WATER AND ENERGY SECURITY FOR PAKISTAN A RETROSPECTIVE ANALYSIS

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ABSTRACT

The water resources in Pakistan are sharply declining due to average annual increase in population and the changing geo-political landscape. The long term resolution lies in cautious expenditure of water and consciousness to preserve. This resource consciousness ultimately derives strategies for better management of water and its associated usage as both together can have far reaching effects for consumption of water and its use for electricity production as mainstay of Pakistan's energy needs. The authors have made an earnest endeavor to notify the significance of fresh water, rapid depletion of its resources and the serious hazards affiliated with this phenomenon. The research paper encompasses a detailed evaluation of available statistics of water flow in the river system, its storage in glaciers and manmade reservoirs. The paper also dilates upon challenges linked with climate change, water shortages, insufficient storage capacities and weak management of available resources. Towards the end, the author has offered a way forward to make best use of available resources and ensure water security in the country. This is an academic undertaking; therefore, the views articulated in the article are those of the authors.

Keywords: Climate changes, Depletion of water resources, Conservation, Water Management, Water Security.

INTRODUCTION

With the upsurge in population and continuing speedy industrialization and growing tendency towards urbanization, the ingesting of water has amplified manifold around the world. The changing paradigm has caused a condition of water insufficiency, generally leading to water shortage and crisis, particularly in agro based countries like Pakistan. Where insufficiency of water is likely lead to economic emergency and subsequently eradication of living beings, paradoxically, the excess availability of water due to heavy rains during monsoon or extensive melting of snow accumulated during unusual winters can result into flooding of vast stretches of Pakistan and ultimately leading it into sea due to lack of storage facilities in the form of big dams or small check dams. This recurrent flood situation has caused immense losses to our economy dragging the country back by decades to recover for the losses. Pakistan is challenged by extra ordinary weather conditions, severe occurrences of floods and droughts one after the other resulting into mammoth loss to agricultural, water infrastructure and livestock. The alarming trends therefore, warrant reappraisal of available water resources, their storage and distribution system and smart ways of using water for agriculture and other needs. Efficient water management along with high tech usage is the need of hour to address issues of water scarcity in short and long term.

SIGNIFICANCE OF RESEARCH ARTICLE

In the contemporary arena, the world at large and Pakistan in particular, is facing water shortage due to adverse effects of climate change. In most of developed and advance developing countries, emphasis are being laid on smart use of water most significantly drip irrigation to get maximum per acre yield by using minimum quantity of water. Similarly, these countries are recycling water for bathing and agriculture use to compensate for less availability of water, while concurrently huge capacity for water storage and distribution system. Pakistan is facing multiple problems ranging from water storage, old vintage distribution arteries and lack of technological advancements in the use of water for irrigation. Therefore, is adversely affected by changing climate pattern and fast depleting the water reservoirs in the country. This article highlights inadequacies in our water management and distribution systems and suggests viable course of actions for optimizing the availability of water.

RESEARCH METHODOLOGY

The article has been completed using qualitative and quantitative research methods.

RESEARCH QUESTIONS

Research article has been developed by answering following questions;

Q 1: How far Pakistan is affected by water crisis as a result of irregular global climatic pattern?

Q 2: What is the overall availability of water and storage capacity in Pakistan and how it is affected by changing weather patterns?

Q 3: What are the challenges in meeting the water requirement in the country?

Q 4: What are the best courses of actions available to Pakistan in efficient water management?

BACKGROUND OF THE ISSUE

Pakistan's chief sources of water absorption are rainfall about 50 Million acre-feet (MAF) caused by summer monsoon, westerly winds and river inflows. About 141 (MAF) in the Indus River System (IRS) is fed largely by glacier and snow melt from the Hindukush-Karakoram-Himalayas (HKH) mountain ranges. Pakistan is rated in the list of 36 most water-stressed countries (Reig Paul, Maddocks Andrew & Gassert Fracis, 2013). Per capita water availability has fallen due to population growth, from 5,600 cubic meters at time of independence to the existing level of 1,017 cubic meters, and is anticipated to decay more with depleted infrastructure in present conditions. The per capita convenience of river water, which was 5,650 m3/y in 1951 and 1200 m3/y in 2003, has dropped significantly to 1000 m3/y in 2010 which is expected to fall below 800 m3/y in 2026. Fears over this broadening gap between supply and demand are multiplied due to peculiar features of Pakistan's climate and geography. Both water and energy security has been termed as the most precarious ones for Pakistan. Indus system and associated tributaries are main source of water, which is charged mainly through melting of snow and glacier in the Himalayan region. Availability of water in the Indus system is seasonal, with 85% river flows occurring during the June to September which corresponds with the concentration of rainfall in the monsoon (Khan, M. Suleman, 2015). Management of water is also another challenge to reduce wastage and optimize the storage of water and skillful regulation.

ANALYSIS OF WATER SOURCES IN PAKISTAN

River Flows: The shares of main rivers to the IRS in Pakistan can be approximated as, 44% by Indus, 19% by Chenab, 16% by Jhelum, 16% by Kabul and 5% by others (Qureshi A. Sarwar, 2011). The flow of water during summers in Kabul and Indus rivers are caused by glacier melting from northern area, whereas in Chenab it is jointly contributed by compound effects glacier and snow melting along with monsoon rains, while river Jhelum is fed by monsoon rains and melting of snow.

Rainfall: About 80% of the rainfall in Pakistan occurs from July to September (IMF Report, 2015) which is termed as monsoon pattern, but it is constantly getting into a low adaptation in an irregular pattern every year thus affecting crops and storage system. Due to its peculiar geographical location, heavy monsoon is experienced in northern parts of

Punjab and as result of river flows downstream, the rest of country get water from IRS. However, the rain patterns in monsoon in Punjab and rest of the country is terming inconsistent every year. It is appreciated that adverse effects of climate change will change the monsoon pattern manifolds and also adversely affect the rains during winters.

Irrigation System: Pakistan is out of few developing countries which have a very elaborate irrigation system for supply of river water to farthest extreme of the country with few exceptions where work is in progress. Apart from five rivers, three big dams Chashma, Tarbela and Mangla, elaborate canals and associated tributaries are main sources of water carriage to irrigate the lands. The approximate distribution of water is 3% for industries and domestic consumption and 97% for agriculture (Planning Commission of Pakistan, 2013). Due to agro based economy, main chunk of water is required for feeding the lands, thus warranting efficiency in use of water especially for agriculture use.

Outflow to Sea: With the upsurge in sea level instigated by climate change, the least flow requirements into sea will rise dramatically to prevent outflow of sea spoiling Indus delta region (Planning Commission of Pakistan, 2010). However, such a problem will be multiplied during average or negligible monsoon season, therefore, a paradoxical situation will be confronted to prevent wastage of land due to sea or suffer land going barren due to drought or less water supply.

Reservoir Capacity: As highlighted earlier, Tarbela, Chashma and Mangla are main water storage dams in Pakistan built during 1970s. The continuous flow of silt due to peculiar terrain conditions has depleted storage capacity of all these dams to a great extent (Planning Commission of Pakistan, 2005). The present storage capacity relates to only 9% of the IRS annual flow and is considered far lower with the world average (40 percent), Nile river basin 34%, India 33%, and Colorado river basin 49% (Planning Commission of Pakistan, 2010). Moreover, the water storage capability per dweller in Pakistan is also quite low. The figures show dismal state of 150 cubic meters when compared to China 2,200 cms, Australia and USA 5000 cms (Oxford University Press, 2006).

Melting of Glaciers: Approximately 80% of Indus River system requirements are fulfilled by melting of glaciers in northern parts of Pakistan, which characterize the 3rd largest ice mass on the earth, following Antarctic and Arctic (IMF Report, 2015). The Upper Indus Basin constitutes more than 5,000 glaciers, equivalent to around 14 years of typical IRS flows. While the glaciers across the globe are depleting rapidly, but those in the Hindukush are considered to be melting faster than others. It is feared that these may disappear by 2035 (Rees, G. and D. N. Collins, 2004). Therefore, chief source of supply in rivers is sharply declining by every passing year.

MAJOR CHALLENGES FOR WATER SECURITY

Drastic Decrease in Per Capita Availability of Water: Decrease in availability of water is accredited to population increase, climate change and inadequate storage capacity. Pakistan was declared water-scarce country in 1992 due to 1700m3 available water per capita according to UNFPA/Ministry of Population Welfare. As per the estimates of Pakistan Water Partnership (PWP), the population is likely to be double in coming two decades, therefore, further decreasing per capita availability of water. As per previous World Bank estimates, per capita availability of water by 2003 has declined to the extent that Pakistan is now characterized as a water-stress country. The current status is 1200m3 per capita per year, which according to Simi Kamal will be further reduced to 855m3 by year 2020 thus vindicating World Bank report (Simi Kamal, 2011).

Depletion of Water Resources: The negative effects of climate change and lack of capacity in preserving and regulating fresh water is fast depleting the accessibility of water everywhere in Pakistan. The down flow of water from India is also reducing every year due to unauthorized construction of dams by India in violation of Indus Water Treaty. Additionally, huge swathes of land have become uncultivable due to water logging and salinity. Underground water has also been used in areas where canal water is inadequate in various parts of Balochistan, Sindh and Punjab and farmers are forced to use deep wells for meeting water needs. This situation worsens in areas where monsoon season does not go well.

Existing Methods of Farming: Pakistan has reasonably well developed irrigation system containing five major rivers, dams, barrages, canals and distributaries which are quite comprehensive in covering entire length and breadth of the country. However, due to inadequate funding and lack development, the available infrastructure has depleted over a period of time. Approximately 97% of fresh water is used only for farming which is quite expensive as per global standards. Instead of refining agriculture techniques to preserve water and surge productivity, the landowners claim more water. Recycling of water is almost nonexistent and hardly any efforts have been made in this direction. In 21st Century, we still rely on old method of flooding the crops and lands causing enormous wastage of this precious commodity. Latest techniques being used in other countries like dripping, sprinkling etc. are not being implemented or sponsored by government. Flooding of agriculture land and lack of knowledge of scientific use of water and inadequate governmental efforts has a strong bearing towards current status of farming. The country of 180 million populations has barely three fully functioning agriculture universities especially where entire orientation of economy is agro based. Research and development (R&D) is least focused area both in public and private ventures, therefore, state of the art smart farming technologies are far from sight for at-least short to medium term in Pakistan.

Climate Change and Related Threats: The climate change is affecting the entire globe and Pakistan is no exception. Adverse effects of climate change are observed in abnormal weather patterns during summers, where excessive melting of snow over glaciers and unusual monsoon generally cause heavy flooding affecting large tracts of lands as well as crops. Similarly, extreme temperature also results in excessive evaporation thus depleting the limited storage capacity. The problems of climate change are manifold ranging from water storage, distribution, crop pattern, per acre yield and warrant stringent measures to prevent adverse effects of rains and flooding on crops.

Problems Related to Management of Water: The requirement of water in Pakistan has to be categorized in major components of domestic, agriculture and industrial expenditures. Irrigation consumes 97 % of available fresh water and contributes 25 % to GDP; and only 3 % of clean water is left for use by industry and domestic users. Pakistan's water management system holds three main reservoirs / dams, over 80 small dams, 19 Barrages, 12 link canals and 45 other canals (Ahmad, Bashir, 2011). Nonexistence of effective water management & regulatory authorities down to lowest village level are a major cause of poor management and non-regulation of water supply for all kinds of uses i.e., irrigation, industrial and domestic.

Limited Storage Capacity: Country's total storage capacity is not more than 30 days for all practical use, which is negligible by global standards and results into flooding every year with heavy losses in men and material. In one year droughts and shortages of water are experienced and in other years, the devastating floods spread havoc all around the country. It is therefore concluded that quantum increase in storage capacity is indispensable to cater for future increases in water requirement and also effectively cater for droughts or floods as they occur. The changing effects of climate change like excessive melting of glaciers during hot summers or excessive monsoon during one or the other year, the excess water need to be stored and later regulated in the required areas, which warrants appropriate storage, distribution channels and regulating mechanism for effective distribution of stored water. The capacity of new reservoirs should also be taken into account the negative effects of silting which results in limiting the storage and regulation capacity.

Population Growth: Per capita availability of water has drastically gone down, primarily due to unchecked and huge population growth. In six decades, it has increased by about 6 times, thus bringing per capita available water from 5600 Cubic Meters to less than 1000 Cubic Meters. Strict check on population growth has become a compulsion now, rather than a choice.

Unawareness in Public and Wastage in Domestic Usage: Drinkable water is too precious a commodity to be dealt so carelessly or casually and wasted unabated on regular basis. While, we can't afford the use of hi-tech sensors in controlled flow of water up to kitchen and toilet taps, we need to be very aware and cautious in economizing its usage. A lot of water is being wasted due to unawareness and non-realization of masses.

Excessive Underground Pumping: Since last few decades, underground pumping for irrigation purposes has increased manifolds. It is affecting aquifers and underground water level is going down with every passing day. At places, it has gone down from 15 – 20 feet to 200 – 300 feet. There is no control or policy for installing Tube Wells/ Pumping Turbines for irrigation purposes.

RECOMMENDATIONS

Enhancing Storage Capacity: There is no denying the fact that Pakistan is seriously lacking in water storage capacity as only two mega dams Mangla and Tarbela and third of little lesser size Chashma are currently acting as linchpin for storage, regulation and electricity generation for the entire country. While the need for more dams have been felt and evaluated since long with sufficient feasibility studies and technical reports, however, consensus building among the provinces could not be done and has remained sticking point even till today. Point to remember here is that such projects should enhance national integration as well as meet energy needs of the country. It is strongly recommended that those alternate dams should be constructed may be big or small in several numbers wherever feasible to help in storage and water regulation at local levels, while mega projects should be pursued after building national consensus. The existing capacity of Mangla and Tarbela dams should be enhanced to permissible limits for optimum use of existing infrastructure as the consensus exists. Small electric generation capacities be installed to get maximum from such projects and these be locally distributed away from national grid. Similarly feasibility study of check dams especially in Balochistan and FATA be considered for seasonal storage and distribution of water for local needs. For growing energy demands, alternate energy sources like solar, nuclear and wind be expedited for generating electricity to meet growing demands of energy security. China-Pakistan Economic Corridor (CPEC) offers enormous opportunities for Pakistan as major part of investment in energy and infrastructure development projects. This should be adopted and supported as national obligation with complete harmony.

Institution of Water Management Authority: Formulation of a comprehensive National Water Policy is need of the hour. Review of existing departments involved in monitoring, storage and supply of water; and a professional, well equipped, more elaborate Water Management Authority be put in place down to Ward/Village level to ensure implementation of national water policies, pre-empt and prevent water crisis. National Water Resources Information System be made part of Water Management Authorities at all levels. For preserving water sources from degradation and protecting the environment, it is recommended that appropriate legislation and promulgation of laws be done as a binding on very citizen to conserve and preserve water sources. Protect ground water through management and technical measures like regulatory framework, artificial recharge etc. Rain harvesting measures may also be considered and educated wherever applicable to serve as alternate source of water.

Provision of Water as Per Changing Demands: While respecting due positions of provinces as agreed in Indus Water distribution accord and National Finance Commission award, effective water regulation is the need of time. Water management should not be a source of competition instead it should enhance national integration. Due to the effects of climate change and disadvantages of lower riparian, those areas need special consideration in allocation of water as it will not have a uniform pattern every year. Additionally, to address the issue of water intrusions by sea, sufficient discharge of water down Kotri is recommended so that cultivable land is not rendered unfit due to adverse effects of sea intrusions.

Efficiency in the Use of Water: For addressing the water shortage and enhancing the crop efficiency, Pakistan has adopted smart technique of "More Crop per Drop" in Development Framework 2010-15. Though a passive measure for water conservation, it involves drip irrigation system where instead of flooding the entire land it reaches out to needed plants through water supply pipes and electronically operated pumping system. Additionally, the brick lining of water channels and canals to prevent seepages have also been undertaken in several parts of country. However, it is recommended that drought-tolerant and economical water-use crops be developed with joint collaboration of China and with our own expertise in the use of biotechnology methods. It is also highlighted that effective measures like laser land leveling, high productivity irrigation systems (e.g. drip, sprinkler and trickle irrigation), furrow irrigation should be incentivized for better harvesting and efficient use of water.

Recycling and Reuse of Water: All developed countries are using water treatment technology and huge plants have been installed for recycling of used water. Such water is ideally suited for bathing, washing and irrigation purposes. If adopted in Pakistan, arranged and managed well, will be a great force multiplier in water conservation and its reuse thus saving the meager quantity of fresh water available in reservoirs for future usage and energy generation like electricity etc.

Measuring and Monitoring Arrangements: For effective planning and management, several processes of monitoring of water distribution at several points during entire supply system should be considered. This will also offer baseline for water pricing which is essential for preservation and extraordinary leverage in the use of scarce water resources through a regulated mechanism. Also formulate National Water Law for improved governance and accountability. Monitoring capacities at national level are recommended to be enhanced for continuous watching of changes in temperature, river flows, and atmospheric constraints. In order to be able to conduct appropriate quantitative valuations of climate related changes and also evaluating the effects of technology related organizational solutions, it is felt that national capacity in innovation and laboratory equipment should be enhanced. The available accessories like Watershed Models and Regional Climate Models may be a good starting point to transform our process of evaluation based on technology. For effective monitoring and skillful usage, Program and Action Plan for 2020 implemented by the government for keeping track of excessive de-glaciation in north of the country resulting into overflow in Indus and other tributaries is considered effective and step in right direction which need to be optimized (Rees, G. and D. N. Collins, 2004).

Capacity Building: The Meteorological and other Departments should facilitate in conducting research intended at developing suitable mathematical models for consistently forecasting droughts (in terms number of months or at least one year in advance) so that appropriate steps are under taken for suitable water management and its usage Similarly, modals and forecasting impact of climate change are also recommended for deliberate measures against water shortage and its usage or disposal of excess water as deemed appropriate by the climate pattern.

CONCLUSION

The water security of Pakistan will be a major challenge in the coming decade. It is directly related to and is a part of human security in 21st Century and has been identified as a major threat. Mitigation strategies and future courses of action have been given in detail in various studies done by various local and foreign think tanks and agencies. It is however regrettable that no concrete steps are being taken in the right direction due to resource constraints and weak governance issues. It is feared that this problem will slowly become a regional and global challenge since it will impinge upon daily lives of people of this area. Serious thought needs to be given to the aspects of water and energy security as it is appreciated that by 2030 we will not have enough water even to provide this basic necessity to our people. Comprehensive analysis on challenges have been done to establish the context of present status followed by practicable recommendation for preparing a predictable road map which will not only meet growing demands of today but will cater for eventual needs of future.

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