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A REVIEW ON: IMPORTANCE OF WATER AND ITS SAVING AT ALL LEVELS

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Abstract

Earth is only known planet on this universe where life is possible only because of availability of water and oxygen. The sustainability of each living thing depends on water because this is critical nutrient of each living thing. We also know that very less percentage of clean water/drinking water is available on the earth. The resources of the fresh water are limited and the users are increasing day by day in the form of domestic use i.e. (drinking, cleaning, cooking, due to increase in the demand of food and fiber) and industries to meet the requirements of human beings. In Pakistan it is not only the agriculture sector where the aquifers are under increasing stress, but many of the major cities other than Lahore (within and outside the irrigation system) are facing water supply sustainability issues due to increasing population and industrialization, especially the urbanization phenomenon. It is a fact that the country is continuously approaching the low-level limits of water availability, which is presently 915 m^3/person/year.

Due to almost pause regarding development of large dams and sedimentation of existing reservoirs, the additional water consumption is being met from the aquifers; as a consequence unprecedented depletion and quality deterioration of the resource is an emerging issue. The emerging situation of excessive groundwater depletion in certain other areas e.g., lower and central parts of Bari Doab and urban area of Lahore district in Punjab, with depletion rates of 16-55 cm/year and 40-150 cm/year, respectively. Similarly, people in Thar are constantly facing food and water shortage situation since many years.

Environmental flow requirements are also an emerging issue due to urban effluent disposal in dry river reaches. Therefore, the current situation of increasing water demands, calls for integration of water demand and supply within and across all the water use sectors, in addition to the construction of large dams by the Federal Government. In this regard, the provinces would also have to take some concrete steps, otherwise extra ordinary waterlogging, groundwater depletion and quality deterioration is expected to continue and even increase in many areas.

It is concluded that the current water diversion capacity of the Indus Basin for agriculture and other water uses is unable to meet current and future water demands. Thus, construction of additional mega dams and adopting integrated water resources management (IWRM) principles for overall water management at Indus Basin Irrigation System (IBIS) scale is the only option for sustainable water

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management. Also, public awareness raising for conservation of water both at political and masses levels is recommended.

Keywords: Freshwater, groundwater, water quality, depletion, aquifer, mega dams

Introduction

Pakistan is continuously moving towards a serious water crisis. The experts are expecting that Pakistan will decline from water stressed to water scarce country by 2030, the reason behind this, misuse and overuse of precious gift of Almighty Allah. The country is facing declining water availability and quality, growing water pollution, and overall environmental insecurity. Water is essential, whether for livelihoods, health, food security, or general economic development. In Pakistan, population growth, elite capture of public benefits, rapid urbanization, and shifts in production and consumption patterns have placed unprecedented stress on water resources. The increasing pressure over water use and misuse is fostering domestic discord. However, it is clear that water scarcity, floods, droughts, and domestic mismanagement can embitter inter ethnic relations and prompt political tension, which can in turn lead to violence. In a country that depends heavily on water for livelihoods, addressing water scarcity problems can alleviate much of the economic and social vulnerabilities that render Pakistan so unstable. Effectively managing water resources and use can create an avenue for rebuilding trust, confidence, and cooperation between the various water stakeholders. If water quality could be maintained, the paucity of water can be better managed and tensions may subside. The country is expected to become water scarce that is less than five hundred cubic meters per capita per year by 2035, some analysts even predicting by 2030. This alarming prediction is derived from a growing population, inefficient supply management, distribution inequalities, and the effects of climate change. Despite uncertainty surrounding how quickly water resources are being depleted and what future populations and industries may need, it is clear that Indus Basin water is insufficient.

Water Availability and Demand

Pakistan is one of the most arid countries in the world. Most of its water supply comes from a single source, the Indus system, which is composed of six major tributaries: the Indus, Chenab, Jhelum, Ravi, Beas, and Sutlej. Glacier melt, snowmelt, rainfall, and runoff supply river flows. Rainfall averages around 494 mm a year and derives mainly from summer monsoons. Precipitation is unevenly distributed and greatly varies by season. The estimated long-term basin-wide surface water availability is approximately 194 to 209 million acre-feet (MAF), of which 142 MAF is extracted in Pakistan. Average renewable water availability is about 154 MAF, of which 45 MAF is from groundwater.

Effective Water Management

Effective water management requires a strategy that integrates institutions, policies, skills, and technology to foster conservation, efficiency, productivity, and

disaster relief. A collaborative approach that embraces all stakeholders is needed to ensure that altering water supplies will meet future requirements. Thus far, Pakistan's water stress has been explained in terms of supply and demand, address the institutional inefficiencies, governance weaknesses, and political deadlock.

The Indus basin system is the largest contiguously irrigated area in the world. By any measure, it is also the product of one of the largest hydraulic interventions in history. The canal colonies of southwest and central Punjab were the centerpiece of a massive social engineering project that built thousands of KMs of canals between 1885 and 1947 in an arid landscape. More than one million people migrated to the nine canal colonies, and the region is today one of the most densely populated and agriculturally productive in South Asia.

Indus Water Treaty-1960

British colonial rule was followed by decades of disputes over water infrastructure and allocations between Pakistan and India. To pre-empt any water wars, the two countries signed the Indus Water Treaty (IWT) in 1960. The agreement divides the Indus River system into the Western Rivers—composed of the main stem of the Indus, the Jhelum, and the Chenab—and the Eastern Rivers—the Ravi, the Beas, and the Sutlej. An average of about 138 MAF flows annually into Pakistan in the Western Rivers. The vast majority of surface water extractions are made from the Western Rivers, where flows are measured by "rim stations" at Kalabagh for the Indus, Mangla for the Jhelum, and Marala for the Chenab. More than 80 percent of the annual flow of the Western Rivers occurs in the three *kharif* (summer) months.

Current Water Withdrawals and its Utilization

Current water withdrawals in Pakistan total about 142 MAF. Approximately 71 percent of withdrawals are from surface water and 29 percent from subsurface groundwater. Withdrawals from surface water account for about 74 percent of the total surface water available, and withdrawals from groundwater account for 83 percent of total renewable groundwater available. River flows in Pakistan are highly uneven temporally, and year-round agricultural requirements depend on adequate storage capacity. However, the Indus' massive irrigation system has a storage capacity of only 121 MAF per year, or a thirty-day supply. This capacity is extremely low given that India can store for 120 to 220 days, Egypt up to 700 days, and the United States for 900 days. A little less than half of Pakistan's population depends on irrigated agriculture for their livelihoods, and one-third lacks access to safe drinking water. Ninety-seven percent of annual available surface water goes toward irrigation to support agriculture. Because Pakistan's transition to an urban and industrial economy is likely to continue, its competition with agriculture for water resources is likely to increase. Evidence points to a widening gap between water supply and demand. The UN estimates that water demand in Pakistan is growing at an annual rate of 10 percent. That is, demand is projected to rise to 274 MAF by 2025. This said, total water availability by 2025 is not likely to change from

the current 191 MAF. This gap of about 81 MAF is almost two-thirds of the entire Indus River system's current annual average flow.

Groundwater Usage

The main source of drinking water in Pakistan comes from groundwater. Below the rim of the Himalayas lies one of the largest freshwater aquifers in the world. The groundwater footprint for the Upper Ganges Aquifer, which sustains both India and Pakistan, is more than fifty times its size and is one of the most overexploited aquifers in the world. Pakistan's subsurface groundwater resources amount to about 51 MAF, most of which lie in Punjab. A substantial amount of the available water diverted in the Indus basin canal system refills the groundwater reservoir. Farmers depend on groundwater to supply about 40 percent of their irrigation water demands. Rates of groundwater exploitation have increased rapidly in the past several decades, and some areas, mainly Baluchistan, are mining aquifers beyond their capacity for natural replenishment. Aquifer mining is supplementing the surface water that reaches Pakistan's farmland, but this indiscriminate pumping and heavy use of pesticides are contaminating the aquifer, whereas marginal quality tubewell water is also increasing salinity in the soils. Although evidence of exploitation is clear, tens of thousands of additional wells continue to be serviced every year. Both the government and donors have failed to reengineer their capacity and funding to deal with groundwater depletion.

Water Pollution and Reduction in per Capita Capacity

Some studies paint a dreary picture of the pervasive pollution of water bodies around industrial estates and urban areas with heavy metals and untreated sewerage. Around 90 percent of industrial and municipal waste, which is largely untreated and often highly toxic, is dumped into open drains and filtrated into aquifers. Natural aquifer cleansing takes decades, even centuries. Furthermore, in Pakistan, which has the twenty-sixth highest infant mortality rate in the world, more than 60 percent of those deaths are caused by waterborne diseases. The effects of water pollution on public health and human security are obvious. Whether they will also translate into threats to peace is an open question.

In terms of per capita availability in Pakistan, the water supply picture may seem worrying. The temporal, spatial, and social distribution of water, which ought to be of greater concern. Water security problems in the country are often presented as an excess of demand over supply, but a deeper understanding of water scarcity must historically contextualize systems of supply and demand. In other words, water supply and demand are not exogenous variables. Rather, the magnitude and nature of supply and demand in any given region have developed as a part of a region's history and geography. Water supply and demand are important in considering water security, not just because of the necessity of respecting absolute ecological thresholds but also because effective policy changes must recognize their deeply social nature. The historical and political economic context through which water demand and supply are established gives us the means to reframe

the water scarcity debate and, thus, the connection between water scarcity and water security. Following table shows the non-agriculture demand with time.

Table-1 Nonagricultural Water Needs (millions acre-feet)

Detail	Years		Addl. Requirement
	2000	2025	
Water supply and sanitation	4.5	10.5	6.0
Industry	2.2	3.5	1.3
Environmental protection	1.3	1.7	0.4
Total	**8.0**	**15.7**	**7.7**

Source: National Water Policy, GOP

Groundwater Depletion in Baluchistan

The groundwater situation in Baluchistan is already tenuous, and the ongoing insurgency in the province is not helping. If the groundwater keeps declining at current rates and laws regulating groundwater pumping continue to be flouted, groundwater may run out in the urbanized Quetta valley. The Pakistan army, which has large installations in the valley, already has contingency plans for evacuating its installations due to the water situation worsen there. Groundwater depletions have already had some adverse social consequences in Baluchistan. The economy of Baluchistan has always been heavily rural and dependent on agro-pastoralist activities. Because the province lies in an arid zone, the region is almost entirely dependent on groundwater to sustain agriculture and rural livelihoods. The main conduit for tapping groundwater had been the traditional *karez* system. A *karez* is an underground aqueduct that passively taps the groundwater in the piedmont and carries the water by gravity to the "daylight point," where the water is then channeled into irrigation ditches for agricultural and domestic uses. The system is environmentally sustainable because it only passively taps the groundwater and cannot cause overdraft, unlike electric pumps. Beyond the importance of environmental sustainability is the significant social capital that crystallizes around the infrastructure of a *karez*.

In the name of agricultural modernization, electric water pumps were introduced to the region in the last three decades of the twentieth century, along with heavy subsidies of electricity for their use. Many of the larger, more powerful farmers in the region were able to access these tubewells and expand agricultural production. However, the electric tubewells have led to rapid declines in the water table, particularly in Pakistani and Iranian Baluchistan, leading to the decline of the *karez* system. Even though the agricultural production is increasing, many of the old *karez* shareholders' water shares are becoming unviable because their *karezes* have gone dry.

Groundwater Depletion in Punjab

Water Contamination Issues Water contamination causes serious health problems, particularly for women and children. Furthermore, although water crises

affect women and men in different ways, it has been widely argued that women suffer disproportionately. The human security of women and children has been adversely affected in particular, because they are responsible for collecting water and are often unable to leave the boundaries of their villages due to cultural reasons, whereas men can travel further to obtain safer sources. The human capital effects of water-related environmental risks amount to at least half of the country's wage losses of 8.8 percent of GDP. The outbreak of dengue fever in Pakistan in the summers of 2011 and 2012 caused considerable public outcry, particularly in the provincial capital of Lahore. In the light of climate change and continuing poor water drainage and sanitation conditions, the threat to public health in Pakistan from waterborne diseases is likely to be further accentuated.

Climate Change and Environmental Hazards

Scientific uncertainty regarding glacier retreat and consequent long-term water availability in Pakistan is considerable. Analysts tend to agree that past patterns and timings of water availability are unlikely to continue into the future. The key climate change challenges in the Pakistani water sector are timing, location, and intensity of flood and drought hazards, which affect economic security and test institutional response and preparedness. The recent floods are a stark reminder of the type of challenges and the level of natural disaster intensity that climate change could bring. In 2010, the country saw unprecedented monsoon rainfall in the northwest of the country, an area outside the monsoon zone. Populations and infrastructure that had never been exposed to those levels of precipitation suffered equally unprecedented damage. More than 21 million people were affected and about 1.8 million homes damaged or destroyed. Floods in Pakistan are generally man-made phenomena, largely because of the highly regulated hydrology of the basin. Most major inundations of human habitations in the basin are a consequence of the breaching of side levees to release pressure on barrages and other diversionary infrastructure in the basin during floods. The operation of breaching sections has been deemed a purely technical matter, but more often than not it is also a political process. All infrastructure in the basin has a safe designed capacity for the flow of water, and once that capacity is exceeded, a breaching section upstream from the barrage is operated to relieve pressure.

Challenges to Effective Water Management

Effective water management requires a strategy that integrates institutions, policies, skills, and technology to foster conservation, efficiency, productivity, and disaster relief. A collaborative approach that embraces all stakeholders is needed to ensure that altering water supplies will meet future requirements. Thus far, Pakistan's water stress has been explained in terms of supply and demand, but the crisis haunting the state is rooted in unsustainable practices and gross mismanagement. Unless serious changes are made to address these institutional inefficiencies, governance weaknesses, and political deadlock, Pakistan may witness upsurges in resource based violent conflict. Yet successful reforms could be the key to more harmonious interactions.

Governance

Pakistan's governance patterns may be one of the biggest factors preventing effective water management. Its regulatory and institutional deficiencies are increasing tensions among stakeholders, who are failing to communicate and cooperate with each other to overcome the weak policies and enforcement mechanisms of the water sector. Most alarming is a seemingly general apathy toward changing current policies and practices. Water disputes in Pakistan are chronic. The perennial irrigation water shortages create conflict between provinces, with each accusing the other of bad faith and duplicity. The lack of water laws that define water rights often pit users against each other; land ownership rather than water use serves as a proxy for water rights. Water bureaucracy in Pakistan is also notoriously corrupt due to both the ineffective internal administrative checks on decisions made by irrigation bureaucrats and the pressure for these bureaucrats to accommodate large landowners, who are often politicians. A reported 25 percent of farmers have acknowledged paying bribes to irrigation officials for water. These officials have almost total discretion in deciding water entitlements.

The storage capacity of the Indus basin irrigation system, which commands thirty-four million acres for irrigation, is only about 121 MAF per capita per year, or a thirty-day supply. Existing dams are rapidly silting, with Mangla and Tarbela losing about 25 percent capacity since they were commissioned in 1967 and 1976. Furthermore, water losses from within watercourses and between canal heads and watercourses amount to about one-third of the total amount of delivered water; an additional 25 percent is lost within farms. Poor management and distribution of irrigated water translate to only 45 percent of cultivable land being farmed at any given time. In other words, Pakistan currently uses 97 percent of its allocated water resources to support one of the lowest productivities in the world per unit of water. Although dams contributed to turning arid land green and offered productive benefits at the outset, the water realities of today render their current use unsustainable. By treating water as a raw material, technical solutions are deployed to harness the water's fullest capacity, which ignore the shortfalls and constraints in water supply and funds for operation, maintenance, and investments. Simply repairing and maintaining Pakistan's existing canal systems could free an estimated 76 MAF of water.