Bridging science & policy in water management

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Water sustains life
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- Human rights to water vs. water rights. (article 25 UN declaration of human rights)

- Water as commodity threatens the poor

- Privatization policy on developed and developing: Neoliberalism.

- Soaring water prices: basic right to basic need.
Water sustains life

• Economic globalization is to blame for water crisis.

• Water regimes based on watershed management and conservation.

• Global water crises in quantity and quality is man-made disaster.

• Environmental imbalance and degradation of life –support ecosystem.
Crisis of water management
Crisis of water management

- Inadequate sustainable policies.
- Fragmented institutions
- Absence of legal system.
- Absence of political will.
- Gap between science & policy.
Crisis of water management

- Public water budget is constrained.
- Water investment is poorly targeted.
- Funding for pollution regulation is insufficient.
- Control over aquifer use is lacking.
- Rain-shed harvest is neglected.
World population stress
World population stress

- Already one third is living in water-scarce areas.
- Rapid population growth lead to environmental degradation and inadequate water supply and sanitation service being overloaded.
- Water supply sources stretched to its limits.
- Surface and ground water pollution is increasing.
- In 20th century world population tripled (7 billion) use of water grew six fold.
World population stress

• By 2050, additional 3 billions will be born mostly in water scarce countries.

• It is the poor, who suffer the most. 1.2 billion without access to safe water, 2.6 billion without basic sanitation.

• Annual people dying 1.8 billion of unsafe water.

• Hunger and malnutrition 1 billion.
Climate Change Stress
Climate change stress

• By 2050, half people on our planet will be living in water scarcity.

• IPCC notes that climate change, water availability may decrease by 25% in arid region, which is already water-stressed.

• Water glaciers to decline where one-sixth of world population resides.

• In Asia, crop yields to decline by 2.5-10% by 2020 and 132 million could be at risk of extreme hunger by 2050.

• Arab countries may suffer 25% decrease in precipitation and 25% increase in evaporation as a result of 3°C rise in temperature.
Water policy: pricing and subsidies

- Free water is wasted water.
- Pricing for domestic, industrial, agricultural may lead to efficiency, and resource conservation.
- Investment demand by In’t bodies and private sector.
- Governments resist pricing and out-subsidies.
- Ascend pricing from poor to middle class to the wealthy.
- The poor pay higher prices for poorer quality water from street vendors.
Water policy: science & legal framework

- Technological and engineering solutions not effective without water policy, institutional and legal framework.
- Land and pricing reforms, transparent water rights, economic incentives, regulatory framework, basin management authority, public participation.
- Empowering women and community-based group in the decision-making process.
- Unique water management scheme: efficiency, cutting losses, protecting water from overuse and pollution.
- Integrated approach: water, land, and people for a sound ecosystem, and sustainable management.
Water policy: management of trans-boundary & shared river basins (rights to water)

- 34% of world’s population lives in In’t river basins covering half the planet land surface and contains 80% of fresh water river flow.

- There are 260 shared river basins, in addition to 270 shared underground aquifers shared among 145 countries.

- 2/3 of renewable water resources in Arab countries originate from sources outside the region. Shared management of downstream with upstream countries is imperative.
Management of shared aquifers or water shed areas or water basins among countries of shared basins.

Drawing on UN convention of the “law of non-navigational uses of international water”. Water scarcity will increase tension among countries of shared basins. Therefore, establishing database for managing shared water resources and build science policy for economic development and cooperation is a must among countries of shared basins.

Shift future conflict toward “share and care” in building “peace for development”.

Water policy: management of trans-boundary & shared river basins (rights to water)
Water policy: water-loss

- Water leakage and water theft of the network distribution of water estimated at:
  - 13% in Europe.
  - 15% in USA.
  - 25% in Turkey.
  - 35% in Arab region.
- Computerized “smart distribution network” to wipe out loss is priority.
Water capacity among nations: UN classification

- **Rich water** countries who secure 8000 m³/capita/year.
- **World average** is 6000 m³/capita/year.
- **Severe water scarcity** is below 500 m³/capita/year.
- 13 Arab countries among world’s most water scarce nations.
- In 8 Arab countries water availability is less than 200 m³/capita/year, less than half UN-designated water-severe country.
- 45 million in Arab countries lack access to clean safe water.
Water capacity: wastewater treatment & reuse

- In Arab countries 10 km³/year of which 5.7 km³ undergoes treatment and 1/3 is only reused.
- 43% of annually generated wastewater is discharged untreated.
- Untapped wastewater treatment and reuse require appropriate policy intervention, national strategy, economic analysis and scientific knowledge to develop best practices in lost recovery, professional training and public awareness.
- In semi-arid water scarce zone, all wastewater should be treated and reused.
Water capacity: desalination

- Arab countries with 5% world population, have 50% share of world desalination capacity.
- By 2016, desalination capacity will be doubled.
- Annual investment by next decade, will reach from $15-$20 billion in Arab region.
- Currently, 25% of Saudi oil and gas used to generate electricity and water. By 2030, will rise to 50%, if current subsidies continue.
- Tariffs' covers 10% of cost.
- Gov’t policy should shift to regulatory function and let desalination industry encompassing design, manufacture, operation & R&D to the competitive private sector.
Sustainable management of a scarce resource: science & water management

- Science is crucial for sound management and governance in enlightened water policy.
- R&D in water science has great potential in finding solutions for a limited source.
- In scarce countries, culture of wise use of water should be brought with education from childhood to become a culture of efficiency, cutting losses, protecting from pollution and overuse, recycle.
- Healthy use of residential rain-shed reservoir.

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Sustainable management of a scarce resource
Sustainable management of a scarce resource: R&D policy

- The economic summit in Kuwait 2009, by heads of states, has placed three top priorities for R&D in the Arab countries as security:
  - Energy
  - Water
  - Food security
- Not seriously incorporated in Arab national policies with well-defined strategy and plan of action.
Sustainable management of a scarce resource: science potential in water policy

- Steer financial allocations whether governmental funding of international cooperation, university & graduate research, R&D on energy-water-food nexus **triangle**.

- Establish long term strategy across changing governments and parliaments **on science and policy in water management and steer funding** on R&D of the **triangle**, incubate delivery of R&D, transfer through technopark.

- Start up companies around, the **triangle** in technoparks. Seek venture-capital and joint-venture regionally & internationally.
Sustainable management of a scarce resource: science potential in water policy

- Develop a network on the triangle among research institutions and universities at the local, regional and global levels.
- Hold an annual science conference for updates on frontier areas of science related to the triangle.
Science potential for sustainable water policy

Unlimited potential what science can do on our planet, where salt water comprises 97.5% of planet waters, and fresh water of 2.5%: 70% tied in polar caps, and of what is left to humanity only 30% in rivers, lakes and ground water.
Science potential for sustainable water policy

- At the global level (R&D)
  - Nanoscience in seeds clouding
  - Monitoring climate change.
  - Nanomembrane in diffusion technology.
  - Sufficient RO’s for harvesting fresh water from oceans & seas.
  - Nanosolar technology for renewables, for sustainable desalination (50% of world desalination in Arab region)
Science potential for sustainable water policy

- At the regional level - continue
  - Remote sensing of water basins and aquifers.
  - Monitoring shifts of shared water of river basins and ground water.
  - Monitoring pollution by upstream countries.
  - Creating a network of science centers and universities of shared river and aquifer basins for sharing data and working together R&D on the triangle.
Science potential for sustainable water policy

- **At the regional level-continue**
  - Create stronger economic and political ties among countries of the shared water-basins leading to peace rather than conflicts.
  - 2/3 of water resources of Arab countries originate from sources outside the region.
Science potential for sustainable water policy

- At the national level
  - Water governance with stakeholders participation.
  - Expand public-private partnership (gov’t-NGO’s)
  - Remote-sensing to identify new water underground rivers and basins.
  - Share information between policy makers and authorities.
Science potential for sustainable water policy

- At the national level—continue
  - R&D for efficient agricultural and irrigation techniques, protected plasticulture etc…
  - R&D on genomic crops, utilizing less water, or new cultivars tolerant to aridity and salinity-stressed physiology.
  - Adopt science-based agricultural practices.
  - Acquiring water virtually through crops from rich-water countries, and concentrate on high value added crops that generate foreign exchange, through well-balanced trade policies. i.e:
    - 1 kg wheat needs 1000 liters of water.
    - 1 kg rice needs 1400 liters of water.
    - 1 kg red meat needs 13000 liters of water.

There is enough water resources of water in the world, but distribution, management and pollution make it unavailable to the masses.
Science potential for sustainable water policy

- At the national level-continue

  - Rich countries provide annually 8000 m³/capita, while scarce-water countries provide annually less than 1000 m³/capita. Distribution of water among sectors in Arab region:
    - 70% agricultural
    - 20% industrial
    - 10% domestic
  - Agriculture in Jordan consumes 80% of water resources.
  - Agriculture in Turkey consumes 74% of water resources.
  - Agriculture in OECD consumes 40% of water resources.
Science potential for sustainable water policy

1. Rainfall distribution of water in Jordan

- 8200 million m$^3$ annual rainfall, 80% loss to evaporation.

- 1640 million m$^3$ annually left:
  - 510 million m$^3$ surface water.
  - 200 million m$^3$ ground water.
  - 860 million m$^3$ soil moisture.
  - 70 million m$^3$ reclaimed water.

2. Jordan share from transboundary annually:

- 80 million m$^3$ Yarmouk transboundary basin (original 296 million m$^3$).
- 60 million m$^3$ Tiberias.
- 68 million m$^3$ Syrian-Jordan underground basins.
- 100 million m$^3$ Saudi –Jordan basin underground (Disi).

Total: 1948 million m$^3$ annually (314 m$^3$/capita/yr).

Source: M. Haddadin, Jordan research Journal No. 3, 2011
Thank you