutz et al., 2016). Timing matters because agriculture, hydropower and flood management all depend on when water arrives. Climate change also increases the frequency and intensity of floods and droughts (Lutz et al., 2016; Heureux et al., 2022; Khizar et al., 2025). For Pakistan, whose agriculture and economy rely on the Indus irrigation system, such variability affects food, energy and economic security (Briscoe & Qamar, 2005; Qureshi, 2017). The hydrological conditions under which the treaty operates are therefore no longer those of 1960.

2.5 Research Gap

The literature reviewed above shows three gaps. First, studies of the treaty are fragmented across legal, political and environmental approaches that rarely overlap. Second, much of the literature emphasizes the treaty's institutional continuity without examining its specific defects in a changing climate (Sattar et al., 2018; Ranjan, 2025). Third, little analysis addresses developments after May 2025, when the treaty's institutions came under direct political pressure. This article responds by examining the treaty's provisions together with the climatic and political conditions in which they now operate.

3. Theoretical Framework: Environmental Security Theory and the Analytical Framework

This section sets out the framework used to read the climatic stress and the post-2025 political record together. The framework combines a theory with a legal object, the Indus Waters Treaty, which is analysed in Section 4. The theory is Environmental Security Theory (EST), which has two pillars: the speech-act model of securitization developed by Buzan, Wæver and de Wilde (1998) and the cause-multiplier model developed by Homer-Dixon (1994).

3.1 Environmental Security Theory: Two Complementary Perspectives

To fully grasp the situation, it is necessary to have a model which takes into account both aspects: physical climate change and political presentation of these issues. Such a combined approach is offered by the Environmental Security Theory (EST).

Environmental Security Theory (EST) began in the early 90s and took two lines of development.

The first one is the Copenhagen School. It stated that the old concept of security was not applicable in the post-Cold War world. The concerns about ethnic conflicts, environmental degradation, migration and the economic issues became significant. They asked the question "how does an issue become a security issue?", rather than "what threats does the state face?". This perspective sees an issue as a security issue when it is packaged in

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a manner that pushes it away from the realm of normal politics, and is perceived as urgent and serious. Therefore, the size of the problem is not the only thing that counts, but presenting it using a different approach. (Buzan et al., 1998)

The second direction comes from Homer-Dixon (1994). Initial research claimed it was the lack of resources that would directly contribute to conflict. However, Homer-Dixon gave a more detailed account of this. Environmental issues are a ‘cause-multiplier,' he said. This does not imply that they are the causes of conflict; rather it means that they exacerbate already existing conflict. Weak institutions cannot cope with stress, whereas strong institutions can help manage it. The relationship is therefore conditional rather than direct.

These are two thoughts that do not conflict, they are complementary. The Copenhagen School works to shed light on how problems such as water can turn into security threats. Homer-Dixon is able to shed light on what the actual physical conditions and pressures are behind those concerns.

Neither perspective is sufficient alone. Speech and language alone cannot explain why 2025 became a security moment while 2010 did not, and physical conditions alone cannot explain why some actors treat water as an occasion for cooperation and others as a threat.

The two pillars are therefore used together. This does not create a new theory; it brings two established ideas into one analytical framework that offers a more comprehensive understanding.

3.2 Treaty Resilience: Analytical Dimensions

To connect the theory to the treaty, the article uses the concept of treaty resilience, assessed along three dimensions. Institutional durability asks whether the treaty’s cooperative mechanisms survive climatic and political stress. Framing-relaxation capacity asks whether the parties can move back from a securitized register to a cooperative one after a crisis. Technical-adaptation capacity asks whether the treaty’s technical provisions and design requirements can be recalibrated to new hydrological baselines. The dimensions draw on both pillars of EST: the first two capture the political and institutional response to securitization, and the third captures the material response to physical stress. They are applied in Sections 4 and 5.

4. Analysis of the Indus Waters Treaty

Section 2 established that the Indus Basin is experiencing changes in hydrological patterns, glacier and snowmelt, precipitation and the frequency of extreme events. These changes are important for the Indus Waters Treaty because the treaty operates through rules that were negotiated in 1960 and were designed to manage water use, allocation and cooperation under the conditions of that period. The purpose of this section is to examine whether those provisions continue to perform their intended functions under the changing environmental and political conditions of the basin.

The analysis covers the twelve Articles and eight Annexures of the IWT, but not with equal space, because their contemporary relevance differs. Articles I, II, III, VI, VIII and IX, which relate most directly to the research questions, receive detailed treatment in Sections 4.1 to 4.5, while the remaining Articles and the Annexures are discussed more briefly in Section 4.6.

The following analytical criteria are applied throughout this section. For each provision, the analysis first considers its original purpose, then examines the contemporary problem, considers the available evidence, identifies the limitation that becomes visible, and finally discusses the implication for treaty resilience. This approach is important because the purpose is not to describe every provision as a defect. Some provisions remain important strengths of the treaty, while others reveal limitations when applied to a basin experiencing greater environmental uncertainty.

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The analysis therefore asks a broader question: how far can the original legal and technical structure of the IWT continue to perform its intended functions when the physical conditions of the Indus Basin are changing?

4.1 Article I: Definitions and the Treaty's Conceptual Baseline

Article I provides the definitions used throughout the IWT. It defines the rivers, tributaries, Eastern Rivers, Western Rivers, agricultural use, domestic use, non-consumptive use, the Transition Period, the Commissioner, the Permanent Indus Commission and interference with the waters. These definitions provide the basic language through which the rest of the treaty operates (Pakistan-India, 1960).

The original purpose of Article I was to create a common legal vocabulary for India and Pakistan. Since the treaty regulates a complex river system and contains detailed technical provisions, the parties needed clear meanings for the terms used in the agreement. Definitions were therefore important for reducing ambiguity and establishing a common basis for implementation. This function remains important today. The allocation of the rivers, the permitted uses of the Western Rivers, the work of the Permanent Indus Commission and the dispute-resolution process all depend on the definitions established in Article I.

The environmental conditions of the Indus Basin have changed considerably since 1960. The treaty's definitions do not contain specific concepts relating to climate change, climate risk, changing hydrological baselines, adaptive management or cumulative climate impacts. However, the absence of these terms should not automatically be treated as a defect. The more important issue is whether the existing definitions prevent the treaty from being interpreted and applied under contemporary environmental conditions. The evidence does not show that Article I has become legally unusable. Its definitions remain applicable. The limitation is therefore more indirect. The treaty provides a stable conceptual framework, but that framework was created around categories of water use and physical river conditions that were understood differently in 1960. As the hydrological system changes, new questions have to be addressed through an older legal vocabulary.

The main limitation of Article I is therefore conceptual rather than operational. It does not prevent the treaty from functioning, but it does not provide an explicit conceptual basis for climate adaptation either. This distinction is important for the overall argument of the chapter. The problem is not that the treaty lacks a definition of "climate change." Rather, the problem is that climate change creates questions that were not central to the conceptual structure of the treaty. Article I therefore illustrates the difference between legal continuity and environmental adaptability.

4.2 Articles II and III: Allocation of the Eastern and Western Rivers

Articles II and III form the central allocation structure of the IWT. Article II deals with the Eastern Rivers, while Article III deals with the Western Rivers. The Eastern Rivers are made available for India's unrestricted use, subject to the treaty's specific provisions, while Pakistan receives the Western Rivers for unrestricted use and India is permitted specified uses of those rivers. Article III specifically allows India domestic use, non-consumptive use, agricultural use under Annexure C, and hydro-electric generation under Annexure D.

The main purpose of Articles II and III was to create a clear division of the Indus river system. Rather than leaving India and Pakistan to negotiate continuously over shared flows, the treaty established a relatively definite allocation of the rivers and then identified the limited uses permitted to each side. This was a major institutional achievement. The allocation created legal certainty and reduced the possibility that every new water-development activity would become a separate political negotiation. Ranjan (2025) and Sattar

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et al. (2018) emphasize the importance of the treaty's institutional design and its ability to provide continuity despite wider political tensions.

The environmental problem is not that the rivers have suddenly changed ownership or that the basic allocation has disappeared. The problem is that the hydrological conditions within which the allocation operates have changed. Section 2.4 showed that climate change is affecting the timing and variability of runoff, glacier and snowmelt, precipitation and extreme events (Lutz et al., 2016; Janjua et al., 2021; Khizar et al., 2025). The treaty, however, establishes a river-based allocation rather than a mechanism for periodically recalibrating that allocation according to long-term changes in basin hydrology. This distinction is important. The IWT does not allocate a fixed annual quantity of water between the two states. It allocates the rivers and establishes rights and restrictions over their use. Consequently, climate change does not automatically invalidate Articles II and III. However, increasing hydrological variability can make the practical consequences of those fixed legal arrangements more uncertain. Pakistan's dependence on the Indus system makes this issue particularly significant. Water availability is closely connected with irrigation, agriculture and the wider economy (Briscoe & Qamar, 2005; Qureshi, 2017). Climate-related changes therefore affect the broader security environment in which the allocation system operates.

The evidence does not support describing Articles II and III as failures. Their clarity is actually one of the treaty's greatest strengths. The limitation lies in the absence of an explicit mechanism for addressing long-term changes in the environmental conditions surrounding the allocation.The problem can therefore be described as an adaptation gap rather than an allocation failure. The allocation architecture is strong in terms of legal certainty but weaker in terms of environmental recalibration. This creates a tension between the treaty's need for stability and the basin's increasing variability.

4.3 Article VI: Exchange of Data

Article VI requires the regular exchange of hydrological and operational data, such as river flow, reservoir releases and canal withdrawals, and allows either party to request further information where it is available (Pakistan-India, 1960). Its original purpose was to reduce uncertainty, which in a politically sensitive basin can itself become a source of mistrust. Climate change makes this function more important. As the timing of snow and glacier melt becomes less predictable, historical averages are a weaker guide, and adaptation requires information on precipitation, glacier conditions, snowpack, extreme events and forecasting (Yang et al., 2014; Hafeez & Kausar, 2022). The limitation is therefore not an absence of data sharing but the absence of a comprehensive climate-data architecture: the treaty does not establish joint climate modelling, common climate-risk assessment or continuous basin-wide forecasting. Climate change increases the importance of Article VI without automatically expanding its legal scope, which makes data cooperation a key point at which treaty resilience and climate adaptation meet.

4.4 Article VIII: The Permanent Indus Commission

Article VIII establishes the Permanent Indus Commission (PIC), composed of one Commissioner from each country, as a standing channel for information exchange, inspections, regular meetings and reports to both governments (Pakistan-India, 1960). It allowed technical matters to be handled institutionally rather than becoming immediate political confrontations, and its continued relevance is one of the strongest examples of the treaty’s institutional resilience (Sattar et al., 2018; Ahmad & Afzal, 2025). Its mandate, however, is centred on implementing the existing treaty and does not expressly cover joint climate-risk assessment, integrated basin modelling or long-term adaptation planning. The limitation is therefore a mandate and capacity gap rather than institutional failure. Institutional durability is stronger than institutional adaptability: the PIC can survive political

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pressure, but its ability to respond to new environmental demands depends on how flexibly the parties use its existing functions.

4.5 Article IX: Settlement of Differences and Disputes

Article IX establishes a graduated dispute-settlement framework. Questions are first examined by the PIC; differences may be referred to a Neutral Expert under Annexure F; and disputes may proceed to negotiation, mediation and, where the conditions are met, a Court of Arbitration under Annexure G (Pakistan-India, 1960). Its purpose was to prevent technical or legal disagreements from becoming wider political crises. The Baglihar, Kishanganga and Ratle cases show that the mechanism can resolve project-specific disagreements without wider escalation (Raza & Adnan, 2023; Ahmad & Afzal, 2025). Climate change, however, alters the type of question that arises. A project may comply with the technical requirements of Annexure D while the wider basin experiences changing discharge, sedimentation, flood intensity and seasonal variability. Article IX is strong at answering whether a particular project complies with the treaty, but less clearly designed to address cumulative environmental change across the basin. It is both a major strength and a limitation, because dispute resolution is not the same as adaptation.

4.6 Other Articles and Annexures

The remaining provisions can be summarized briefly. Article IV, on drainage and maintenance, contains no scarcity-sharing rule, leaving no clear guidance on managing shortages during severe droughts that climate change is expected to make more frequent (Qamar et al., 2019). Article V, on financial provisions, contains nothing comparable to a regional climate fund (Hafeez & Kausar, 2022). Article VII, on future cooperation, is the treaty's most promising basis for joint climate-resilience work, but it depends on political willingness (Saeed & Ahmad, 2021). The emergency provision in Article X does not clearly address climate-related emergencies (Khizar et al., 2025); Article XI preserves a technical outlook rooted in the 1960s (Qamar et al., 2019); and Article XII makes formal amendment difficult in conditions of political deadlock (Hafeez & Kausar, 2022). Annexures D and E, which govern run-of-river hydropower and storage on the Western Rivers, are central to the project-level disputes noted above, while Annexures F and G supply the procedures for the Neutral Expert and the Court of Arbitration.

5. The Post-2025 Scenario: Climate Stress, Political Tension and Treaty Resilience

The preceding sections examined the changing environmental conditions of the Indus Basin and the limitations that become visible when the provisions of the IWT are considered against those conditions. The post-2025 period provides a different type of empirical test. The issue was no longer only whether the treaty could accommodate changing hydrological conditions or manage technical disagreements. The treaty's institutional mechanisms were placed under direct political pressure during a period of serious deterioration in India-Pakistan relations.

The importance of this period for the present study lies in the interaction between the environmental and political dimensions of the water relationship. The 2025 crisis was not caused by climate change. The political tensions between India and Pakistan have deep historical, territorial and security roots. However, the growing importance of water under conditions of hydrological uncertainty made the treaty more politically sensitive. Climate change therefore operated as a threat multiplier, increasing the significance of existing institutional weaknesses rather than acting as an independent cause of the crisis.

5.1 The Post-2025 Period as a New Test for the Treaty

The post-2025 period represents an important change in the environment surrounding the IWT. Before this period, many of the major disagreements between India and Pakistan concerning the treaty were connected to particular hydropower projects, technical

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specifications, interpretation of treaty provisions, or the appropriate dispute-resolution mechanism. The Kishanganga, Baglihar and Ratle disputes, for example, were largely dealt with through the treaty's existing institutional and legal procedures.

The events of 2025 were different in character. Water relations became directly connected with a wider security crisis between the two states. This placed the treaty's cooperative mechanisms under a level of political pressure that was different from an ordinary technical disagreement. Niazi and Sheikh (2025) describe the 2025 developments as a transformation in the way the treaty could be used within a broader strategic confrontation, while Mehmood (2025) and Thakur et al. (2025) place the water dispute within the wider India-Pakistan security crisis.

This distinction is important for the argument of this article. The treaty had already demonstrated that it could survive political crises. Therefore, the question is not whether political tension automatically destroys the IWT. Instead, the question is whether the combination of political tension and environmental uncertainty places additional pressure on institutions that were already facing adaptation challenges.

The post-2025 period therefore provides an empirical setting in which the findings of Sections 2 and 4 can be brought together. The changing hydrological conditions identified earlier increased the importance of information, cooperation and technical management. The article-by-article analysis showed that these mechanisms have considerable value but were not designed as a comprehensive climate-adaptation system. The political crisis then affected the very cooperative environment in which these mechanisms are expected to function.

5.2 The April–May 2025 Crisis and the IWT

The April–May 2025 sequence was the most significant recent political test of the treaty. According to the material examined in this study, the Pahalgam attack on 22 April 2025 was followed by India's decision to place the treaty's cooperative provisions in abeyance. Pakistan subsequently responded by treating any disruption of water supplies as an extremely serious security matter and raised the issue through international forums (Niazi & Sheikh, 2025; Mehmood, 2025; Thakur et al., 2025). India also closed the main land border crossing with Pakistan (BBC News, 2025), and Pakistan has since continued to call for the treaty’s restoration (BBC Urdu, 2026).

The significance of this sequence is not simply the political announcement concerning the treaty. It is the fact that a treaty that had generally operated through institutional continuity suddenly became part of a broader security confrontation. The treaty's legal text did not change. What changed was the political environment in which its provisions were expected to operate.

This distinction is important. The 2025 crisis did not create the structural limitations identified in Section 4. Those limitations existed before the crisis. The crisis instead activated and exposed them more clearly. Article VI already depended on information exchange. Article VIII already depended on the functioning of the Permanent Indus Commission. Article IX already provided procedures for differences and disputes. None of these provisions disappeared from the treaty because of the crisis. However, their practical operation became more difficult when bilateral cooperation itself was under strain.

The available evidence therefore supports a distinction between textual continuity and institutional disruption. The treaty continued to exist as a legal instrument, but some of the cooperative processes through which it operates were affected. The PIC was not abolished, but its functioning was disrupted. Similarly, the Ratle proceedings were not simply erased from the treaty framework, but their operation was affected by the wider political environment (Niazi & Sheikh, 2025; Sharma, 2025; Mehmood, 2025; Barman, 2025).

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This is significant for the concept of treaty resilience developed in Section 3.2. Institutional durability does not require the complete absence of disruption. An institution can experience serious pressure and still survive. The 2025 experience therefore provides evidence of strain without complete institutional collapse.

5.3 Water as a Security Issue During the 2025 Crisis

One of the most important developments in the post-2025 period was the increased securitization of water. The water relationship between India and Pakistan has always had a strategic dimension, but the 2025 crisis brought water more directly into security discourse. Pakistan's response to the possibility of disruption in water supplies reflected the perception that water security was directly connected with national security (Niazi & Sheikh, 2025; Mehmood, 2025; Thakur et al., 2025).

This development is important in relation to the Environmental Security Theory framework established in Section 3. The framework combines two related ideas: the securitization process through which an issue is presented as a security concern and the cause-multiplier understanding through which environmental stress can intensify existing political pressures. The 2025 case allows these two dimensions to be considered together.

The security framing of water did not emerge because climate change suddenly created hostility between India and Pakistan. The political relationship was already characterized by deep mistrust. However, the growing uncertainty surrounding water availability made water more strategically sensitive. Climate change therefore added another layer to an already contested political relationship.

The evidence thus supports the argument that climate change acts as a multiplier rather than a direct cause. The conflict cannot be explained by glacier retreat, changing rainfall or hydrological variability alone. At the same time, ignoring these environmental pressures would leave out an important part of the contemporary context in which the treaty operates.

This distinction also helps maintain continuity with the earlier sections. Section 2 showed that environmental change, water insecurity and hydropolitics are closely connected, while Section 3 established the theoretical basis for understanding environmental stress as interacting with existing political structures. The 2025 case provides an empirical example of this relationship rather than requiring a new theoretical explanation.

5.4 Institutional Performance During the Crisis

The 2025 crisis provides an opportunity to assess the three dimensions of treaty resilience: institutional durability, framing-relaxation capacity, and technical-adaptation capacity.

On the first dimension, institutional durability, the treaty proved relatively strong. Its legal framework was not replaced and its institutions remained legally relevant, although PIC inspections were degraded in part rather than formally dissolved (Niazi & Sheikh, 2025; Sharma, 2025). On the second, framing-relaxation capacity, the post-ceasefire record shows limited re-engagement, including communications involving the World Bank and indications of partial PIC reactivation (Farid & Ashraf, 2025). This suggests that the cooperative dimension was not permanently destroyed, but the evidence does not show that full cooperation was restored: some cooperative language returned without necessarily restoring the earlier level of cooperative substance. On the third, technical-adaptation capacity, the evidence is weakest. The crisis neither changed the treaty’s technical provisions nor produced a mechanism for recalibrating them, so the environmental pressures described in Section 2.4 remained in place while the political environment became more difficult.

The treaty therefore showed stronger resilience in maintaining its institutional existence than in adapting its technical and environmental framework. It has mechanisms for

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managing defined disputes and maintaining communication, but not an equally developed mechanism for continuous climate adaptation.

6. An Integrated Way Forward for the Indus Waters Treaty

The preceding sections identified how changing environmental and political conditions expose the limits of the treaty's provisions. Five types of response emerge from this analysis: allocation and hydrological adaptation; information, data exchange and institutional cooperation; project-level and basin governance; dispute resolution and legal adaptation; and the broader geopolitical relationship within which all of these operate. This section does not repeat the provision-by-provision findings but explains how the responses relate to one another, in what order they should be pursued, and how the differing priorities of India and Pakistan can be accommodated within one coherent approach.

6.1 Allocation and Hydrological Adaptation

The analysis of Articles II and III (Section 4.2) points to maintaining the fixed allocation of the Eastern and Western Rivers while improving the quality and currency of the hydrological information that supports its implementation. Climate change does not require reopening the allocation. Debates over the criteria for equitable allocation are long-standing in international water law (Wolf, 1999), and reopening them would risk the legal certainty that the present allocation provides. The remaining responses therefore concern the information, institutions and procedures through which the allocation operates.

6.2 Information, Data Exchange and Institutional Cooperation

The information and institutional responses associated with Articles VI to VIII (Sections 4.3 and 4.4) are closely related. Stronger data exchange gives the Permanent Indus Commission substance to work with, and a more consistent Commission gives that data an institutional home. Both parts of this are reflected in the changes observed in the existing treaties – as outlined by Cooley and Gleick (2011), better information sharing and shared institutional arrangements are some of the most feasible adaptations that can be made to the existing treaties, and the United Nations Economic Commission for Europe's practical guide to transboundary water agreements points in the same direction (UNECE, 2021). For the IWT, this means taking a combined approach of information and institutional measures, not one without the other, as they are mutually reinforcing. In practice, this means using Article VI's provision for additional data to establish routine exchange of glacier, snowpack, precipitation and flood-forecast information, particularly during the monsoon; using Article VII and the Commission's mandate to convene joint technical working groups on climate-risk assessment and basin modelling; and keeping a protected channel for emergency flood communication whatever the state of political relations.

6.3 Project-Level and Basin Governance

Hydropower and storage under Annexures D and E raise a different problem: individual projects may satisfy the treaty's technical requirements without account being taken of their cumulative effect on the basin. Updated hydrological assessment and early technical consultation through the PIC, supported by Article VI data exchange, are therefore the most practical response. Project governance is best seen as a strand of the information and institutional category rather than a separate line of reform, but project-by-project assessment should be supplemented by attention to cumulative basin-wide effects.

6.4 Dispute Resolution and Legal Adaptation

The analysis of Articles IX and XII and Annexures F and G (Sections 4.5 and 4.6) points toward a graduated approach rather than a single remedy. Technical consultation through the Permanent Indus Commission should settle most emerging disagreements before a formal amendment under Article XII is considered; only if this stage genuinely fails should formal amendment be considered. Cooley and Gleick's (2011) survey of other transboundary

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agreements shows a similar logic: review and amendment processes that do not require full renegotiation, with formal amendment an option but not an automatic reaction to every new pressure.

6.5 India and Pakistan's Differentiated Priorities

The information and project-governance categories are likely to be of greatest importance to Pakistan, given that it is most sensitive to variations in water availability due to its downstream location. India's interest is more likely to lie in demonstrating that greater flexibility in project design does not violate the treaty. These different emphases do not need to be harmonised to a single shared vision of the Treaty's future if it is to work, as both states have an interest in having a predictable information environment rather than having an uncertain one: Pakistan because uncertainty has a direct impact on water security; and India because an uncertain information environment would be the very thing the Treaty was designed to avoid.

6.6 Maintaining Treaty Functioning Amid Political Tension

Finally, technical and institutional mechanisms should be insulated as far as possible from the wider political relationship. Hydrological conditions will continue to change when bilateral relations deteriorate, as the 2025 abeyance showed (Niazi & Sheikh, 2025). Technical cooperation will not resolve the broader rivalry or the mistrust between the two states, but keeping data-exchange, consultation and emergency-communication channels open can prevent technical and legal questions from becoming entangled with the security confrontation. The partial post-ceasefire re-engagement described in Section 5.4 suggests that such channels can be reopened, but only if the parties choose to use them.

7. Conclusion

This article examined how climate change, institutional capacity and political tension together affect the effectiveness of the Indus Waters Treaty. It argued that climate change acts as a threat multiplier rather than an independent cause of conflict: glacier retreat, shifting monsoon patterns and extreme events increase the importance of institutional weaknesses that were already present, particularly under conditions of mistrust between India and Pakistan.

Three findings stand out. First, the allocation framework in Articles II and III remains legally clear and is not itself the source of the difficulty; the problem is an adaptation gap, because the treaty has no mechanism for recalibrating its operation to changing hydrological baselines. Second, the information, institutional and dispute-settlement provisions (Articles VI, VIII and IX) are valuable but were designed for treaty administration and project-level disputes rather than for climate adaptation. Third, the 2025 crisis showed that the treaty is more resilient in maintaining its institutional existence than in adapting its technical and environmental framework: it experienced strain without collapse, and re-engagement afterwards has been partial (Niazi & Sheikh, 2025; Farid & Ashraf, 2025).

The way forward lies in preserving the treaty's legal core while strengthening its adaptive capacity: improved climate-related data exchange, stronger flood and drought preparedness, expanded technical cooperation through the Permanent Indus Commission, attention to the cumulative effects of projects, and a graduated approach to legal adaptation in which formal amendment is a last resort rather than a first response. Because the two states' priorities differ, with Pakistan most concerned with information and India with project flexibility, their shared interest in a predictable information environment offers the most realistic basis for cooperation.

The study is qualitative and document-based, relies on secondary sources rather than interviews with treaty officials, and examines a single treaty, so its findings are not intended to be generalized to all transboundary basins. Future research could test the treaty-resilience

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dimensions through interviews with current and former Commissioners, compare the Indus with other basins, and track how the treaty evolves as the post-2025 situation develops.

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