Transboundary Water Cooperation in the Indus Basin: Challenges & Opportunities

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Questions raised

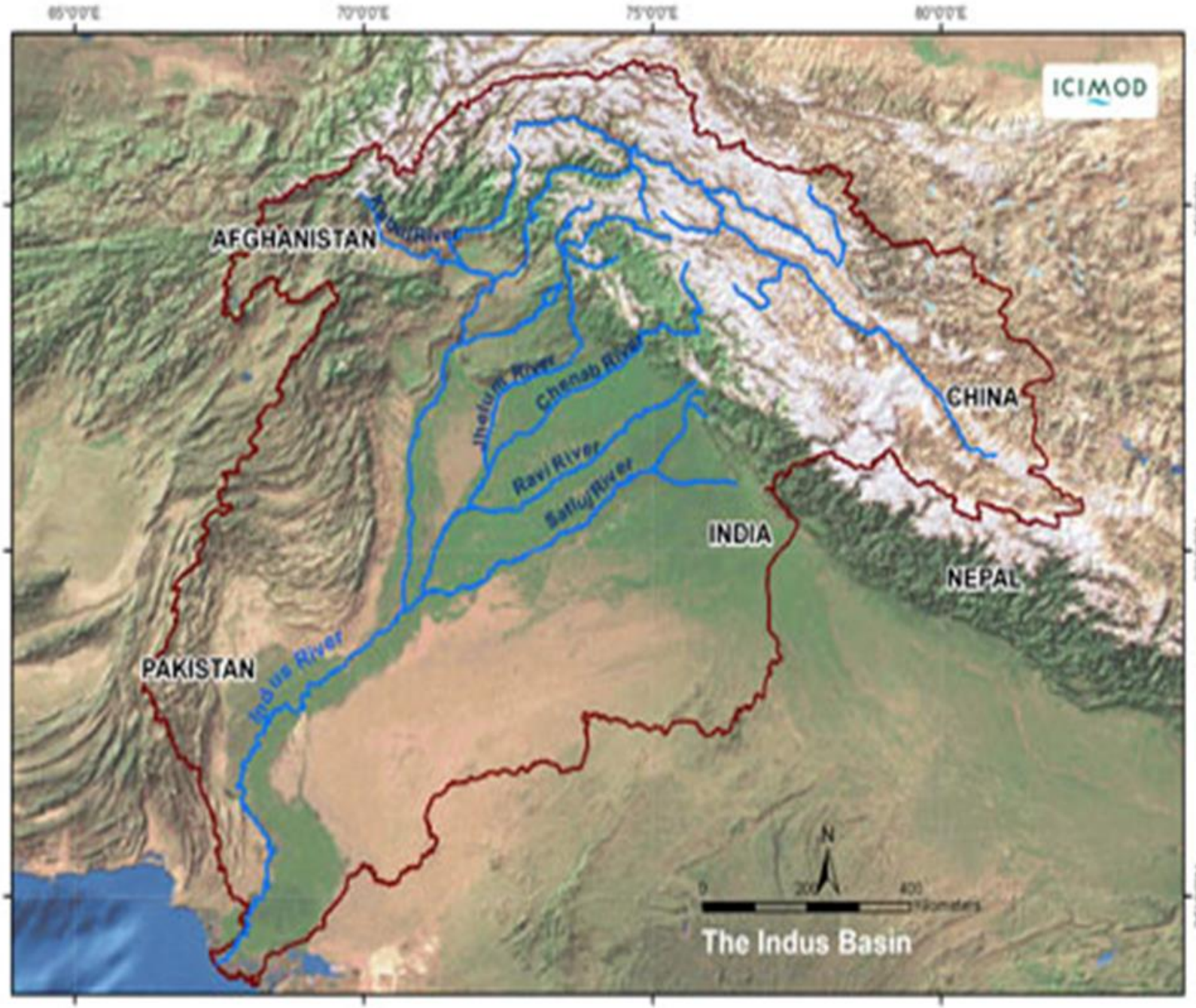
- **How climatic threats, rising population, rapid urbanization, industrialization & increased industrial and agricultural uses will aggravate water stress in the Indus basin?**
- **What are the existing institutional structures governing IB regime (IWT) and to what extent they provide cooperative framework in sustainable management of the IB?**
- **What India, Pakistan can do together to adopt a cooperative & coordinated approach for sustainable management of IB which can help them in achieving SDGs?**

Main Argument

- The main argument is:
  - **Given growing climatic, demographic, economic and political challenges to Indus Basin (IB)** ***India and Pakistan need to enhance transboundary water cooperation framework within broader parameters of the Indus Water treaty (IWT)*** which **will greatly help them in achieving their Sustainable Development Goals (SDGs).**

Pakistan's water landscape & Vulnerabilities

- **Pakistan is one of the world's driest countries with a an average annual rainfall of about 240 mm. It is a 'single basin' country & its dependence on external water resources is 76%.**
- The population and economy are heavily dependent on an annual influx into the Indus river system. **The basin accounts for 21 % of GDP, 45 % employment, and more than 60 % of its exports.**
- Pakistan is moving from water stressed to water scarce country. **The per capita water availability has fallen from 5,600 cubic meters per person in the 1950s to 1066 cubic meters in 2010. It is projected to hit 800 cubic meters annually by 2025.**
- **Pakistan has very little water storage capacity, barely store 30 days of water in the Indus basin**, while India can store for 120-220 days, Egypt up to 700 days and the US for 900 days.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ICIMOD
AFGHANISTAN
Kabul River
Jhelum River
Chenab River
Ravi River
Satluj River
CHINA
INDIA
NEPAL
PAKISTAN
Indus River
N
0
200
400
Kilometers
The Indus Basin

Emerging Challenges to Indus Basin

- **The Indus basin** shared by Pakistan, India along with China and Afghanistan **is highly dependent on water derived from the melting of snow and glacier in the upper part of the basin**.
- **The contribution of melt water to the flow of Indus River is estimated to be from 50 to 70% of the total flow &** remaining comes from rains during monsoon season from July to Sept.
- **Snow melt account for more than 65 % of the Indus river ; 50 % of Jehlum & 49 % of Chenab rivers.**

Seasonal Variability:

- **The quantum of water flowing in the Indus & its tributaries varies widely from year to year, depending on snowfall in the Himalayan & Karakoram ranges** and rainfall in the catchment areas.

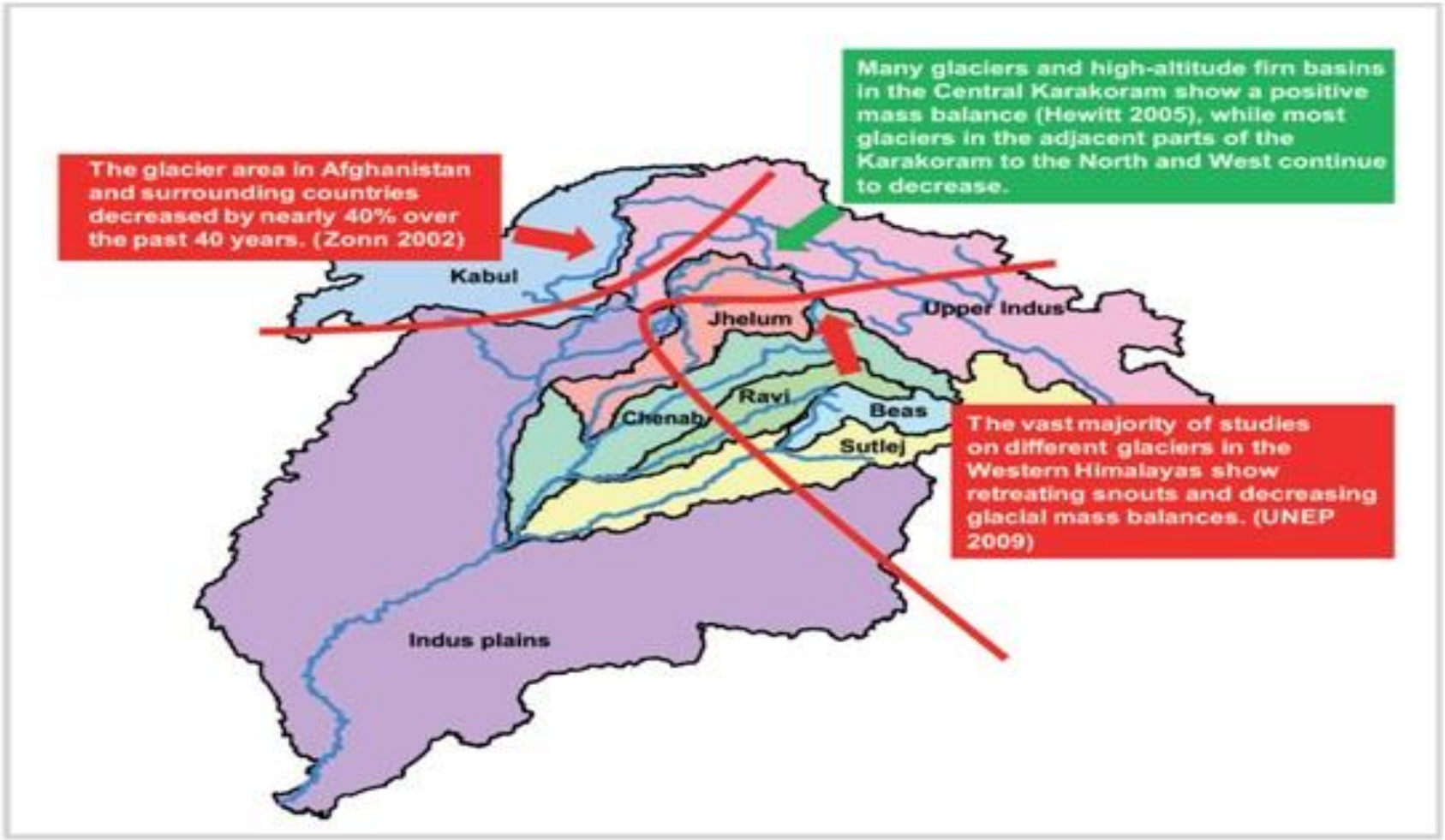
Contribution of Snow, Rain & Glaciers in Upper Indus Basin Flows (WAPDA)

Location	Snow (%)	Rain (%)	Glaciers (%)
River Indus above Tarbela	30-35	5-10	**60-80**
River Jhelum above Mangla	65	35	**---**
River Kabul above Nowshera	**20-30**	**20-30**	**30-35**

Melting Himalayan Glaciers

- There is a **high uncertainty in the behaviour of glaciers in the Upper Indus Basin (UIB), esp. the cryosphere.**
- Various studies incl. those conducted by ICIMOD indicate that **glaciers in western Himalaya are retreating while glaciers in central part of the UIB in the Karakorum range are advancing** described as Karakoram anomaly.
- **The Kolahoi, Kashmir's biggest glacier, main source of Jehlum river is melting faster than other Himalayan glaciers**, from 11 km2 to 8.4 km2 over the **past three decades**.
- **The Siachen glacier - the site of an Indian-Pakistani military standoff has shrunk to half its size.** The glacier is the source of the Nubra River that falls into the Shyok River in Ladakh which then empties into the Indus.

Spatial behaviour of glacial dynamics in the Indus Basin



- Space Application Centre **(SAC), India observed: 359 glaciers in the Chenab basin that stretched over 1,414 sq. kms (Km2) in 1962, were reduced to 1,110 km2 by 2004 - a reduction of 21 % in the snow cover area.**
- Int. Centre for Integrated Mountain Dev. **(ICIMOD)** observes:
  - **receding & eventually disappearing high altitude reservoirs of snow & ice will over time reduce downstream runoff, and increase its variability.**
  - In June 2010 Walter W. Immerzeel report, ***Climate Change will Affect Asian Water Towers*** observed that **by 2050 IB would lose 8.4 % of its upstream flow due to climate change.**

Effects of Glacial Retreat on river flows

- **Effects of Glacial Retreat on run off:** best estimates are that **there will be 50 years of glacial retreat, during which time river flows will increase.**
- **In the beginning there will be 20 to 40% increase in Indus flows and after 50 years, there will be glacial retreat** and flows **will drop down to 30 to 40%- in 100** years time.
- Reports suggest that water flows in the western rivers have **decreased from 119 MAF in 1960 to 113 MAF in 1997** and further fell **to 102 MAF by 2011**
- **In Chenab, the average annual flow has declined by 12 % b/w 1960 and 2011**, while **in the river Jhelum it has declined by 17 %.**

Degradation of the Indus Watershed

- Indus watershed is highly vulnerable to environmental change due to deforestation, and pollution.
- **The environmental degradation in the upper reaches of IB is going to have adverse impact on the down stream flows of the western rivers.**
- **Forest cover in the Indus basin is extremely low at 0.4% as more than 90% of the original cover has been lost mainly in the upper parts of the basin.**
- The deforestation has adversely affected the ecosystem and the watershed of the UIB.

- **Upstream construction of dams is also having local as well as transboundary environmental effects** as came out in case of Kishenganga Project- on Gurez Valley and Neelum Valley.
- **The UIB is prone to natural disasters like earthquakes, floods, landslides, avalanches, high velocity winds**, snow storms that will be aggravated by Climate change.
- **The degradation of water bodies in the UIB is also affecting both the quality and quantity of the water in the catchments area**. the three major lakes-**Wular lake, Dal lake and Mansbal lake are facing environmental degradation due to pollution.**

The Changing Demographics in the IB

- With **basin's population of 215.8 million**, **the annual per capita water availability of 1,329 m3, is much below the threshold of 1,700 m3** and is lowest when compared to **GBM (3473 m3)** and **Helmand (2589 m3)** basins in the region.
- **Pakistan's per capita water availability has dwindled from 5,600** cubic meters to **1,066 cubic metres in 2010.** it is going to fall to a critically low level of just **858 cubic meters annually by 2025 when Pak pop will rise to 208 million. (WAPDA)**
- The National Academy of Science, in its report on hydrology in the Himalayan region (NAS, 2013) estimated that **by 2050 Pak. will move to 700 cubic meter per person.**

FUTURE WATER SCENARIO

Year	Population (Million)	Water availability per capita (m^3)
1951	34	5300
1961	46	3950
1971	65	2700
1981	84	2100
1991	115	1600
2000	148	1200
2010	168	1066
2020	196	915
2025	209	850

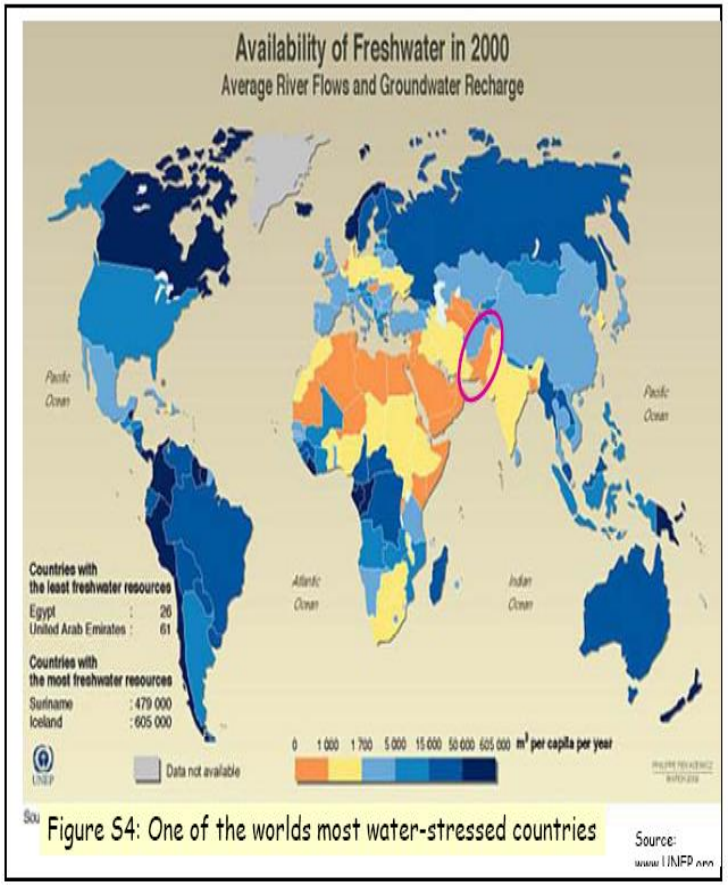


Figure S4: One of the worlds most water-stressed countries

Source: www.UNEP.org

- **In India per capita water availability has fallen from over 5000 cubic meters in 1950 to 1545 cubic meters by 2011 census.** India may reach the threshold level of **1000 cubic meter per person in 2025**.
- **Agriculture sector is the largest consumer of water in Pak. & India**. Extensive irrigation is placing IB water resources under heavy stress, with **about 90% of the available flow utilized- Pak 96.03% & India 86.46%.**
- **Over-pumping and inefficient irrigation techniques have led to sharp decline in groundwater levels,** loss of wetlands and salinization of agricultural lands.
- **Growing Pop., urbanization and industrialization, are resulting in higher water demands for domestic and industrial uses, food & energy production.**

Hydro-politics over Indus: Pakistan's dilemmas as a lower riparian

- **In 1947, Partition of the subcontinent drew line cutting across the Indus system,** leading to the disruption of well-established irrigation systems.
- **The disruption of flows to Pak. in April 1948 exposed Pak's vulnerability to the Indian control over the headwaters of the Indus system.**
- In 1960 India & Pak signed **IWT that governs transboundary water rights & obligations of India & Pak**. in rel. to each other.
- It **divided Indus river system** giving three Eastern Rivers- Sutlej, Beas & Ravi to **India with 33 MAF of mean flow** and three Western Rivers- Indus, Jhelum & Chenab, to **Pakistan with 136 MAF of mean flow**.

Pakistan Water Rights Under IWT
Articles III, IV & II

- Article III stated:
  - **Pakistan shall receive "unrestricted use of all waters of Western Rivers" Article III (1)**
  - India shall be under **obligation to let flow all waters of W. Rivers & shall not permit any interference with these waters,** except for restricted uses provided in Annex C & D. Article III (2)
- Besides, under **Article II on Eastern Rivers**, Pak. was permitted by way of exception to take water for **domestic use**, **non-consumptive use** and certain **limited agricultural use specified in *Annexure B***
- **Annex B stipulated agriculture use of 45,500 acres** from 4 tributaries of river Ravi- Basantar, Bein, Tarnah and Ujh

- **Article III (4) of the Treaty precludes the building of any storages by India on the W. Rivers, except to a limited extent carefully laid down in Annexures D & E**, which also specify technical conditions relating to engineering structures and features, such as limits on raising artificially the water level in the operating pool, pondage levels, crest level of the gates (where a gated spillway is considered necessary), location of intakes for the turbines
- **Article IV (2) clearly stipulated that any "non-consumptive use made by each party would not materially change...** the flow in any channel to the prejudice of the uses on the channel by other party."

India's Entitlements on W. Rivers

- Besides **entire flow of the E Rivers** (Article II) **India was allowed limited uses- i.e., agriculture, drinking water, non-consumptive uses and hydro-electric power generation, subjected to stringent restrictions and conditions laid down in Annexes C, D & E.**
  - **India is entitled to use 1.3 MAF for irrigation purposes & 3.6 MAF for conservation, flood moderation & hydel generation. Spelled out as general storage, power storage & flood storage.**
  - India is **allowed to construct run-of-river hydroelectric plants** on the W. Rivers & all the technical parameters for each river are **specified in Annexure D**. **Annexure E stipulates the limits of various storages of water** by India on the western rivers.
- **It is interpretation of the permissive & restrictive provisions on the western rivers that are at the heart of the current water tensions b/w India and Pak.**
- India is building an array of hydro projects on the W. rivers citing permissive aspect of the provision while Pak. fearing their consequences is invoking restrictive aspect of the provision.

India's Entitlement of Storage on the Western Rivers (MAF)

River system	General Storage	Power Storage	Flood Storage	
Indus	0.25	0.15	Nil	0.40
Jhelum (Excluding Jhelum Main)	0.50	0.25	0.75	1.50
Jhelum Main	Nil	Nil	As in paragraph 9, Annex. E	
Chenab (Excluding Chenab Main)	0.50	0.60	Nil	1.10
Chenab Main	Nil	0.60	Nil	0.60
Total	1.25	1.60	0.75	3.6

IWT & Pakistan's Water Security

- **Growing water stress in the two countries coupled with looming climatic threats to the IB system and change in demographic, hydrological, political, economic and energy environment is putting** the **Indus water regime created in 1960 under enormous stress.**
- **Pakistan as a lower riparian is on the receiving end of the change** which has raised alarm bells in water insecure Islamabad. **Being a lower riparian Pakistan wants to ensures its water security** in the coming decades **without compromising its water rights under the Treaty.**
- **During the last two decades construction of several upstream dams on the W. rivers for power generation has led to controversies regarding compliance with the provisions of the Treaty.**

- The treaty has some grey areas like **it does not specify number of dams that India can build on W rivers has made Pakistan apprehensive about India's design over W rivers.** Other issues including **cumulative impact of projects on the flows, and impact of Climate Change.**
- **This has widened distrust b/w the co-riparian.** Pak took Baglihar to NE & Kishenganga project to Int Court of Arbitration. Now difference have arisen over Kishenganga and Rattle hydroelectric projects- Pak for Court of Arbitration, India for NE.
- **Article IX of the IWT on the settlement of disputes sets out the mechanisms for resolution of legal (disputes) and technical issues (differences) ie a court of arbitration or a neutral expert** or any other way agreed by the Permanent Indus Commission.

- **Blood & water cannot flow simultaneously, Modi, said referring to Uri incident in September 2016. A Task Force has been set up to fast track hydropower projects on the western rivers.**
- Pakistan warned **revocation of Indus Water Treaty could be taken as an act of war or hostility against Pakistan.**
- Pakistan has also expressed concerns over the designs of five Indian hydroelectric projects: 1000MW Pakal Dul, **850MW Ratle, 330MW Kishanganga,** 120MW Miyar and 48MW Lower Kalnai.

Framework for Sustainable Management of IB

- A cooperative framework for sustainable management of IB to meet emerging challenges should include
  - **Bridging knowledge gaps:**
    - **Joint Monitoring of impact of Climate Change on the Indus basin river system.**
    - **Joint Study on the behaviour of Himalayan glaciers**
    - **Joint study on the effects of Glacial Retreat on run off**
  - **Coordination in watershed management**
  - **Strengthening capacity of Permanent Indus Water Commission (PIWC)**
  - **CBMs on hydropower development**
  - **Integrated approach to Water Resources Management**

Joint Monitoring of Impact of Climate Change on Indus basin system

- **Transboundary scientific coordination** is essential in order **to obtain a holistic perspective of the existing & anticipated changes in the natural system of IB.**
- **Collaboration in scientific and technical research on the impacts of climate change on the cryosphere of the Indus basin** covering the four Hindu Kush-Himalayan countries of Afghanistan, China, India and Pakistan
- **Sharing of experiences to create an environment of ownership of scientific work** b/w government institutions engaged in sustainable water resource management in the Indus basin.

Joint Study on the behaviour of Himalayan glaciers

- **Glacial fluctuations and changes in precipitation patterns are expected to alter the hydrology of IB.**
- The **largest challenge stems from inadequate information &** monitoring, and limited scientific understanding of these high elevation glaciers.
- **The study of the behaviour of Himalayan glaciers is very important to assess the actual impact of climate change on the Himalayan glaciers.**
- Both sides need to **form a group of experts to jointly study the behavior of glaciers whether decreasing or advancing**.

- A **Glacier Monitoring Research Centre could be set up to**
  - Study the **Climate Change impacts on UIB Cryosphere and Forecast**
  - **Long-Term water availability from Upper Indus Basin**
  - **Conduct Mass-Balance studies** for five selected glaciers in four years.
  - Carryout **Mapping and Monitoring** of more than 50 UIB **glacier snouts.**
- This can help in understanding the extent of glacier melt and **creating joint mitigation and adaptation techniques, sharing information and improving flood forecasting systems.**

Declare all glaciers protected area

- India, Pak and other co-riparian China & Afghanistan need to work together in responding to the challenges posed by Climate change. They can use ICIMOD platform which is based in Nepal & is already focusing on the issue.
- **India-Pak need to declare all glaciers protected area**. **Siachen must be demilitarized.** Parties showed interest & offered new ideas to resolve the issue, by turning it into a '**mountain of peace**' or '**zone of peace', but political will is missing to move forward.**
- Proposal of an **ecological science Park near the Siachen and Baltoro glaciers** has been under consideration for some time **should be adopted by both sides.**

Joint Study on the effects of Glacial retreat on run off

- **Reports suggest that water flows in the western rivers have decreased. It is happening under the conditions of climate change which predict that there will be 50 years of glacial retreat, during which time river flows will increase.**
- **The additional flows in the western rivers remain undetermined. Pakistan being lower riparian has a right to its due share out of this additional water.**
- **There should be a Joint study on the effects of Glacial Retreat on run off, assessing predictable flows under climate change.**

Cooperation in watershed management

- Coordination in **watershed management is critical to maintain sustainable flow, to control soil erosion & floods.**
- **Cooperative watershed management will** help IB in **sustaining flows, controlling soil erosion, sedimentation & floods**, esp flash floods.
- **There is need of a mechanism on water management and environment under which both sides can meet periodically, exchange data on water quality and water flows, and consult with one another on environmental problems & share best practices.**
- **This can be covered under Article VII of the IWT.**

- **Watershed management projects should factor in climate change,** and some 'dedicated climate change adaptation projects' should be designed to deal with high-risk watersheds within UIB.
- Both sides need **to work together in mapping deforestation and its impact on Indus watershed in UIB** and **coordinate strategies for sustainable conservation, protection and development of forests in the region.**
- **There is need to expand the scope of Article VII of the IWT on "future Cooperation" for the sustainable management of the IB.**
- **Issue of pollution** of the river bodies in the Indus system can be addressed through [**Article IV** (9)].

Strengthening PIWC

- **Restructuring & strengthening the capacity of PIWC** is very important for effective functioning of this imp institution. The scope and mandate of the Commission need to be broadened.
- **The Commission need to focus on developing its capacity in water diplomacy**, water & conflict resolution, water law, treaty provisions- legal & technical issues et.
- **This would enhance its role in resolving the issues relating to the many issues relating to interpretation of the treaty** & help parties to recourse less to other mechanisms available in the treaty for dispute settlement.

CBMs on Hydro Power development

- **IWT allows India to build run of the river projects** on the Western rivers, but stipulated restrictions and conditions that safeguard Pakistan's interests. In the past two decades or so, **many controversies have arisen due to lack of timely data sharing** in compliance with the provisions of the Treaty. This has widened distrust b/t the co-riparian. Pak took Baglihar to NE & Kishenganga project to Int Court of Arbitration.
- **Trust building**:
  - **Real time data sharing through installation of telemetry system.**
  - **Transparency in data sharing regarding the construction of Indian projects on W. Rivers.**
  - **Assessment of the cumulative impact of the Indian hydro projects on W. rivers on the down stream flows & environment.**
  - Sharing of **Environment Impact Assessment** (EIA) of the Indian projects on the western rivers will build trust.

Integrated approach to Water Resources Management

- **Internal water resource management** becomes v. imp given the fact that **physical separation of the Indus tributaries** has **hampered the possibilities of efficient integrated basin management.**
- In view of **growing demographic change adding to water scarcity**, it is the **responsibility of both countries** to **ensure internal water resources management** by **following the principles of Integrated Water Resources Management (IWRM)** & **share best practices in water conservation** techniques in agriculture, industrial & domestic uses.

Conclusion

- **Transboundary and national water development and management are strongly inter-linked to sustainable management of water resources.**
- **Internal water resources management** becomes very imp. given the fact that **physical separation of the Indus tributaries** has **hampered the possibilities of efficient integrated basin management**.
- **Climate change, changing demographics, rapid urbanization & industrialization are emerging as new challenges to the sustainable management of the IB** and **need to be addressed by India and Pakistan through a cooperative framework that ensures coordinated response to common challenges.**

- **Sustainable Management of Water & Sanitation- SDG 6 and target 6.5 refers to the implementation of IWRM and need to include transboundary dimension. This can be only achieved if co-riparian in IB in particular India & Pakistan rise above water nationalism and recognize it as a precious shared resource which can be preserved through an IWRM approach.**
- There is a **need for a paradigm shift in water management from technocratic approach** that looks almost exclusively toward engineering solutions **to socio-centric approach** which lays **emphasis on indigenous physical and human resource management** and is more resource-efficient and ecologically conducive.