

Revisiting the IWT for technical gaps and climate change vulnerability: a policy perspective from Pakistan

Saira Hafeez*¹ | Syed Waqas Ali Kausar²

1. Riphah Institute of Public Policy, Riphah International University, Islamabad, Pakistan.

2. Department of Public Policy, National University of Modern Languages, Islamabad, Pakistan.

*Corresponding Author Email: hafeezsaira907@gmail.com

Received: 28-Sep-2022 | Revised: 10-Dec-2022 | Accepted: 15-Dec-2022 | Published: 30-Dec-2022

Abstract:

The history of India-Pakistan relations has been brimming with squabbles and conflicts since their separation in 1947. Except for the significant and lasting Indus Waters Treaty (IWT) of 1960 for sharing river waters, little-to-none economic cooperation has taken place between the two riparian states. This paper analyses some noticeable gaps that have rendered this treaty obsolete such as the escalating influence of climatic changes on water resources of the region and some other shortcomings, namely the possible limits of shared water usage, unrestricted use of shared waters for power generation, rerouting of water, and the lack of synergistic projects. Moreover, due to the exponential increase in water and energy demand along with the aggravating depletion of water tables in Pakistan, the treaty is failing to secure the combined water resources of the Indus river basin. This study presents the policy perspective to guide future endeavours, ensuring the treaty's survival as it needs the necessary adjustments to enhance the socio-economic cooperation between India and Pakistan, put in place the collective efforts for mitigation of risks posed by climate-induced disasters, and improve the management of water resources for collaborative development.

Keywords: Indus Waters Treaty, Indus River basin, Pak-India rivers, climate change, river basin, water resources, water conflicts, water policies, riparian states.

How to Cite: Hafeez, S. & Kausar, S. W. A. (2022). Revisiting the IWT for technical gaps and climate change vulnerability: a policy perspective from Pakistan. *Journal of Humanities, Social and Management Sciences (JHSMS)*, 3(2), 88-103. <https://doi.org/10.47264/idea.jhsms/3.2.6>

Publisher's Note: IDEA Publishers (IDEA Journals Group) stands neutral with regard to jurisdictional claims in the published maps and institutional affiliations.

Copyright: © 2022 The Author(s), published by IDEA Publishers (IDEA Journals Group).

Licensing: This is an Open Access article published under the Creative Commons Attribution-NonCommercial 4.0 International License (<http://creativecommons.org/licenses/by-nc/4.0/>)



1. Introduction

Since the partition of British India back in 1947, there have been numerous political conflicts, trade embargos, and military standoffs between India and Pakistan. The major factors behind these hostile relations and conflicts include cross-border terrorism and the ongoing dispute over the highly sought-after Kashmir region given that three wars between India and Pakistan have been fought due to the Kashmir issue (Ganguly, 1987). The geographical significance of the Kashmir region cannot be ignored as the Indus river flows through it before entering Pakistan. The lines of control in Kashmir were drawn during the partition in 1947, splitting the Indus basin between the two countries. This resulted in India gaining control of the part of Kashmir with upstream waters along with the power to regulate the downstream water flow of the Indus river basin (Gardner, 2019). The Indus flood plain, rated by NASA as one of the over-stressed aquifers in the world, sustains a large agricultural population of Pakistan whose livelihood and survival depend on these waters (Buis & Wilson, 2015). With the rapidly growing population in Pakistan, water demand is projected to increase while the supply is projected to decrease due to groundwater depletion and over-extraction of natural resources. In addition to the population issue, the long-term water security of Pakistan is mainly threatened by the country's intensifying vulnerability to climate change (Amir & Habib, 2015).

In 1960, the *Indus Waters Treaty* (IWT) was signed between India and Pakistan to act as a medium for cooperation and dispute settlement regarding the Indus water usage between the two countries. For many decades, the treaty has been used to govern shared river waters of the Indus basin as well as to resolve frequent pressing conflicts over water between India and Pakistan. India has control over the upstream waters of the Indus basin and IWT has been providing basic protection to downstream Pakistan through its allocated rivers. Nevertheless, the treaty is now outdated and there are some prominent gaps in the treaty including groundwater extraction in transboundary regions, collaborative development, and the impact of environmental crises such as climate change on water availability (Jayaram, 2016). However, it is quite challenging to bring India and Pakistan together for revisiting the treaty in the context of contemporary water security issues as the inherent mistrust between these countries creates a fertile ground for hostility where the construction of more and more dams in upstream areas by India and the resulting fear of shortage of water in Pakistan is a major point of conflict (Ahmad, 2012). Many Indian dam projects in Chenab and Kishanganga rivers have been opposed by Pakistan with a claim that they violate the IWT. Although there is no exit clause in this treaty, it might not survive the next few decades (Katchinoff, 2010).

Diplomatic tensions between these countries are further aggravated due to frictional political narratives often used by political leaders and nationalist media to increase their public popularity. Indian political parties have used terrorism and the blame game around bomb attacks in its cities as a justification for violating the treaty from time to time and threatening Pakistan on economic grounds (Roy, 2019). On the other hand, Pakistan's government entirely blames India for flooding and water scarcity while water management within its own boundaries needs significant improvement. In addition to the non-stop conflict with India, the exclusive dependence on the Indus water basin has put Pakistan at a high risk among the water-stressed countries in the world, yet Pakistan spends much more on defence and nuclear warheads than on improving its water management infrastructure (Mustafa et al., 2017). However, in the face of worsening climate vulnerability, both India and Pakistan need to put aside their differences and work together to mitigate risks posed by deteriorating water

resources of the region. This paper examines the gaps in Indus Waters Treaty in the context of technicalities and climate change vulnerability of the region in order to suggest the revision of the Indus Waters Treaty. Moreover, it puts forward effective policy measures to mitigate the depletion of shared rivers of the Indus basin and uplift regional cooperation amid the ongoing water crisis.

2. Literature review

River Indus rises in western Tibet, an autonomous region of China, and flows northwest through the disputed region of Kashmir, bending sharply southwest to enter Pakistan from where it finally drains into the Arabian Sea. It is joined by many tributaries, notably Jhelum, Chenab, Ravi, Sutlej, and Beas, on its way to the Arabian Sea. This whole geographical situation was one of the major factors behind years of conflict between India and Pakistan as India had control over the whole Indus system and with it the power to withhold waters from the channels that flowed into Pakistan (Kugelman, 2016). To resolve this issue, the World Bank, under President Eugene Black, gathered a team of engineers from both the countries and the World Bank itself to assess the Indus system situation. In 1954, the World Bank proposed a treaty to distribute the Indus river basin between India and Pakistan to reduce the geopolitical conflicts and the resulting water scarcity in the two nations. Under the treaty, Pakistan was to get unrestricted access to the western tributaries of the Indus system, namely Indus, Jhelum, and Chenab; and India to the eastern tributaries, namely Ravi, Sutlej, and Beas. But the treaty was a huge compromise for India as it was being asked to give up its control of half of the Indus tributaries while gaining nothing other than peace with Pakistan (to a certain extent). Hence, it was later proposed that the treaty would allow India to use unlimited water from western tributaries for non-consumptive usage such as power generation, floating of property, and fish culture. After years of intense negotiations, the treaty was finally signed by the President of Pakistan—Ayyub Khan — and the Prime Minister of India —Jawaharlal Nehru, known as the *Indus Waters Treaty* (IWT) of 1960 (Kokab & Nawaz, 2013; World Bank, 1960).

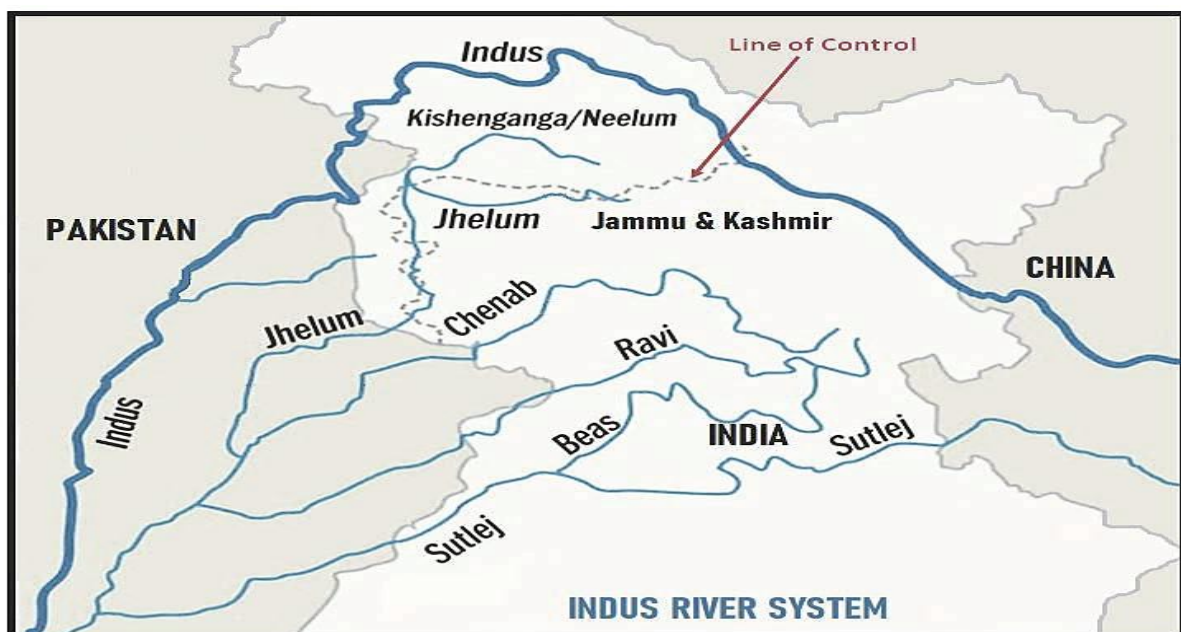


Figure 1: Map of the Indus river basin (Karki et al., 2011)

Indus Waters Treaty is considered quite a successful treaty as it played an important role in peacefully resolving various contentions over water between India and Pakistan. However, there are some significant gaps in the treaty that mainly affect the water supply of Pakistan. One of these major limitations is that the treaty lacks some specific instructions and restrictions on Indian water usage from Pakistan's allocated tributaries. Under the treaty, the allocation and management of water resources do not reside on equitable distribution or operating regulations, but on the locality of river Indus's tributaries. The main thing that paved the way to this gap was the difficulty in making India agree to the treaty as India already had all the benefits due to the geographical boundaries of Indian and Pakistani territories, combined with the geography of the Indus system itself. Moreover, the treaty lacks details on some important aspects, especially on the rerouting of water. The treaty did not specify if rerouting of water from western rivers is forbidden as it can have serious repercussions on Pakistan's water supply being a low riparian state. The only limits the treaty specified in this regard were on certain design features of the artificial reservoirs and the irrigation water usage (Gupta & Ebrahim, 2017; Miner et al., 2009).

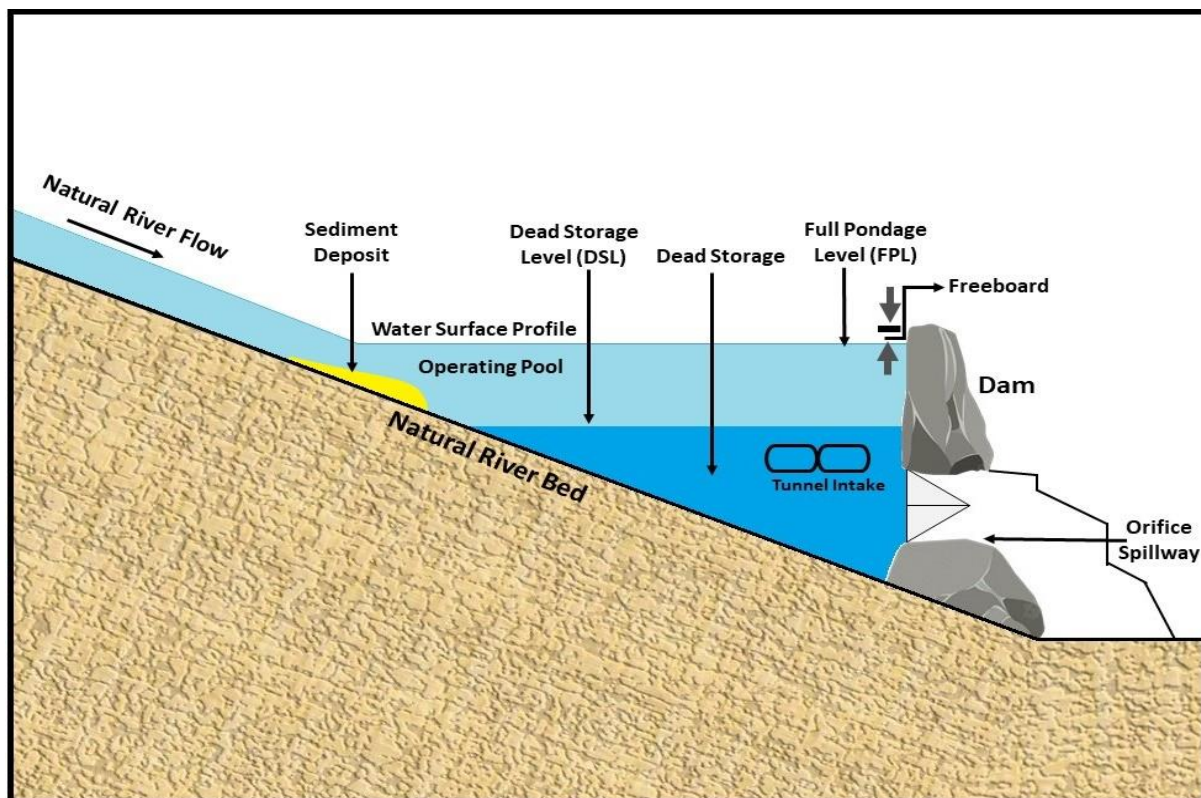


Figure 2: Schematic view of a dam with low-level outlets (Naqvi, 2014; United Nations, 2018)

River Chenab is responsible for providing water for 21 canals and irrigating approximately seven million acres of agricultural land in Pakistan. India has already built 14 hydroelectric plants on Chenab (Jamal, 2017). Near the end of the 20th century, India started building one of the main Indian hydroelectric projects on the western rivers: the Baglihar dam. India started the initial construction of the Baglihar dam in 1999. Pakistan objected to this project, claiming that its design violates the six criteria prescribed in Annexure D of IWT. The essence of the objection was the usage of low-level outlets in the Baglihar dam as the low-level outlets allow the complete drainage of water from a reservoir and their main goal is to flush out sedimentation from the reservoir. The issue was that these low-level outlets would also allow

India to control the flow of Chenab water to Pakistan. Therefore, the design of the Baglihar dam jeopardized Pakistan's water security. This issue would become more pressing due to Pakistan's vulnerability to climatic shifts with heavy rains in monsoons and no glacier melt in extreme winters. According to experts, the Baglihar project could deprive Pakistan of nearly 321 thousand acre-feet of water during the winter months which would jeopardize agriculture and food security in the country. The IWT restricted the use of low-level outlets in dams but specifically for flow control. Therefore, the neutral expert assigned to solve this dispute in the light of IWT ruled in favour of India. He supported India's claim that low-level outlets are a necessity for modern reservoirs to remove silt (Khattak, 2008).

In addition to these dams on Chenab, India also constructed the Kishenganga dam on a tributary of river Jhelum as IWT does not specify restrictions on rerouting water of western tributaries by India. The Kishenganga plant would operate by using a 21-km long tunnel (KHEP) to divert the Kishanganga/Neelum river water to a power station before discharging it into Wular lake and then, finally, the water would be allowed to enter river Jhelum. Pakistan objected to this project as experts said that this diversion will reduce the flow of the Kishanganga/Neelum river by 21%, decrease the power potential of the Neelum-Jhelum Hydroelectric Plant (NJHEP) by 10%, and will adversely affect about 133,000 hectares of agricultural land in Pakistan-administered Kashmir (Jamal, 2017). However, the Court of Arbitration ruled in favour of India, asserting that the diversion does not violate IWT since the water is diverted back to the river Jhelum in Pakistan (Haq & Bhutta, 2013; United Nations, 2013). These voids in the treaty leaving out unrestricted usage and rerouting of shared rivers' water are vivid examples of the outdated nature of this treaty.

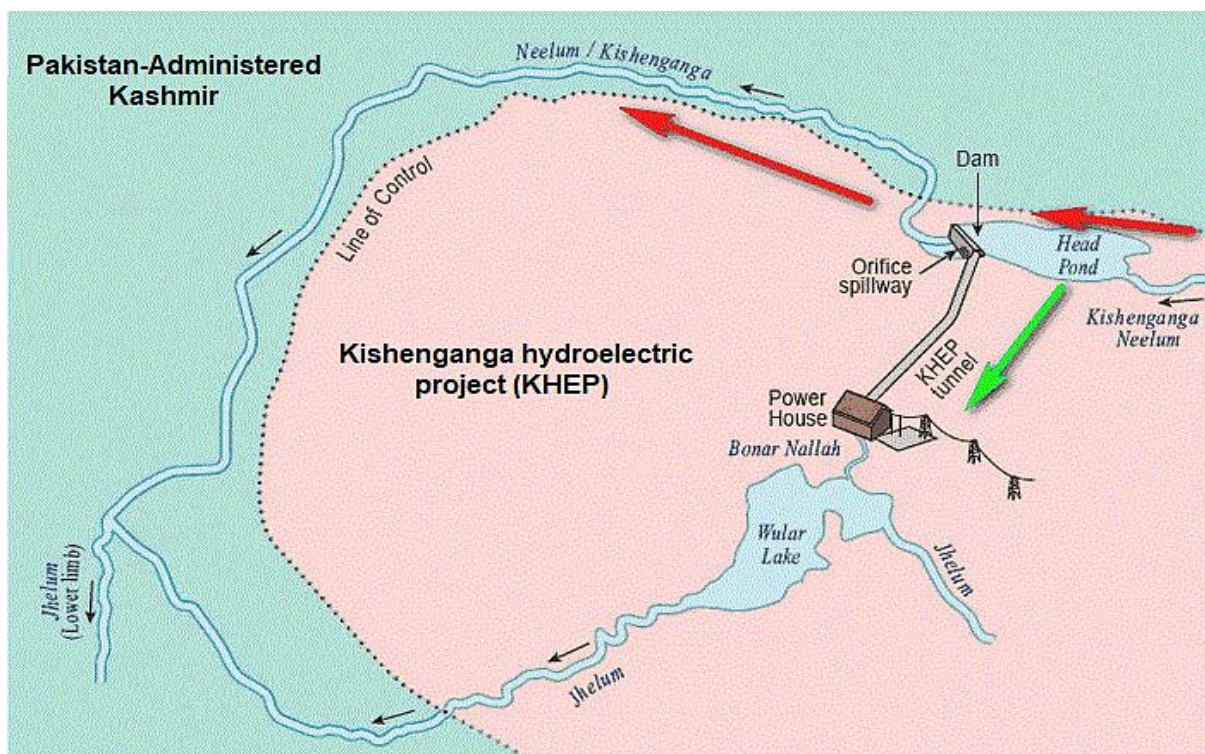


Figure 3: Jhelum river flow in the context of Kishanganga dam construction (United Nations, 2018)

Climate change is a global phenomenon posing challenges to the economic security of nations worldwide, to some more than others. Pakistan and India are among the top ten countries in the

world that are most vulnerable to climate change (Eckstein et al., 2021), however, the IWT is more than sixty years old and it does not factor in the implications of environmental crises such as climate change and global warming on the region's water security. The climatic changes are measured by tracking incessant escalation in the earth's temperature and spatiotemporal changes in patterns of precipitation. These changes have serious implications for both flood-prone and water-scarce regions as they exacerbate the flood risk in monsoon and drought risk in dry seasons to alarming levels. In addition, being a downstream state, Pakistan has the disadvantage of receiving water with diminished quality and quantity regardless of water quality provisions for development infrastructure discussed in Articles four and eight (Miner et al., 2009; Nax, 2016).

3. Theoretical framework

The framework of this research revolves around the critical analysis of certain gaps in the Indus Water Treaty that are threatening the survival of this settlement. The Indus Water Treaty has been governing shared river waters of the Indus basin and providing the foundation to resolve frequent climacteric conflicts between the two archenemies: India and Pakistan. However, this treaty is over 62 years old now and it needs certain revisions to hold its ground amid changing climate risk vulnerability of the region. Therefore, the framework of this study takes into account the implications of climate-driven threats to water resources of the Indus basin. Due to changing climatic patterns, water availability in India and Pakistan has been declining and groundwater extractions have reached a new high. On this account, the framework of research is set up around the assessment of possibilities for the inclusion of groundwater allocation in the Indus plain, in addition to the shared river waters. Moreover, it also looks into the possibilities of finding a middle ground in the disagreement over India's construction of power generation projects on the shared rivers, using low-outlet dams and rerouting the rivers, via synergetic projects to deal with the ongoing water crisis in the region.

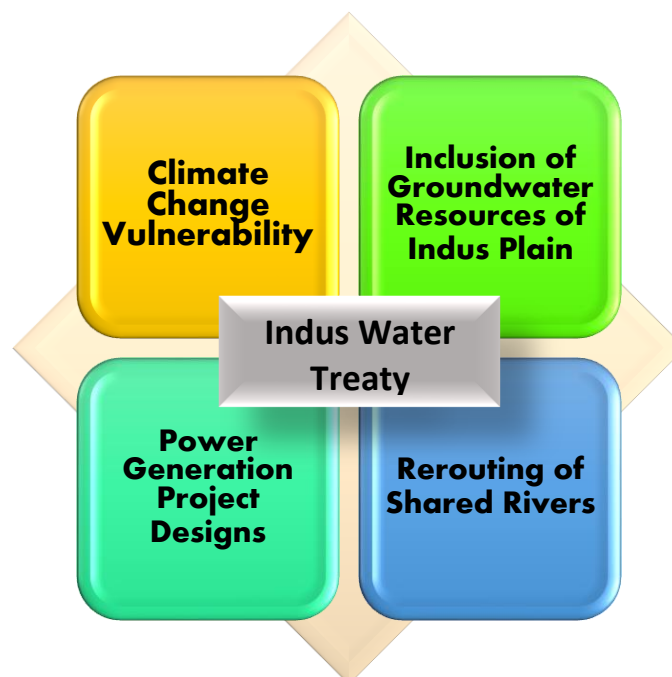


Figure 4: Theoretical Framework of Research

4. Research methodology

This research is primarily based on the critical review of the literature available on the subject under study. The data was collected from secondary sources due to the nature of the study and these sources included the document of the Indus Water Treaty, reports from the World Bank Group (WBG), the International Court of Justice (ICJ), and Global Conflict Tracker. The information on climate change was collected from the publications of the Pakistan Meteorological Department (PMD). In addition, the perspective of previous studies and different water experts in Pakistan was also taken into account for the critical analysis of the matter at hand.

The analysis of this study explored the implications of rerouting river waters for Pakistan due to power generation projects in India, the possible limits of groundwater usage in the Indus basin, climate-induced factors that have threatened the water availability and demand in the region, and the lack of synergistic projects in order to put forward effective policy measures to mitigate the depletion of the Indus basin water resources and uplift regional cooperation amid the ongoing water crisis.

5. Findings and discussion

The Indus Water Treaty in its current form lacks the mechanism to ensure the security of Indus water resources for the people of India and Pakistan. If the treaty is to survive, it needs the necessary adjustments now more than ever because water and energy demands are projected to increase exponentially. Moreover, the changing seasonal patterns and escalating global temperatures have rendered both India and Pakistan struggling to survive on reduced water supply from the Indus system. In order to reach the terms that can mitigate water crises in both nations, a fair deal of cooperation is a prerequisite. While critically evaluating the treaty, M.T. Klare, an expert on global conflicts over water, highlighted that the treaty focuses only on the separate development of the Indus basin and does not discuss the possibilities of eliminating conflicts by joint development projects (Qamar et al., 2019). However, the continuous hostile relations between these two countries have always stood in the way of cooperation and collaborative development.

5.1. Use of water as a strategic tool

The Indus basin accounts for over 95.8% of the total freshwater resources of Pakistan, making it depend almost entirely on Indus and its tributaries for irrigation water. Agriculture is the backbone of Pakistan's economy; the farming and animal husbandry sustained by the Indus river and its tributaries provides over 90% of food and about 65% of employment in the country (Pohl & Schmeier, 2014). Unfortunately, the animosity has stimulated India and Pakistan both to use every power and resource they possess as strategic leverage against one another. A vivid example of this claim is India's use of its upper riparian position and power to control flow to Pakistan in events of any political or armed conflict. For instance, after the Kargil conflict in 1999, the relations between the two countries remained hostile. India decided to cut off excess supply from eastern tributaries, inflicting enormous damage to Pakistan's economy. As shown in Figure 5, the inflow from eastern rivers to Pakistan remained extremely low for almost five years after the Kargil conflict (Young et al., 2019).

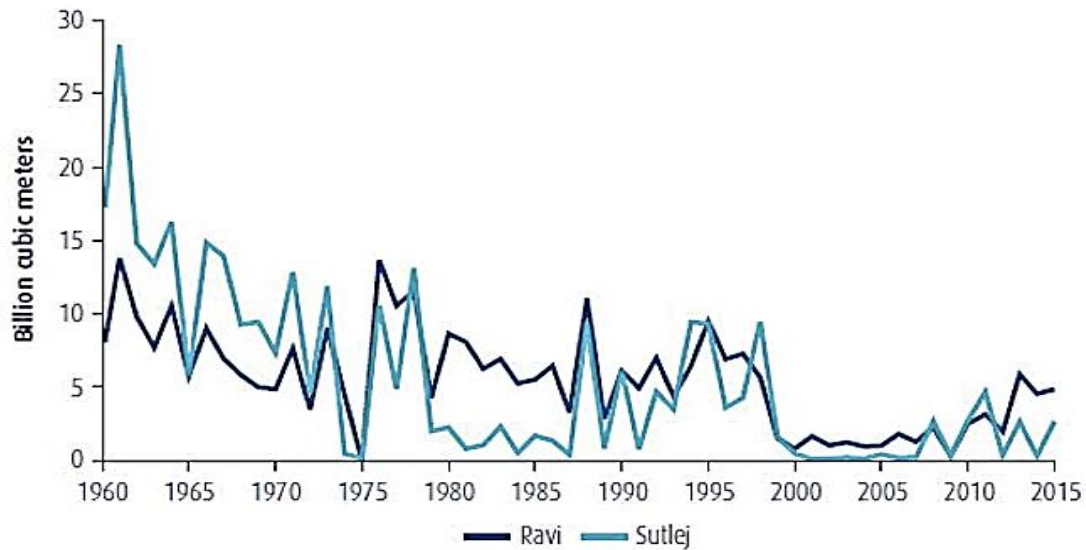


Figure 5: Yearly water inflow from Ravi and Sutlej to Pakistan (Young et al., 2019)

In addition to direct military stand-offs and political conflicts, India has also been using Pakistan-affiliated terrorism in the past as an excuse to justify backing away from diplomacy and cutting off water flow to Pakistan (Roy, 2019). For example, following the Uri attacks of 2016 in India, Narendra Modi—the Prime Minister of India—stated, “Blood and water cannot flow together,” using water control as a tool to intimidate Pakistan (Express Web Desk, 2016). Furthermore, the Baglihar dam was approved so that India could properly maintain the reservoir by removing sedimentation. However, India used the low-level outlets of the dam to reduce the flow of the Chenab river when relations between the two countries became strained in 2008. Indian government and military believed that Pakistan’s intelligence agency ISI was involved in the 2008 Mumbai attacks led by a Pakistan-based terrorist group Lashkar-e-Taiba (Ridel, 2012). As a result, there was a risk of another war between the countries. India had already filled the Baglihar dam a month prior to the attacks and it decided to block Pakistan’s water supply from the Chenab river. This incident cost Pakistan 23,000 cusecs of water; farmers were not able to irrigate the fields which led to 3.5 million agricultural tracts left barren. In addition, India has decided to divert water from eastern tributaries and stop the supply to Pakistan using projects such as the Shahpur-Kandi dam on river Ravi (Jamal, 2017). The IWT does not prevent the use of water as a strategic tool in the conflicts between the two states, compromising the food and water security of a huge portion of the population depending on Indus water tributaries, especially when the escalating climate vulnerability has already been affecting the crop productivity and economic gains of the farming communities. Hence, some serious and urgent measures are needed to address this void in the Indus Water Treaty for the collaborative water security of India and Pakistan.

5.2. Climate change and water availability of Pakistan

Climate change vulnerability has aggravated the situation of water security in the Indus basin and the water resources of Pakistan, being at downstream end of Indus River System, have been facing a more severe hit of these changing weather patterns. For instance, the dangerously overexploited groundwater reservoirs of Pakistan currently stand at a recharge rate of 61 billion cubic meters against the extraction rate of 65 billion cubic meters, tearing down the resilience against unpredictably changing riparian water supply and weather patterns, further intensifying

the water crisis in Pakistan (Lytton et al., 2021). The country’s per capita water availability has also been decreasing over the past few decades from more than 5000 cubic meters in 1951 to around 1000 cubic meters in 2021, mainly due to overexploitation and exponential population growth. The current projections indicate a further 53% increase in population by mid-century, putting Pakistan at a high risk of facing absolute water scarcity by 2040 (Ali, 2021; Amir & Habib, 2015).

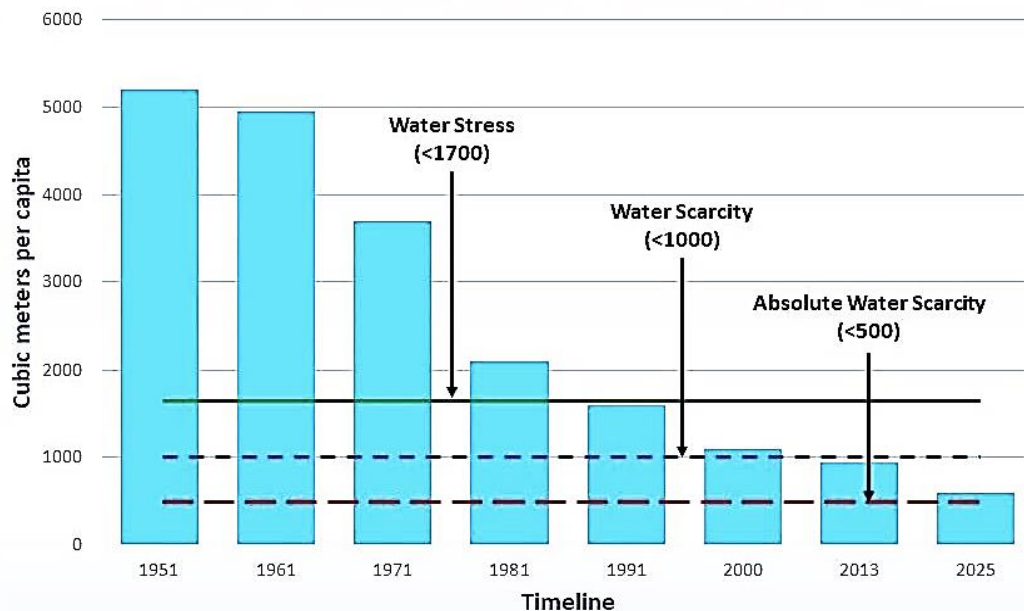


Figure 6: The water availability of Pakistan over the past decades (Jaffari et al., 2020)

5.2.1. Precipitation shifts

Pakistan’s average yearly temperature has increased by 0.5°C during the last half century, subsequently causing abrupt shifts in rainfall rates and threatening water security as well as the well-being of the aquatic ecosystem (Chaudhry, 2017). These drastic changes in precipitation have added to the chaos of water crises over the last two decades and Pakistan has suffered a lot more in comparison to India due to Pakistan’s sole dependency on Indus Basin Irrigation System, whereas India depends on multiple river systems. The variations in temperature and rainfall due to changing climate trends exhibit weaker and warmer monsoons over the northern monsoon belt of Pakistan directly affecting Indus Basin water levels. A noticeable decline in monsoon rainfall was recorded from 2010 to 2017 with typically heavy rainfalls in 2010 and an overall drier monsoon season in the past few years. However, the rainfall in monsoon 2022 has been recorded as more than 160% above the long-run average of 140.9 millimeters, bringing about massive flash floods in Sindh, Balochistan, and southern areas of Punjab (Pakistan Monsoon, 2022). High variability in monsoon rainfall makes it difficult to plan crop sowing and harvesting. Moreover, it further increases Pakistan’s reliance on Indus water for irrigation. India, on the other hand, is free to take water from western tributaries (under certain conditions) and use as much water as they want from the eastern tributaries even in a time of extremely low rainfall and resulting water scarcity. Moreover, floods are a highly disastrous natural hazard in Pakistan as of all the population prone to natural disasters, about 90% is subjected to floods. The apocalyptic monsoon floods of 2010 and 2022, for instance, wreaked havoc on Pakistan; killing thousands of people and leaving even more homeless, inundating

crop areas, destroying infrastructure, and putting a huge dent in Pakistan's economy (Memon, 2013; Omu & Teoh, 2022). Hence, climate change seems to increase the inequality in the Indus water rights of India and Pakistan according to the premises of IWT (Safdar et al., 2019).

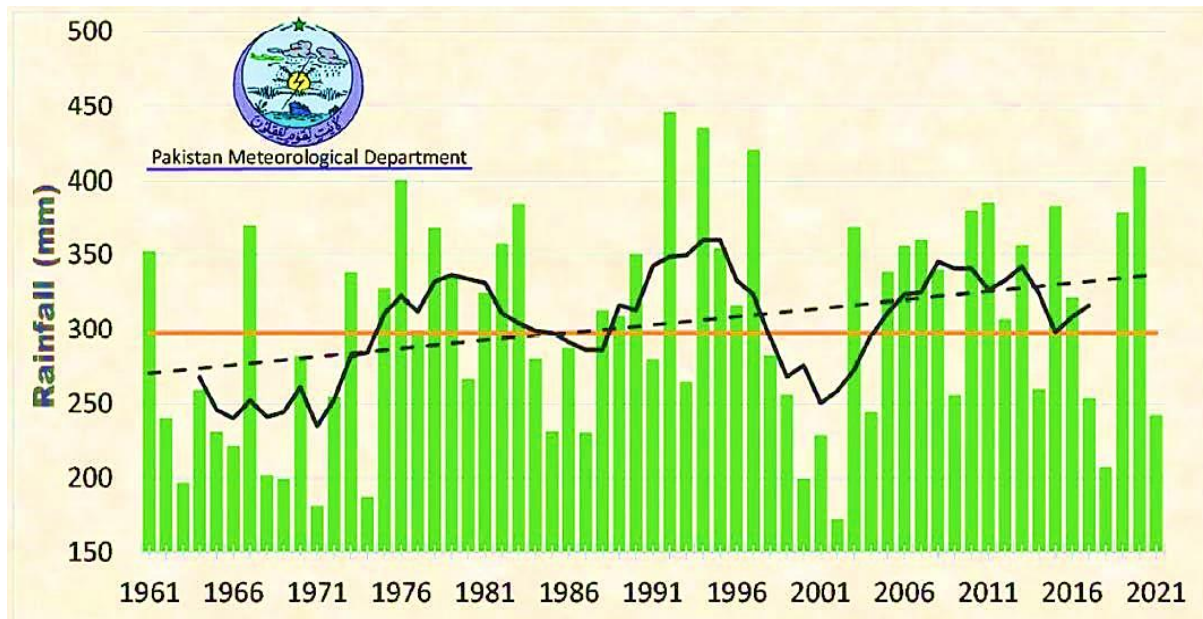


Figure 7: Annual rainfall records of Pakistan (Pakistan Meteorological Department, 2021)

5.2.2. Glacial recession

Glaciers cover about 13700 km² of Pakistan's area which makes up approximately 13% of the upper Indus basin mountains (Butt & Iqbal, 2009). Indus river system, the principal water source of Pakistan, depends mainly on precipitation water, snowmelt runoff, and glaciers; approximately 50-70% of the average water flows of this basin come from glacial and snowmelt water, making it highly sensitive to impending climate change (Young et al., 2019). Although the melting of glaciers can help manage drought conditions in the short run, the long-run shrinkage of these glaciers is threatening the water availability of the Indus river basin amid anthropogenic global warming (Soofi & Aziz, 2017). Pakistan's glaciers are depleting at alarming rates, particularly glaciers of the Hindu Kush-Himalayan region are showing signs of rapid shrinkage, melting faster than any other part of the world. These melting glaciers not only jeopardize the country's water security but also increase the risk of floods which, in addition to causing deaths and spreading diseases, account for the mass destruction of crops and infrastructure. These devastating impacts of climate change and global warming are not felt equally between India and Pakistan. Being a downstream country, Pakistan suffers much worse consequences from the melting glaciers in terms of heavy floods (Hameed, 2016). However, the Indus Water Treaty does not address this issue which bolsters the case for revisiting the treaty.

5.3. Poor agricultural practices and water governance in Pakistan

Pakistani government leaders also need to take responsibility for the water crisis but they tend to put all the blame on India while the reality is that Pakistan's poor agricultural practices and water management system play a significant role in aggravating water insecurity (Sattar &

Bhargava, 2019). For example, Pakistan’s government not only allows but encourages the growth of highly water-thirsty crops such as sugarcane. One kilogram of sugarcane takes roughly 1500-3000 liters of water to produce. Yet, it does not contribute to the food security of Pakistan. Neither does it contribute significantly to exports (Haq & Bhutta, 2013). Over 80% of water resources are employed in the production of four major crops i.e., rice, cotton, wheat, and sugarcane, which add only 5% to the country’s GDP. Apart from growing water-intensive crops, the crumbling water infrastructure with an overall efficiency of only 39%, adds to the wastage of already underpriced canal water during the delivery to farms. As illustrated in Figure 8 below, irresponsible water wastage and poor irrigation networks are among the leading causes of the water crisis in Pakistan (Abubakar, 2018; Daud et al., 2017).

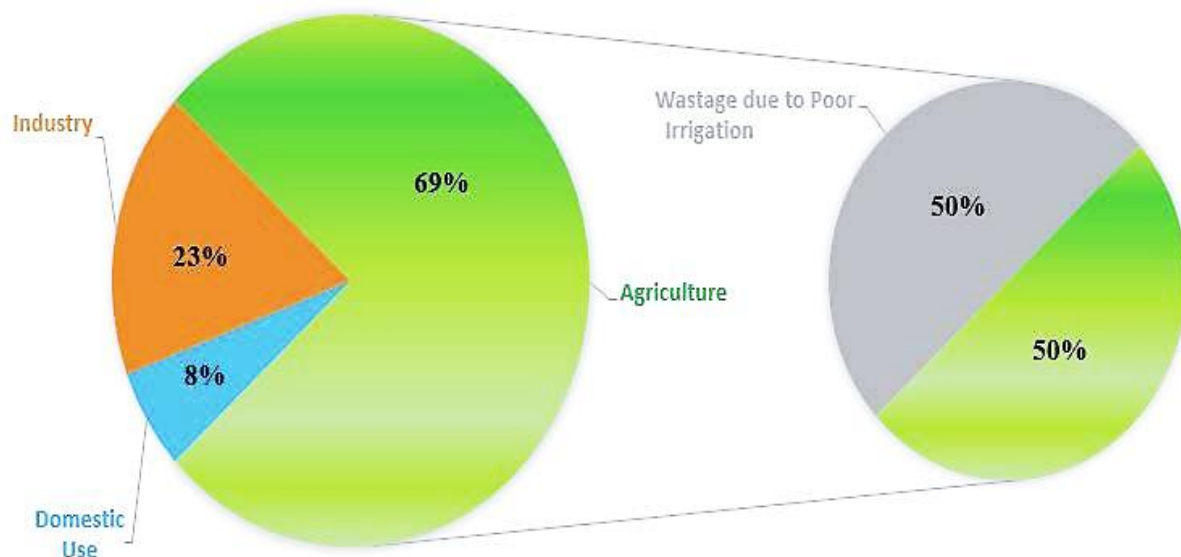


Figure 8: Pakistan’s water consumption and irresponsible wastage of water due to poor irrigation (Khosro et al., 2015)

In addition to poor irrigation and inefficient water consumption, Pakistan does not allocate an adequate budget for wastewater treatment, desalination, and maintenance of artificial reservoirs. For instance, Dawn reported in 2017 that three of the four desalination plants in the port city of Gwadar were lying idle for more than seven years, while the working one could not operate at maximum capacity due to a lack of infrastructural resources. Numerous people in Baluchistan—a highly water-scarce province in Pakistan—rely on expensive water from tankers which is not even safe for drinking (Baloch, 2017). Moreover, the total dam capacity of Pakistan is 27.81 km³ which is already far lesser than the country’s needs and due to the lack of maintenance of the reservoirs, this storage capacity cannot even be utilized to its full potential (Tariq & Giesen, 2012). Despite growing water insecurity, Pakistan does not spend much on improving water management. Instead, it allocates a huge amount of budget for the defense to prepare for the “potential wars”. Even during the 2000s when water inflow was record-low, Pakistan chose to spend most of its money on nuclear warheads instead of dealing with the water crises.

5.4. Policy perspective for future endeavours

In order to combat the water crisis in India and Pakistan, three key areas must be administered: cooperation between India and Pakistan, risk management as well as mitigation, and water

resource management. Both countries need to work hard for improving diplomatic relations as cooperation is the ultimate solution to the Indus basin conflicts. The inclusion of collaborative development projects in IWT can encourage more efforts such as the “Water Conflict in South Asia” project by the South Asia Center to be made at interstate levels so that both governments join hands to discuss and implement solutions to water scarcity. Moreover, there is a need to build mutual trust between both countries through correct interpretation and possible revision of the Indus Waters Treaty, diplomatic efforts for water security, and the development of a system that promotes honest sharing of inflow data and joint monitoring of the impact of climate change.

A lot of conflicts between the two governments arise due to the inadequacy of policy frameworks and implementation measures. The revision of IWT for synergetic progress and formulation of legal policies to improve water allocation between and within countries has the potential to address the intense water scarcity issues. Moreover, political and policy reforms are needed to develop systems that promote transparency between governments and enhance trust between agricultural stakeholders and official service providers. The proposal of encouraging joint development projects on the Indus basin using IWT and minimizing water wastage through shared efforts can pave the way for collaborative advancement to promote the conservation of Indus water reservoirs.

While the conflict between India and Pakistan has phenomenal importance, the socio-ecological dimensions of water scarcity must not be overlooked, particularly when the political environment is unpredictable and climate change is becoming a more severe threat. The IWT needs revision to incorporate climate change-induced uncertainties and encourage cooperative sharing agreements between India and Pakistan in order to address their vulnerability to disasters induced by global warming and climate change. These projects can help both India and Pakistan adapt to variable climatic shifts and build a climate-resilient infrastructure for the conservation of water resources. Moreover, there is a need to include risk management and mitigation systems to provide safety against climate change, natural hazards, and political turmoil; aiming to build resilience against both water scarcity and flooding.

Furthermore, responsible consumption, proper management of water resources, and development of water recovery infrastructure are of utmost importance. The revision of IWT for collaborative research and development has the potential to help both countries reduce water wastage in agriculture by adopting smart irrigation practices and innovative technology. Other countries in the region also need to be engaged in the process as the issue of climate change has no respect for borders and its impacts can be seen on the whole region in the form of aggravating water scarcity.

6. Conclusion

The conflicts between India and Pakistan have been causing turmoil since the partition of the two nations in 1947. These conflicts, fueled by animosity, have always stood in the way of shared progress using the Indus water system. The disputed region of Kashmir, in particular, is the bone of contention between these two countries due to its demography, geostrategic location, and contribution to glacial water. The *Indus Waters Treaty* of 1960 was the only token of economic cooperation but with exponential growth in demands for water and energy combined with global warming and climate change, the outdated treaty is failing to deal with

the contemporary water security challenges of the Indus river basin. Moreover, there are several shortcomings on technical grounds, for instance, the treaty does not specify the limits to which the water from allocated tributaries or groundwater reservoirs can be used by each country, and it does not address the rerouting of rivers for building dams in the context of resulting impact on the water inflows of downstream regions. The treaty has successfully been resolving pressing water disputes between the two countries for six decades now, but the inherent mistrust between India and Pakistan keeps fuelling the hostility where India is building more and more dams in the upstream waters and Pakistan opposes this endeavour due to the fear of water shortage. Both countries often stay at the risk of war neither of them can afford and unfortunately, a precious resource like water is reduced to a strategic weapon in times of disagreement.

Amid the aggravating vulnerability to climate change, both India and Pakistan are struggling to survive on reduced water supply from the Indus basin and its tributaries. The unpredictable precipitation patterns and rapidly receding glaciers add to this dilemma as the risk of floods or droughts can jeopardize the economic security of both states, especially when the increasing temperatures are already affecting the agricultural yield. In addition to these struggles, the water and energy demands are exponentially increasing and water availability is constantly declining. Unfortunately, the decades-old IWT does not address these risks posed by climate change, therefore, there is an absolute necessity to revise the treaty for promoting cordial relations between India and Pakistan to survive the extreme climate events. Instead of halting each other's progress, both countries must reach a common ground to counter the ongoing water crisis, and using IWT as a corridor can pave the way for cooperation. Therefore, the IWT must be reviewed to encourage opening up venues for collaborative development projects on the Indus basin, improving the management infrastructure of shared waters, allocating collective funds for water conservative practices and technological advancement, and building risk management structures to combat the escalating threats posed by climate change. Both states need to set aside their differences in the face of crises, heeding the advice of Ryūnosuke Akutagawa that individually each of them is just one drop, together they can be an ocean.

Declaration of conflict of interest

The author(s) declared no potential conflicts of interest(s) with respect to the research, authorship, and/or publication of this article.

Funding

The author(s) received no financial support for the research, authorship and/or publication of this article.

ORCID iD

Saira Hafeez <https://orcid.org/0000-0002-3418-9193>

Syed Waqas Ali Kausar <https://orcid.org/0009-0001-5570-1627>

References

- Ahmad, S. (2012). Water insecurity: A threat for Pakistan and India. Atlantic Council. <https://www.atlanticcouncil.org/in-depth-research-reports/issue-brief/water-insecurity-a-threat-for-pakistan-and-india/>
- Ali, K. (2021, July 13). Per capita water availability in Pakistan has decreased by 400pc. Dawn News. <https://www.dawn.com/news/1634786>
- Amer Rizwan Khattak. (2008). World Bank Neutral Expert's Determination on Baglihar Dam: Implications for India-Pakistan Relations. *Pakistan Horizon*, 61(3), 89–108. <https://www.jstor.org/stable/23725987>
- Amir, P., & Habib, Z. (2015). Estimating the impacts of climate change on sectoral water demand in Pakistan. https://cyphynets.lums.edu.pk/images/Readings_concluding.pdf
- Baloch, B. (2017, January 23). Four desalination plants lying idle in Gwadar amid water shortage - Pakistan - DAWN.COM. Dawn. <https://www.dawn.com/news/1310204>
- Bruce Ridel. (2012, July 1). Mumbai Terror Attack Group Lashkar e Tayyiba Now More Dangerous Than Al Qaeda. Brookings. <https://www.brookings.edu/articles/mumbai-terror-attack-group-lashkar-e-tayyiba-now-more-dangerous-than-al-qaeda/>
- Buis, A., & Wilson, J. (2015). Study: A third of big groundwater basins in distress – Climate Change: Vital Signs of the Planet. NASA. <https://climate.nasa.gov/news/2297/study-a-third-of-big-groundwater-basins-in-distress/>
- Butt, M. J., & Iqbal, M. F. (2009). Impact of Climate Variability on Snow Cover: A Case Study of Northern Pakistan. *Pakistan Journal of Meteorology*, 5(10), 53–63. [http://www.climateinfo.pk/frontend/web/attachments/data-type/5. Impact of Climate Variability on Snow Cover.pdf](http://www.climateinfo.pk/frontend/web/attachments/data-type/5.Impact%20of%20Climate%20Variability%20on%20Snow%20Cover.pdf)
- Chaudhry, Q. U. Z. (2017). Climate Change Profile of Pakistan. Asian Development Bank. <https://dx.doi.org/10.22617/TCS178761>
- Daud, M. K., Nafees, M., Ali, S., Rizwan, M., Bajwa, R. A., Shakoor, M. B., Arshad, M. U., Chatha, S. A. S., Deeba, F., Murad, W., Malook, I., & Zhu, S. J. (2017). Drinking Water Quality Status and Contamination in Pakistan. *BioMed Research International*. <https://doi.org/10.1155/2017/7908183>
- Eckstein, D., Künzel, V., & Schäfer, L. (2021). Global Climate Risk Index 2021. <https://www.germanwatch.org/en/19777>
- Express Web Desk. (2016, September 27). Blood and water cannot flow together: PM Modi at Indus Water Treaty meeting. India News, The Indian Express. The Indian Express. <https://indianexpress.com/article/india/india-news-india/indus-water-treaty-blood-and-water-cant-flow-together-pm-modi-pakistan-uri-attack/>
- Ganguly, S. (1987). Wars without End: The Indo-Pakistan Conflict. *The Annals of the American Academy*, 9(2), 183–205. <http://hjb.sagepub.com.proxy.lib.umich.edu/content/9/2/183.full.pdf+html>
- Gardner, K. (2019). Moving Watersheds, Borderless Maps, And Imperial Geography in India's Northwestern Himalaya. *The Historical Journal*, 62(1), 149–170. <https://doi.org/10.1017/S0018246X18000146>
- Gupta, J., & Ebrahim, Z. (2017, January 6). Win some, lose some, Indus Waters Treaty continues. The Third Pole. <https://www.thethirdpole.net/en/regional-cooperation/win-some-lose-some-indus-waters-treaty-continues/>
- Hameed, A. (2016, July 17). Climate Change and Glacier Melting: A Case Study on Retreating Karakoram Glaciers, Pakistan. PAMIR TIMES. <https://pamirtimes.net/2016/07/17/climate-change-and-glacier-melting-a-case-study->
-

- [on-retreating-karakoram-glaciers-pakistan/](#)
Haq, S., & Bhutta, Z. (2013, December 22). Kishanganga project: Victory claims cloud final arbitration award. *The Express Tribune*. <https://tribune.com.pk/story/648986/kishanganga-project-victory-claims-cloud-final-arbitration-award>
- Jaffari, R., Baloch, N. M., & Tahir, Z. (2020). Water For All: Food-Energy-Water Nexus. In D. R. Aftab, K. Zaheer, & D. M. Yousufi (Eds.), 6th International Water Conference, 29-30th December (pp. 198–210). <https://pcrwr.gov.pk/6th-international-water-conference-29-30th-december-2020/>
- Jamal, H. (2017, May 6). Impact of Indian Dams in Kashmir on Pakistani Rivers | Water Distribution in Indus River Treaty. *About Civil Engineering*. <https://www.aboutcivil.org/impact-of-Indian-dams-in-Kashmir-on-Pakistani-rivers.html>
- Jayaram, D. (2016, August 2). Why India and Pakistan Need to Review the Indus Waters Treaty. *Climate Diplomacy*. <https://climate-diplomacy.org/magazine/cooperation/why-india-and-pakistan-need-review-indus-waters-treaty>
- Karki, M. B., Shrestha, A. B., & Winiger, M. (2011). Enhancing knowledge management and adaptation capacity for integrated management of water resources in the Indus River Basin. *Mountain Research and Development*, 31(3), 242–251. <https://doi.org/10.1659/MRD-JOURNAL-D-11-00017.1>
- Katchinoff, J. (2010). Parched and Hoarse, Indus Negotiations Continue to Simmer. *Wilson Center*. <https://www.newsecuritybeat.org/2010/04/parched-and-hoarse-indus-negotiations-continue-to-simmer/>
- Khoso, S., Wagan, F. H., Tunio, A. H., & Ansari, A. A. (2015). An overview on emerging water scarcity in pakistan, its causes, impacts and remedial measures. *Journal of Applied Engineering Science*, 13(1), 35–44. <https://doi.org/10.5937/JAES13-6445>
- Kokab, R. U., & Nawaz, A. (2013). Indus Water Treaty: Need for Review. *Academia*, 2(2), 210–218. https://www.academia.edu/download/31725521/article_with_adnan.pdf
- Kugelmann, M. (2016, September 30). Why the India-Pakistan War Over Water Is So Dangerous. *Foreign Policy*. <https://foreignpolicy.com/2016/09/30/why-the-india-pakistan-war-over-water-is-so-dangerous-indus-waters-treaty/>
- Lytton, L., Ali, A., Garthwaite, B., Punthakey, J.F., & Saeed, B. (2021). Groundwater in Pakistan's Indus Basin: Present and Future Prospects. <https://documents.worldbank.org/en/publication/documents-reports/documentdetail/501941611237298661/groundwater-in-pakistan-s-indus-basin-present-and-future-prospects>
- Memon, N. (2013). Malevolent Floods of Pakistan 2010-2012. Strengthening Participatory Organization (SPO). <https://spopk.org/wp-content/uploads/2019/11/malevolentfloodrepo.pdf>
- Miner, M., Patankar, G., Gamkhar, S., & Eaton, D. J. (2009). Water sharing between India and Pakistan: A critical evaluation of the Indus Water Treaty. *Water International*, 34(2), 204–216. <https://doi.org/10.1080/02508060902902193>
- Mustafa, D., Gioli, G., Karner, M., & Khan, I. (2017, April 5). Contested Waters: Subnational Scale Water Conflict in Pakistan. *United States Institute of Peace*. <https://www.usip.org/publications/2017/04/contested-waters-subnational-scale-water-conflict-pakistan>
- Naqvi, F. (2014, January 11). Dam-age Control. *Newsweek*.

- <https://www.newsweekpakistan.com/dam-age-control/>
- Nax, N. A. (2016). Looking to the Future: The Indus Waters Treaty and Climate Change. Conflict and Dispute Resolution Program and the Graduate School of the University of Oregon. Eugene, Oregon, United States. <https://transboundarywaters.science.oregonstate.edu/sites/transboundarywaters.science.oregonstate.edu/files/Publications/Nax - 2016 - Indus Treaty and Climate Change - Thesis.pdf>
- Omunu, F., & Teoh, J. (2022). PAKISTAN: 2022 Monsoon Floods (Issue No. 6). <https://reliefweb.int/report/pakistan/pakistan-2022-monsoon-floods-situation-report-no-6-16-september-2022>
- Pakistan Meteorological Department. (2021). State of Pakistan Climate in 2021. http://www.pmd.gov.pk/cdpc/Pakistan_Climate_2021.pdf
- Pakistan Monsoon 2022. (2022). <http://www.pmd.gov.pk/cdpc/home.htm>
- Pohl, B., & Schmeier, S. (2014, September 22). Hydro-Diplomacy Can Build Peace Over Shared Waters, But Needs More Support. Wilson Center. <https://www.newsecuritybeat.org/2014/09/hydro-diplomacy-builds-peace-shared-waters-support/>
- Qamar, M. U., Azmat, M., & Claps, P. (2019). Pitfalls in transboundary Indus Water Treaty: a perspective to prevent unattended threats to the global security. *Npj Clean Water*, 2(1). <https://doi.org/10.1038/s41545-019-0046-x>
- Roy, D. (2019, February 22). Can India Unilaterally Revoke Indus Waters Treaty With Pakistan? News 18 Explains. <https://www.news18.com/news/india/can-india-revoke-indus-water-treaty-unilaterally-news18-explainer-2045325.html>
- Safdar, F., Khokhar, M. F., Arshad, M., & Adil, I. H. (2019). Climate Change Indicators and Spatiotemporal Shift in Monsoon Patterns in Pakistan. *Advances in Meteorology*, 2019. <https://doi.org/10.1155/2019/8281201>
- Sattar, U., & Bhargava, A. (2019, March). Hydropolitics in the Indus Basin: The Indus Water Treaty & Water Mismanagement in Pakistan. *The Yale Review of International Studies*. <http://yris.yira.org/essays/3101>
- Soofi, A. B., & Aziz, J. (2017). Filling the Missing Gaps in the Indus Water Treaty. *RSIL Law Review*, 1(1), 3–24. https://heinonline.org/hol/cgi-bin/get_pdf.cgi?handle=hein.journals/rsil2017§ion=5
- Abubakar, S.M. (2018, August 26). How Pakistan wastes its water. DAWN. <https://www.dawn.com/news/1428966>
- Tariq, M. A. U. R., & Van de Giesen, N. (2012). Floods and flood management in Pakistan. *Physics and Chemistry of the Earth*, 47–48, 11–20. <https://doi.org/10.1016/j.pce.2011.08.014>
- United Nations. (2013). Award in the Arbitration regarding the Indus Waters Kishenganga between Pakistan and India: Vol. XXXI. <https://doi.org/10.18356/e8f5acf5-en-fr>
- United Nations. (2018). Reports of International Arbitral Awards: Vol. XXXI. http://legal.un.org/riaa/volumes/riaa_XXXI.pdf
- World Bank. (1960). Indus Water Treaty. <https://doi.org/10.1017/S0020818300025376>
- Young, W. J., Anwar, A., Bhatti, T., Borgomeo, E., Davies, S., Garthwaite III, W. R., Gilmont, E. M., Leb, C., Lytton, L., Makin, I., & Saeed, B. (2019). Pakistan: Getting More from Water. <https://openknowledge.worldbank.org/handle/10986/31160>