

Analysing the indus basin: the basis of india-pakistan water conflict assignment

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Introduction: Water as we understand it is crucial for life and survival.

Unfortunately sharing and managing this finite resource in South Asia has been a problem of great concern. At one level, there are issues that point to the fact that there is a water crisis looming over the region, whereas at another level, water tensions seem to be deeply embedded in the turbulent history of the region. Whichever the case maybe, the “water war” rationale forecasts war between countries that have competitive use or scarce water and are dependent on a shared water resource.

Similarly, India-Pakistan water related differences point to the fact that there is either scarce or competitive use of water along with aspects of the historical enmity, which has led to the recent and most pronounced dispute over water issues of the Indus Basin¹. The Indus Basin conflict is more complicated than it seems, owing to the turbulent history, lack of trust and differing requirements of the two countries. Though the two countries signed Indus Water Treaty in 1960 to prevent any water related conflicts, tension is now flaring over the recent dispute over the building of Kishanganga dam.

It is clear now that the 1960 treaty is not enough for peaceful water sharing in this region and new methods need to be devised in order to limit the externalities i. e. damaging ecological and economic factors to the region¹,
2. The objective of this research is to highlight these two main externalities of Kishanganga dam in the Pakistan region and provide a detailed analysis along with a glimpse of study area and finally propose possible solutions to this conflict. Objectives: The geographical distribution of environmental and economic resources is a potential contributor of conflicts.

Within the genre of these resources, water has been given the most importance, owing to the vital importance of water for human survival. One of the few examples of a successful settlement of a major international river basin conflict was The Indus Water Treaty 1960. This treaty was signed by the two countries in 1960, as an agreement to share the water of the Indus Basin. The Indus Water treaty is also one of the few examples of international agreements on sharing of river water that has been hailed as a success, despite the ongoing rivalry between the India and Pakistan^{2, 3}.

But, now Pakistan has raised concerns and strongly objected to India's construction of a hydropower project on the Neelum River, known as Kishanganga River in India, a tributary of the Jhelum River in Kashmir. According to reports Pakistan claims that building of dams by India on the western rivers like the Kishanganga Dam is a clear violation of the Indus Water treaty and will affect Pakistan's access to water⁵. The cumulative effect of numerous projects like these could give India the ability to store enough water to limit the supply to Pakistan at crucial moments in the growing season.

Table 1 shows the number of projects and their power generation capacity India has planned as compared to their neighbouring nations⁴. India however claims that the treaty through does not permit them to build dams for water storage on the western rivers passing through their territory; it does allow them to make limited use of water which includes building hydroelectric power projects. India therefore claims that the Kishanganga

project comes under this category, and it is opposed by Pakistan on the narrow definition as to what the word "storage" means^{3, 4}.

The environmental impacts associated with constructing large scale dams, like the Kishanganga dam, have significant negative impacts on the environment. Apart from demolition of towns and forests that surround the dam, it also affects upstream and downstream species, water quality and may increase the likelihood of earthquakes and landslides in the area.

Construction of Kishanganga can also disrupt habitats of the large number of species living in the Indus River by creating barriers in the river and preventing the fish of different species to cross resulting in loss of biodiversity.

Also, the barrier will prevent the fish from traveling to regions where they spawn preferably and hence reducing the populations of the species⁶. The loss of forests or agriculture land will lead to erosion and the build-up of sediment at the base of the river. This will cause the level of the Indus River to rise, and hence increasing the chances of flooding the downstream areas in Pakistan. Increased sedimentation which may contain pesticides and other agriculture run off in to the river may lead to eutrophication of the water body and its eventual death in the future.

This will greatly impact the hydrological cycle of this area reducing the amount of precipitation per year which may lead to droughts in area arid to semi-arid areas in Pakistan and India⁷. Even though the construction of Kishanganga dam does have some positives for India like having a natural and renewable resource, an energy supply and hydroelectricity but its

disadvantages in terms of impact on the environment still outweigh these positives. Large dams have been a key component of infrastructure development in capitalist countries+.

Countries with rapidly developing economies are constructing new dams to provide energy and flood control to their growing populations in riparian as well as distant urban communities. The main purposes served by dams are irrigation, hydropower and flood control. Even though the main economic benefit of dams is agriculture, but for India making hydroelectric dams can help boost its economy by providing ample electricity for its industrial growth^{6, 8}. To keep pace with the globalization and liberalization of economy, industrialization is the iota of pressure for India.

Several factors including geographical suitability, local governments and most importantly economic implications of dam construction affect the where the dam is constructed. Once built, dams epitomize many public investment policies, ranging from road construction to trade liberalization⁹. Therefore, it is essential for India to divert water from Indus River, to generate energy that can feed its rapidly growing economy, but this will come at a cost of Pakistan already stagnant agriculture economy.

Study Area: The Indus River is considered one of the largest rivers in the world and it originates from Mount Kailash in Tibet on the North side of the Himalayas at an altitude of 5, 486m. The total length of the river is approximated to be 3, 200km, bisecting the physical territory of Pakistan longitudinally. From its origin to the Guddu Barrage in Pakistan it is called the upper Indus and downstream from the barrage it is called lower Indus¹⁰.

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The Indus Basin is surrounded by the Karakoram and Haramosh ranges on the North, the Himalayas ranges on the East, the Sulaiman and Kirthar ranges on the West and the Arabian Sea on the South. In the upper Indus Basin, there are three principal tributaries on the right bank namely the Kabul, Swat and Kurram, whereas the left bank in Punjab has five main tributaries namely Jhelum, Chenab, Ravi, Beas and Sutlej. The total length of the tributaries of Indus is approximately 5,600 km. The Basin extends over an area of approximately 1,166,000 km² and lies in China, India, Pakistan and Afghanistan^{9, 10}.

The length of the river in India is about 1,114 km and the river travels a distance of about 2,880 km until it reaches the Arabian Sea. The map of the Indus basin is presented in Figure 110. The Kashmir valley in Indus basin is also thought to be gifted with exotic natural and scenic beauty of the water bodies. Because of this, poets refer to it as "Paradise on earth". Apart from being visually attractive, these rivers and lakes are of great environmental, ecological and socio-economic significance¹⁰.

Detailed flow of the Indus basin water is shown in figure 2. Analysis Indus Water treaty 1960 The Indus Water Treaty was signed in 1960 between the Republic of India and Islamic Republic of Pakistan, which was brokered by the World Bank¹³. The treaty was mainly signed as a result of Pakistani fear that since the source of the Indus basin resided in India, it could potentially create droughts and famines or cause floods in Pakistan. The treaty contains 12 articles, under which all the waters of the Eastern Rivers i. e.

Sutlej, Beas and Ravi were allocated to India for unrestricted use and unrestricted use of the Western Rivers i. e. Indus, Chenab and Jhelum to Pakistan, which India was under the obligation to let flow¹³. Specific provisions were made under article IV, which specified regular exchange of river and canal data between the two countries and article VII emphasized on future cooperation. Another important article in the Indus Water treaty 1960 is article IX, which deals with settlement of differences and disputes between the two countries.

Under this article, if the commissions are unable to solve their differences on a specific problem relating to water usage, provisions have been made for reference to a neutral expert, and if the neutral expert fails to solve the problem then the Court of Arbitration can be pursued under article IX¹³. An analysis of the negotiation process of the Indus Water Treaty also clearly indicates the importance of a third party in conflict resolution, provided it plays an unbiased but active and constructive role. It is widely agreed by many experts and the World Bank that the Indus Water treaty is a success¹².

In support of this statement, the effectiveness of involving a third party in negotiations that is mentioned in the treaty is cited and also the need of cooperation and coordination as possible options in resolving conflicts over the river basin. But it is evident that the treaty is not entirely effective and still remains difficult to implement at its best, mostly due to the unwillingness of the two countries to put aside their national interests in front of the rivers. It is also evident that India has more bargaining power

than Pakistan as the river basin lies in India, making the treaty difficult to implement.

Even though the treaty states the minimum amount of water that needs to be transferred to Pakistan, in practice it is much difficult to divide a river as explained by the treaty. Due to these flaws, Pakistan has accused India once again of building dam which will reduce the flow of water to Pakistan to almost less than half of its original share^{11, 12}. Simply stating the regulations for water transfer and dictating the terms of use of the rivers is not going to help resolve the differences; the Treaty therefore has yet to provide solutions to this complicated issue. Proposed Dam Dynamics

The proposed Kishanganga Hydroelectric project once built will be located on Kishanganga River, a tributary of river Jhelum, 160km upstream of Muzaffarabad and involved diversion of Kishanganga to a tributary named Bunar Madumati Nullah of Jhelum River through a 22km tunnel³. The project will cost a total of \$950 million and involves construction of a 37m high concrete faced rock fill dam and an underground power house. A maximum gross head of 697m is proposed to be utilized which will generate 1350 Million units of energy, in a 90% dependable year, with an installed capacity of 330MW³.

This 330MW dam would affect Pakistan's right over Indus River, by reducing river flow into Pakistan and minimize its power generation capacity of Neelum-Jhelum hydropower project near Muzaffarabad in Pakistan occupied Kashmir which is currently 969MW. The detailed layout of the dam is shown in figure 3 below^{3, 14}. Regarding the dynamics of the dam Pakistan has

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already raised a number of objections in 2004 when the project was announced. Because of these objections India was compelled to revise the design of the dam in order to satisfy Pakistan's objections.

However, Pakistan was still not satisfied with the revisions made to the design and raised further objections related to the gate structure, height, size, level, diversion plan, storage capacity and power intact of the dam. The two countries failed to reach a common ground regarding these new objections. Even though Pakistan made strong claims about the effects of the dam on Pakistan like the reduction in the flow of water into Pakistan by 11% in summer and 27% in winter, it still does not have any exact data at present that can prove the negative consequences of the dam in its region¹⁴.

Problems caused by Kishanganga Dam Rivers across the world possess a very delicate ecology that depends on the location, temperature and other abiotic factors of the river. The plant and animal communities that inhabit the river margins evolve to adapt to the river's own peculiar pattern of flow, ecological niche, current speed, nutrients and the food chain. Ecological Effects:

Building dams alter the natural pattern of disturbances in the river that the plants and animals have evolved for. This alteration affects the coordination of an aquatic animal's reproductive cycles and annual flood season. These small scaled floods are important for the survival of these animals as they help to take nutrients from the land and deposit them into the river, providing food for the animals in the river¹⁵. Vegetation in the riparian zones

also depends on these small scale natural floods, which if interrupted will change the ecology of riparian zones for ever.

An example of this is found in Southwest United States, where enormous floodplains of cotton wood have been replaced by dry and barren areas of grass. Paradoxically, where building dams can cease small scale natural flood, they can also cause large scale direct submergence of large number of houses, villages, cultivated lands and forests due to floods. For example, the Tehri project in the Himalayas has led to the direct submergence of the town of Tehri, comprising of 37 villages and 10, 000 families¹⁵.

Another important factor that concerns the ecology of the rivers is the change in temperature due to large scale dams. Rivers tend to be fairly homogenous in temperature. Whereas, dams are layered, warmer at the top and colder as you go down. If water is released from a reservoir downstream, it is usually released from the lower layers of the dam which would make the river colder than it ought to be. This will affect numerous microenvironments in the river that are contingent on the regular cycles of temperature throughout the year.

River temperatures along with dams as physical barriers will also affect the migration of fish in the river¹⁴. If this migration is blocked for longer periods, it can result in loss of biodiversity, and ultimately reduced fish in the river. This can lead to the transition of the river from Oligotrophic to Eutrophic level. These ecological impacts will reduce the population of fish that inhabit the rivers downstream to Kishanganga dam and will also pose a major threat for flooding of the Neelum-Jhelum River in Pakistan.

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Reduction in the population of the fish will affect the fishing industry of Pakistan and also pose a major threat of flooding in the surrounding areas of Neelum-Jhelum River. The continuing absence of proper safeguards and the exclusion of environmental and social criteria mean dams are likely to create massive social and environmental disruptions for the neighbouring countries.

Economic Effects: Agriculture is the backbone of Pakistan's economy.

Pakistan is now one of the world's fastest growing populations which now is estimated to be over 160 Million⁴.

Due to the lack of large river regulation capabilities the country is facing serious food shortage. Now, given the present situation with India controlling its rivers, Pakistan could soon become one of the food deficit countries in the future. With diversion of water from Neelum-Jhelum River to the Kishanganga dam, Pakistan will face a deficit of 21% of water which would reduce 16% power production causing a loss of about Rupees 5 billion in one year¹⁵. As with most developing nations, agriculture is the primary source of income for Pakistan and it's considered to be the single biggest sector of GDP.

Almost half of the total labour force in the entire of Pakistan is employed in the agriculture sector and draws about 22% of its GDP¹⁵. Taking in to account the dependency of Pakistan economy on agriculture, the Indus River is considered to be the lifeline of Pakistani economy. Therefore any project that would give India control over the flow of these rivers like development of Kishanganga Dam is perceived by Pakistan as a threat to injure Pakistan's economy or a method of causing floods by releasing water during time of war. Suggested solutions to the conflict Arbitration:

In case the relationship between the two countries does not improve and they do not decide to resolve the matter by themselves, the issue could likely be taken to the United Nations arbitration court. It happens to be that Pakistan has already decided to move to World Bank for arbitration, as it had done in the case of Baglihr dam in 2005. This will allow appointment of a neutral expert under the provisions of the treaty signed in 1960 (Indus Water Treaty 1960) who would be expected to seal an unbiased deal¹³. For a case to be registered, Pakistan needs to pin point exactly what they require India to do, in order to help their cause.

In this case Pakistan needs to raise objection on whether India has the right to divert the route of Kishanganga River and secondly whether India is allowed to reduce the water level of the river below the dead storage level of the dam. All these objections need to be supported by the articles in Indus Water Treaty 1960 in order to be successfully backed up. Conflict resolution through cooperation and coordination: It is widely believed that water related events at the national level are related to both water and non-water events at the international scale.

However, the nature of these relationships and the extent to which they are present varies from country to country. This shows the intricacies of the hydro-political dynamics that are contingent on the historical and political conditions within the region or basin. For these complex differences to be resolved, it is preferable to settle them through cooperation and coordination between the nations¹⁶. Furthermore, once cooperative water regimes are

established through treaty, they turn out to be resilient over time, even between hostile neighbours like India and Pakistan.

Answering three overarching questions can suggest where the problem resides and what needs to be focused on, this can be shown in figure 415, 16. This can be proved by the approximately 300 treaties that have been signed since 1814, which mostly deals with water management, food control, hydropower projects and allocation of consumptive and non-consumptive uses of river basins. Public Policy: There needs to be a change in environmental and political policy of the third world countries.

Having effective public policies for environmental protection with incorporation of economic analysis will contribute to the reduction of such disasters. Also, if these policies are already present but are out dated, they need to be revised to reflect the current environmental and economic crisis and to account for institutional, legal and regulatory framework of a country¹⁶. This will require contributions from an invaluable resource of researchers, policymakers, industry professionals and journalists to provide up to date information and design the most applicable environmental and economic policy.

Activists: Activism incorporates international action to bring about change in social, political, economic or environmental policies. Activists are generally considered to be more informed about a particular subject than regular citizens and are therefore taken more seriously by the government. Activists usually engage in different ways to reach out to the public and spread awareness about a specific subject. Writing newspaper articles, street

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marches and going on strikes are some of the ways that are usually practiced by activists to spread awareness¹⁷.

One of the most famous examples of activists is the “Ladies of the Lake” that help revive Lake Simcoe from an almost irreversible path. Such activists can help spread awareness about the Kishanganga Dam in the republic of Pakistan and India and cause them to take actions to limit the detrimental impact of the Dam in the environment. Human Rights activists can also get involved to help the endogenous community where the Dam is being built.

Methodology For the purpose of this research, all the data regarding the location, dam dynamics and policies were gathered from primary scholarly articles.

This information lays a foundation for the research, as all the arguments and analysis of the essay is synthesized from this information. Information regarding the functionality of hydroelectric dams and their potential impacts on the surrounding area was taken from the article by Bakis⁵. Bakis provides this information in his article through a case study of Pursuk dam in Eskisehir. Information specifically for Kishanganga dam was cited from a web site that is run by the Indian government in order to provide updated information about the project.

NHPC limited, not only provides the information on dam dynamics but also highlights specific information on the layout of the dam and its features¹⁰.

The specific route of the Indus Basin and the flow of water in its five tributaries were taken from several articles, as the information was slightly different from article to article depending on the author's origin and the

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place where the article was published^{4, 6, 8}. Several articles were analysed so that inaccurate data could be ignored and only the information that is most likely to be unbiased was chosen for clear representation of the Indus water dispute.

Finally articles with information on economic impact and ecological impact of dams were gathered from a large number of primary articles^{1, 2, 5, & 8}. All the information on economic and ecological impacts of dams was not only based on the Kishanganga dam, as there was not much information in the literature about this specific problem, hence similar impacts by other dams with similar geography was also analysed and the information was analyzed to meet the needs of this research paper.

For solutions regarding this dispute, most of the ideas were drawn from random research on World Wide Web like the need of cooperation and coordination between countries and other ideas were taken for class discussions like the need of activists (Ladies of the lake) and NGOs. Apart from primary scholarly articles, newspaper articles were also used, as they provide current information and are focused on a particular subject.

Newspaper articles used were all from either private news corporations or government owned news websites^{9, 14, 15, & 16}.

Information about whether the Kishanganga dam is violation of the Indus Water Treaty 1960 was taken from The Nation, Pakistan. com, The Hindu and New York Times^{12, 18}. Conclusion: In conclusion we need to realize that the major force behind the current situation where countries are busy building dams on river basin is economic globalization, which is affecting the lives of

many people, communities and nations. Despite the huge magnitude of destruction these constructions can cause, it's still a wide spread belief that infrastructure is integral to development of third world countries.

Therefore it is essential to credibly evaluate large dams and address the endogeneity of dam placement to minimize its consequences on neighbouring countries. Also, any development of dams by India should be made sure to fall under the Indus Water Treaty 1960, and if there are any amendments that need to be made to the treaty, should be done by approval of both the countries for mutual benefit. This will help to reduce the impact of dam on Pakistan, and therefore also minimize the ecological and economic effects of such magnitude.

There is a need for both countries to unite and logically work towards solving their problem, so to find a sustainable sharing solution with minimum adverse ecological and economic impact on each of the country. For this both countries need to come to grips with the current dynamic forces of globalization in order to understand the causes of the impending world-wide water crisis. Figure 1: Map of Pakistan and India showing the location of the Kishanganga Dam. Figure 2: Detailed flow of water from the Indus Basin in to its five main tributaries.

Figure 3: Layout of the Kishanganga Dam, showing the diversion of water through the canal. Figure 4: Overarching questions that suggests where the problem between countries like and how they could be solved. Table 1:

shows the number of Dams that are already made and are under way in

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