ISWEL Workshop

INAUGURAL SESSION

PAKISTAN’s WATER CHALLENGES AND OPPORTUNITIES

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VIENNA 29 May 2018
Current State of Economy

- Population is the sixth largest in the world
- GDP ranks at 138th in the world
- Human development index ranks at 146
- Global Competitive Index is at 133 even lower than Nepal
- WB index of ease of doing business is at 122
- Economic Freedom Index ranks at 121 unfree
- Our children rank at bottom in science and maths
- These international benchmarks are indicative of our dysfunctional economic and political system
- We have to get our priorities right for economic progress and avert becoming a case of economic failure
What is happening to our water resources? Even though the story of our water resources management is not what it should have been, but let us look at it in the framework of:

Challenges and Opportunities
A Water Policy Too Late

• We have just approved nations first water policy in more than seventy years
• In the wake of climate change and related water management crisis, its an overly delayed accomplishment
• We still have to get its implementation plan in place
Institutional and other issues

• Too many institutions managing water and too many laws governing it.
• No single organization responsible for the integrity of the Indus river basin
• WAPDA was expected to be the custodian of the water resources of the basin, but in reality this never happened due to overlapping roles and responsibilities of several water related institutions
• Importantly in managing the basin integrated approach has been largely overlooked
Other issues

- Increasing population
- Climate Change: more frequent extreme events and declining flows in our western rivers
- Low production and productivity of irrigated agriculture
- Disproportionate agricultural water use
- Short and narrowly focused private sector engagement
- Imperfect marketing and markets
- Financing plans at various levels largely missing.
- Land and water ownership issues remain mixed
- Weak regulatory role in water use
- Issues of IWT
Main sources of water of the Indus Basin

- Glaciers and snow
- Monsoon rains
- Groundwater
Average Water Availability in Pakistan

Abstractions of Ground Water 50 BCM
Rainfall 17 BCM *
Inflow into Rivers 171 BCM
From Outside Indus Basin 5 BCM *

193 BCM
Losses in Rivers 14 BCM
49 BCM to Sea

Into Canals 125 BCM
Available at Farm-gate 144 BCM

Under Ground Aquifer

Urban & Industry 5 BCM
Seepage and Evaporation in Canals 31 BCM
Seepage and Evaporation at Farm
Evaporation

Seepage and Evaporation
Outfall to Sea 49 BCM

* Seventy Years Average
1.23 BCM = 1 MAF
The HKH region, the “water tower”

- Largest reserve of snow and ice outside the polar regions
- 54,000 glaciers; 60,000 km$^2$ area; 6,000 km$^3$ ice volume (ICIMOD, 2011)
- ~0.76 million km$^2$ snow cover
- 10 river basins; 6 trans-boundary
- Serves 1.3 billion people
The Indus Basin

- Basin area 1,140,000 sq.km.
- Pakistan (47%), India (39%) China (8%) and Afghanistan (6%)
- Most glaciated river basin
- Indus: 21,192 km$^2$
- Glaciation 35.3 % of basin area
The Indus Basin

- Water resources highly dependent on melting of snow and ice
- Already water scarce (978 m$^3$/person/yr)
- Large water dependent population (~215 million)
- Largest irrigation system (major part in Pakistan)
- Supply driven system, in great need of better management
<table>
<thead>
<tr>
<th>CATEGORY</th>
<th>AREA (MH)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Geographical Area (total area)</td>
<td>79.3</td>
</tr>
<tr>
<td>2. Area suitable for agriculture</td>
<td>31.2</td>
</tr>
<tr>
<td>3. Irrigated + Barani</td>
<td>22.1</td>
</tr>
<tr>
<td>4. Irrigated area by all sources</td>
<td>18.0</td>
</tr>
<tr>
<td>5. Additional area that can be brought under irrigated agriculture</td>
<td>9.2</td>
</tr>
</tbody>
</table>
Hydropower perspective

• Hydel power capacity potential 80000 MW
• Current capacity 6500 MW
• 1000 mw capacity on our rivers generate annual average 4.6 billion units of power
• 10000 mw will generate 46 billion units of power annually at Rs 2 per unit (as a by product of a multipurpose dam).
• The annual cost of producing equivalent power from Diesel/furnace oil will be Rs 500 billion at current prices
Climate Change in Indus Basin

• The basin is experiencing the Effects of Global Warming & Climate Change
• Rising trend in temperatures
• Increasing extreme weather events
• Decrease in Glaciers and snow covered Area
What we need to do

• Understand the climate change in UIB
  – Climate monitoring, modeling
• Better understand the glacier dynamics
  – Glacier monitoring (in-situ, remote sensing)
• Understand CC impacts on hydrology, water related hazards, ecosystem and livelihoods
  – Impact studies, modeling, social studies

Coordination and sharing is essential
PAKISTAN (RAINFALL)

- Pakistan is one of the world’s most arid countries – over 75% of its area it receives rainfall less than 250 mm annually and 20% of it less than 125 mm. Almost 14 MAF is the total contribution from rainfall. The population and economy are therefore heavily dependent on annual inflows into Indus River System of about 154.88 MAF of water mostly derived from snow and glacier melt, to that is added a large amount from groundwater
The Indus Aquifer

• Punjab is underlain to depths of 1,000 feet or more by unconsolidated alluvium, which was saturated to within a few feet of land surface by the early sixties.

• The alluvium varies in texture from medium sand to silty clay, but sandy sediments predominate.

• Large capacity wells, yielding 4 cfs or more, could theoretically be developed almost everywhere.

• Ground water occurring within a depth of 500 feet below the surface averaged less than 1,000 ppm of dissolved solids throughout approximately two-thirds of the Punjab
The Indus aquifer (Contd)

- Usable ground water in storage in this part of the alluvial aquifer is approximately estimated to be of the order of 2 billion acre-feet.
- In the other one-third total dissolved solids range from 1,000 to about 20,000 ppm
- This ground-water reservoir underlying the Punjab is a valuable resource of enormous economic value and its scientific management holds the key to prosperous irrigated agriculture in the Indus Basin and provides resilience to water availability and use in the basin and hence provides considerable protection from CC impacts.
Challenges of Groundwater Management

- Nature of occurrence of groundwater in the Indus aquifer is complex.
- Depletion due to overdraft.
- Quality deterioration.
- Water logging and secondary salinization due to poor drainage and unregulated conjunctive use.
- Groundwater pricing and energy issues.
- Groundwater governance.
22% in Punjab and 78% area in Sindh has saline GW. About 70% pump sodic water. Exploitation in FGW areas causing intrusion of saline water. About 4.5 Mha are salinized, 2.7 only in Punjab.
INDUS BASIN WITH ITS RIVER SYSTEM

<table>
<thead>
<tr>
<th>AREA</th>
<th>Presently Irrigated Areas</th>
<th>Ongoing Schem</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sindh</td>
<td>6.5 MA</td>
<td>1.0 MA</td>
</tr>
<tr>
<td>Punjab</td>
<td>33.4 MA</td>
<td>1.5 MA</td>
</tr>
<tr>
<td>NWFP</td>
<td>2.3 MA</td>
<td>0.5 MA</td>
</tr>
<tr>
<td>Balochistan</td>
<td>2.2 MA</td>
<td>0.8 MA</td>
</tr>
<tr>
<td>TOTAL</td>
<td>44.4 MA</td>
<td>3.8 MA</td>
</tr>
</tbody>
</table>
Indus River System (IRS)
## Key facts and figures – Indus Basin

<table>
<thead>
<tr>
<th>Infrastructure</th>
<th>Count</th>
<th>Name of Structures</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of Reservoirs</td>
<td>3</td>
<td>Tarbela, Mangla, Chashma,</td>
</tr>
<tr>
<td>Number of Barrages</td>
<td>16</td>
<td>Sulemanki, Islam, Baloki, Marala, Trimmu, Panjnad, Sukkur, Kotri, Tauns, Guddu, Chashma, Jinnah, Sidhnai, Rasul, Qaderabad</td>
</tr>
<tr>
<td>Number of Headworks</td>
<td>2</td>
<td>Mangla, Khanki</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Infrastructure</th>
<th>Count</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of Link Canals</td>
<td>12</td>
</tr>
<tr>
<td>Canal commands</td>
<td>44</td>
</tr>
<tr>
<td>Water diversions to canals</td>
<td>105 MAF</td>
</tr>
<tr>
<td>Ground water extraction</td>
<td>42 MAF</td>
</tr>
<tr>
<td>Avg. Escapage to sea</td>
<td>32 MAF</td>
</tr>
<tr>
<td>Number of water courses</td>
<td>107,000</td>
</tr>
<tr>
<td>Length of canals</td>
<td>585,000 Kms</td>
</tr>
<tr>
<td>Number of tube wells</td>
<td>Million +</td>
</tr>
<tr>
<td>Canal-irrigated area</td>
<td>36 MA</td>
</tr>
</tbody>
</table>
Important characteristic of flow in Lower Indus basin

• Almost 80 percent of the flows into the basin are transboundary
• About 75-80 percent of the river flows happen to become available in three months in the summer. During the rest of the year it’s a trickle,
• The basin cannot sustain perennial supplies without adequate storage in the system
• Of these flows again almost 70-80 percent is from glacial melt
• Therefore what happens to the glaciers due to CC will profoundly affect water availability.
Per Capita Storage Capacity in different Countries

<table>
<thead>
<tr>
<th>Country</th>
<th>Cubic Meters per Capita</th>
</tr>
</thead>
<tbody>
<tr>
<td>USA</td>
<td>6000</td>
</tr>
<tr>
<td>Australia</td>
<td>5000</td>
</tr>
<tr>
<td>China</td>
<td>2000</td>
</tr>
<tr>
<td>Spain</td>
<td>1500</td>
</tr>
<tr>
<td>Morocco</td>
<td>1000</td>
</tr>
<tr>
<td>India</td>
<td>500</td>
</tr>
<tr>
<td>Pakistan</td>
<td>500</td>
</tr>
<tr>
<td>Ethiopia</td>
<td>50</td>
</tr>
</tbody>
</table>
Indus Waters Treaty

• Signed in 1960 and took 10 years to conclude
• Gave three eastern rivers (Sutlej, Ravi and beas) to India and three western to Pakistan (Indus, Jhelum and Chenab)
• All the waters of eastern rivers were allowed for exclusive use by India
• All the waters of the western rivers without any restriction was allowed to Pakistan for its use except some domestic agricultural non consumptive and hydro electric uses in India
Limits to uses by India of waters of western rivers

- The treaty imposes restrictions on agricultural and hydropower generation which are stipulated in annex C and D. India shall not store any water of, or construct any storage on, the western rivers. Article 4 and annex C D and E list the conditions under which India’s uses from western rivers are to be ensured.
- India’s uses for hydropower was one of the most contentious issues in the negotiations.
- As in most such cases it’s in interpretation of letter and spirit of the Treaty that have raised issues.
History of issues in Implementation

- Salal dam 1974
- Wullar barrage/ Tulbul Navigation Project 1986-1987
- Baghliar 450 MWs 1999
- Kishinganga Hydro electric Project 900MWs 2004
- Pakistan has raised objection on many other projects as well.
Emerging Issues and concerns

- Decreasing flows in the western rivers
- Climate Change and its impacts in upper and lower parts of the basin
- Institutional weaknesses on both sides but more so on our side
- Groundwater management and its quality
- Environmental flows
- Insufficient technical information and analysis on likely impacts of growing number of hydroelectric projects proposed by India on western rivers
- Water shed management of western rivers
- Grossly inadequate storage in the system
- Deteriorating quality of water coming down natural drainages and river system from upper riparian sources
Shortcomings of IWT

• No provision for decreasing flows in the system due to climate change
• Pollution of water from industry agriculture and deforestation
• Watershed management of western rivers
• Environmental flows of eastern rivers in Pakistan
• Groundwater
Some strengths of IWT

• It has withstood test of time including three wars
• It has a robust dispute resolution system
• The fact we have a Treaty is great strength in itself
• It has provision for joint development of mutually beneficial projects (obviously this can only happen when there is trust)
• At this point in time unfortunately that trust is at its lowest because diplomatic relations are in poor state between the two countries, and that is also where the weakness of the treaty also lies.
Does track II process help?

• Open discussions in track II brings out new ideas more freely, brings clarity to issues and when required facilitates agreement to investigate them more.

• There is a view that this should continue and be encouraged so that useful spadework is already done to help decision makers improve their understanding so it could lead to better implementation of the Treaty.

• More broadly there is also need for talks among professionals and opinion makers at large, based on good science and sound practices, to facilitate a better understanding of the issues and options on both sides.
Conclusions and suggestions

- The very large existing financial investment in water and hydropower infrastructure provides untapped potential for public and private sectors to draw on for developing land water and energy sectors in an integrated manner.

- We have failed to leverage this infrastructure and denied Public Private Partnership to play its useful role.

- Besides large infrastructure projects, smaller and more micro investments in village ponding structures, micro hydel projects, small dams, water harvesting etc can address local water shortages and enhance water security in vulnerable areas of the country (GB, KPK, Baluchistan) but the larger storage deficit in the system will essentially require major storage facilities.
Conclusions and suggestions 2

• Move away from business-as-usual.
• Climate change influences should be recognized and mainstreamed in policy planning and implementation.
• River basin management approach be followed.
• Benefit sharing in reaching agreements between provinces provides best hope for legislative and institutional arrangements for the future.
• Fewer and more empowered water management institutions are required which all stakeholders believe in and trust.
• Principle of subsidiarity and stakeholder involvement needs to be followed in water usages.
• Financial sustainability of operating systems needs to be ensured at all levels.
Conclusions and suggestions 3

• Irrigated agriculture, the largest user of water needs to be more efficient. Related policies must provide for incentives for water savings. The saved water to be taken to new areas that have no water and are poor.

• For productivity gains greater integration of agriculture and water institutions at all levels is needed
Conclusions and Suggestions

- Water discourse needs to be redefined with focus on more stakeholder participation at all levels,
- Water savings, water savings and water savings
- Prevention of pollution of water bodies
- Good salt management in the basin,
- Regulated and prudent use of ground water,
- Equity and access to water for human consumption,
- Vastly improved service delivery in all aspects of water development and use,
- A fresh discourse on benefit sharing among the provinces
- Water as socio economic and environmental good and
- Good science and best practices for better water management
- Water institutions of the future will only be viable if they succeed in effectively serving the above mandate.
Conclusions (contd)

• Better water management will bring resilience and since most manifestations of climate change (floods droughts and other extreme events) are reflected in water, improved water management will allow greater capacity to absorb climate shocks when they come locally and also nationally.

• Pakistan’s economy is basically a water economy. If we manage its water resources well it will flourish otherwise poverty will remain rampant and our aspiration for prosperity will only languish.

• We urgently require to prioritize actions under the new water policy and have a implementation plan in place soonest. Political commitment is important.
Indus Basin as granary for South Asia

• ThIndus basin is a excellent case for greater system analysis and more good science to make into a truly global laboratory for irrigated agriculture (Robert McNamara)

• Then strengthen link between science and the farmer to facilitate his uptake of the resulting technologies

• The Indus Basin will then have the potential to become the granary for all of South Asia

• This is the model we need to work towards
Thank you