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A POLICY PAPER TO ENCOUNTER RISING SOCIO-POLITICAL AND CLIMATIC IMPACTS ON LOOMING WATER CRISIS IN PAKISTAN

Hafiz Jawad Sohail, Dr. Masood Arshad, Sohail Ali Naqvi and Sajjad Ahmad Kamal

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Sustainable development and growth in economic and social welfare is strongly linked with good water management and human capital development. A country bestowed with a high number of natural water resources and contiguous irrigated systems in the world, is at the brink of food insecurity, water crisis and climate emergency. Despite more than sixty years of arbitration by the World Bank under "The Indus Waters Treaty 1960", there is rising tension in Pakistan and India over the Indus River and has accelerated more after recent upstream water infrastructure projects and hence could be considered a flashpoint of nuclear war between the two neighboring countries. Similarly, after signing the Water Apportionment Accord (WAA) in 1999 amongst the provinces and subsequently establishment of the Indus River System Authority, domestic conflicts over water are all time high within the country. All this clearly indicates that the legal frameworks and policies whether on paper or in practice do not play a significant role in successful resolution of these conflicts and water management in the case of Pakistan. Likewise, socio-environmental factors of water crisis in Pakistan include over population and rising per capita use of water, lack of urban planning and increased demand, water pollution, irresponsible behavior by industrial sector, unsustainable agricultural practices, lack of sanitation for rural and marginalized communities, tank mafias, rising temperatures, changing monsoon patterns, glacial melting, and extreme events.

According to UN Sustainable development Goals, to ensure availability and sustainable management of water and sanitation for all means

i) universal and equitable access safe and affordable drinking water,

ii) access to adequate and equitable sanitation and hygiene for all and end open defecation,

iii) improved water quality, wastewater treatment and safe reuse,

iv) increased water-use efficiency across all sectors and ensure sustainable withdrawals and supply of freshwater to address water scarcity,

v) implementing integrated water resources management at all levels, including through transboundary cooperation,

vi) protection and restoration of water-related ecosystems, including mountains, forests, wetlands, rivers, aquifers and lakes,

vii) expand international cooperation and capacity-building support to developing countries in water- and sanitation-related activities like water harvesting,

desalination, water efficiency, wastewater treatment, recycling and reuse technologies, and

viii) achieving the support and strengthen the participation of local communities in improving water and sanitation management.

The Organisation for Economic Co-operation and Development (OECD) outlined a number of Principles on Water Governance in a new Policy Paper that are more relevant to Water Governance in Asia-Pacific countries. While they can prove to be an effective instrument in improving the water governance in Pakistan, there are some country contextual dimensions that need to be given priority in setting the right trajectory towards improved water governance and integrated Water Resource Management in Pakistan. Starting from

i) Incorporation of SDGs (Sustainable Development Goals) into policies and practices,

ii) Highlighting the role of private sector and industrial cooperation,

iii) Identifying the clear role and responsibilities of public authorities and operational management,

iv) Fostering strong coordination among water institutions,

v) Adopting cross-sectoral approach towards water management,

vi) Prioritization of sustainable practices over short-term benefits,

vii) Minimizing the dependence on Single River System,

viii) Availability of water related data and information,

ix) Replicating the best global practices in water sector that meet local dynamics,

x) Working on Institutional capacity building to adapt to the future needs,

xi) Addressing the local conditions to mitigate climatic challenges related to water crisis,

xii) transboundary water cooperation through Integrated Water Resource Management,

xiii) Provincial preparedness towards water crisis after Eighteenth Constitutional Amendment,

xiv) Mobilizing Water Finance and local Solutions,

xv) Improving the role of academia, media and research Institutions, and

xvi) New Public Management

INTRODUCTION AND BACKGROUND

Indus River is a transboundary resource and billion people living on the either sides of the Indo-Pakistani border rely on Indus River waters and its tributaries/ distributaries and so it's a question of survival for them that can never be compromised on the basis of any political or legal force. The Indus Basin is also a strategic and political interest between

India and Pakistan because the headwaters of the basin lie in India and the bulk of the command area falls in Pakistan (Jaitly, 2009).

Of the Indus Basin's 1,138,800 km2 area, 52% is in Pakistan and 34% in India; the remaining 14% lies in China, Afghanistan and Nepal (UNEP, 2002). The Indus River Irrigation System is the backbone of the country's agricultural economy.

The partition of the Indian subcontinent in 1947 set Pakistan and India at odds regarding rights over the shared waters of the Indus, especially given that the headworks of two major canals irrigating Pakistani lands (Central Bari Doab and Dipalpur) were within India's territorial borders. Through the "good offices" of the World Bank, Pakistan and India finally agreed on the Indus Waters Treaty. It was signed on 19 September 1960, effective retroactively as of 1 April 1960, and ratified in January 1961 (Wolf & Newton, 2008).

Several attempts have been made for a peaceful resolution of water issues between the two countries but they proved to be temporary and only served to postpone the conflict to a later time. According to Press Release No. 27, issued by Ministry of Information and Broadcasting, Govt. of Pakistan, in the 117th meeting of the India-Pakistan permanent Indus Commission that was held in Islamabad on March 03, 2022, Pakistan reiterated its observations on the Kiru Hydroelectric project (HEP) located upstream river Chenab and India's new run-of-the-river small HEPs on Western rivers. Under the relevant provisions of the Indus Waters Treaty (IWT) 1960, the meeting of the India-Pakistan Permanent Indus Commission (PIC) takes place alternately in Pakistan and India annually.

Similarly, domestic conflicts over sharing and distribution of water resources among the provinces are at an all-time high even after signing the Water Apportionment Accord (WAA) in 1999 amongst the provinces and subsequently the establishment of the Indus River System Authority. This is not a new domestic issue that surfaced after the partition of India and Pakistan but even before the partition of India and Pakistan, the Indus posed problems between the states of British India. In 1942, a judicial commission was appointed by the British government to study Sind's concern over planned Punjab development. The Commission recognized the claims of Sind, and called for the integrated management of the basin as a whole. The Commission's report was found unacceptable by both sides, and the chief engineers of the two sides met informally between 1943 and 1945 to try to reconcile their differences. Although a draft agreement was produced, neither of the two provinces accepted the terms and the dispute was referred to London for a final decision in 1947. Before a decision could be reached, however, the Indian Independence Act of August 15, 1947 internationalized the dispute between the new states of India and Pakistan (Wolf & Newton, 2008).

"We have data to prove when and how much water was stolen by Punjab. Unless the government ensures the implementation of the 1991 accord in letter and spirit, there is little hope that the water situation will improve in Sindh," he said. This was stated by a farmer with whom Dawn News spoke to over the impact of heat episodes that have struck the province in recent months, posing a threat to food security and water resources (Ilyas F., 2022).

In the presence of all these legal frameworks and treaties, Pakistan's National Water Policy 2018 (NWP) and even 2019 Punjab Water Act, all conflicts and issues standstill and appear on the surface again and again and deepen so.

The Pakistan government's Vision 2025 puts forward several important initiatives to be completed by the set date. Under the heading for a water crisis, the pollution of reservoirs and waterways is recognized as a serious threat with the major sources of contamination originating from industrial areas and urban settlements. Most of this waste directly pollutes the Ravi and Chenab rivers resulting in water-borne diseases as the most common form of infection to affect the national populace. Studies have shown that a shocking 50 percent of all river pollution in Pakistan originates from the Ravi. Environmental laws are already in place yet there is little to no enforcement of these laws by the authorities (Mohiuddin, S. H. 2019). The Pakistan Supreme court has ruled that water companies operating in Pakistan must pay Rs. 1 per every liter of groundwater they extract. The judgment by the apex court has not been enforced as there is no existing infrastructure and enforcement framework to support the decision.

The geographic location of Pakistan places the country in the heat surplus zone on Earth, putting it high on the vulnerability scale of climate change with considerable increase in frequency and intensity of extreme weather events and erratic monsoon rains (as demonstrated by the unprecedented floods of 2010) (National Water Policy 2018).

Now we are also sure that climate change will particularly affect the world's shared freshwater resources and pose a serious threat to water security. The rainfall is neither sufficient nor regular, to meet the growing needs of water (Kahlown, 2002). Shifting precipitation patterns and increased melting of mountain glaciers will disrupt the upstream sources that nourish river waters, upsetting the timing and quantity of downstream flows. Farming, fisheries, forestry, and other environmentally sensitive sectors represent significant portions of the economies of most developing nations, making them particularly vulnerable to climate impacts. (Jaitly, 2009). Variability in the distribution and timing of snowfall and changes in snow and ice melt may be amplified by climate change, which has implications for managing basin water resources. Consequently, water is a key factor in managing risks related to famine, disease epidemics, migration, inequalities within and between countries, political instability and natural disasters (UN Report, 2021).

Water insecurity is not water scarcity. There are 32 countries, which have less water per person compared to Pakistan, and 26 of these have a greater average per capita Gross Domestic Product (GDP). As the world's sixth most populous country, Pakistan's challenge is not the availability of water, but access by and management across various sectors, primarily agriculture, industries, municipal services, and the environment. Increasing demand by all sectors as a consequence of population increase, economic growth, and climate change will accentuate the need for better cross-sectoral management (Batool, 2019).

Agriculture consumes the most water in Pakistan, but it is used in a wasteful manner, with huge losses due to evaporation and waterlogging, and one of the lowest levels of productivity per acre in the world (Mohiuddin, S. H. 2019).

Similarly, social factors exacerbating water scarcity are dangerous to the extent of threat to national security. The growing populations of both countries and the resultant increased demand for water have made the sharing of transboundary water increasingly complex. Stress on waters due to population growth, unplanned urbanization, unsustainable agricultural practices, increased demands in irrigation, paddy fields, industrial practices, lack of sanitation infrastructure, water pollution, sewerage and many other social factors are all those realities that are ignored and neglected in planning and policy. Both countries also want to meet their electricity needs and agricultural production for which they rely on the water resources of River Indus. Similarly, Food self-sufficiency is an escalating concern in Pakistan. Managing groundwater resources continues to be a major challenge in the Indus Basin (Yu W 2013).

Water access and quality of both surface and groundwater have drastic social consequences, affecting thousands in both urban and rural areas. Women and children are especially vulnerable to waterborne diseases and improper sanitation (Batool, T. 2009).

In short, the Indus River is a question of billions of people and their livelihood and survival. Therefore, improving water governance in Pakistan is no more a choice or option to avoid transboundary conflict but also has become a question of national sovereignty and integrity. The changing climate, biodiversity loss, ecosystem degradation, increasing levels of chemical pollution and waste, desertification, land degradation, floods, drought, and poverty, inequality and conflict, are all closely related and need to be addressed synergistically.

STATEMENT OF THE PROBLEM

Pakistan is facing social, political, economic and environmental threats to its water resources. International and domestic conflicts on water resources utilization and distribution have been occurring for decades. Climatic crisis and social factors like over extraction and rise in per capita usage are deepening the crisis to an alarming stage. In the presence of international arbitration by The World Bank and existence of a comprehensive National Water Policy 2018, the conflicts are at a standstill and remain outstanding. Water ecosystem in Pakistan is under severe stress and facing extreme water and food insecurity. It's a question of the billion people living across the sub-continent and either side of the River Indus that is seeking a peaceful resolution and sustainable solution to the emerging extreme water emergency. A comprehensive approach and timely action are the need of the hour to safeguard against irreversible damage and water scarcity in the near future.

Although Institutions like IRSA have been established under the guidelines of NWP but they have failed to meet their objectives. Stakeholders' engagement, institutional ownership and social inclusion aspects are clearly missing and are the main reasons of policy failure like several other policy frameworks in Pakistan. To make policy work, there should be some country contextual dimensions that need to be given priority in setting the right trajectory towards improved water governance and integrated Water Resource Management in Pakistan.

CURRENT POLICIES

The National Water Policy was approved on April 24, 2018 by The Council of Common Interests (CCI) presided over by Prime Minister Shahid Khaqan Abbasi along with Balochistan Chief Minister Abdul QuddusBizenjo, Punjab Chief Minister Shahbaz Sharif, Khyber Pakhtunkhwa Chief Minister Pervez Khattak and Sindh Chief Minister Syed Murad Ali Shah signing the National Water Charter. The spirit of camaraderie proved to be short-lived as hours later three chief ministers walked out of the NEC meeting (Dawn, 2018).

Pakistan's National Water Policy 2018 looks comprehensive but at the same time, it lacks country contextual ground realities and local dynamics and most importantly stakeholder engagement, expert analysis and wide consultations. It looks very random and fails to identify major water challenges of the country. In short, it hasn't served the purpose since its adoption in 2018 and remained merely a piece of paper. Similarly, this policy doesn't chalk out recommended solutions or financial methodology/ investment to promote efficient irrigation system and improvement in existing agricultural practices that are the major reasons for poor water management and water losses in the country. It doesn't speak about water intensive crops, urban designs, risk management against natural hazards or mangroves that need constant supply of water. Similarly, there are many interlinked areas and contemporary water dynamics like food security, population expansion and Tank Mafias in major cities like Karachi, Islamabad and Lahore that broaden the water crisis in Pakistan. Cross-sectoral coordination and technology cooperation mechanisms, the lack of clear quantitative or qualitative targets were also missing and no reliable data collection mechanism related to water was defined in the policy. SDGs targets and indicators related to water and sanitation, roles and responsibilities for policy implementation and operational management among water institutions were not identified and made public. Role of community, media, banking sector and financial institutions were not given due diligence in the policy formulation. Most importantly, identification of major public, private and social sector stakeholders and their input in the policy making was lacking in the NWP 2018.

ALTERNATIVE SOLUTIONS

Agreed upon unanimously by the United Nations member states in September 2015, the SDGs set out a framework to tackle the world's most pressing social, economic, and environmental challenges in the lead-up to 2030.

Sustainable Development Goal (SDG) 6 is the global SDG targeting the improvement of access to water and sanitation by 2030. SDG-6.5 specifically Addresses water resources management with its Indicator 6.5.1 on Integrated Water Resource Management (IWRM) and 6.5.2 on Transboundary Water Resource Management (TWRM), which read as follows, and shall be achieved by 2030 worldwide in order for water and sanitation in the 2030 Agenda for Sustainable Development of the UnitedNations (UN) to be successful (Ladel J, 2020).

- 6.5.1 Degree of integrated water resources management implementation (UN report-1)

- 6.5.2 Proportion of transboundary basin area with an operational arrangement for water cooperation (UN report-2).

To ensure sustainable management of water and sanitation for all, it is essential to look at the water cycle in its entirety, including all uses and users. Countries need to move away from sectoral development and management of water resources, in favour of a more integrated approach that can balance different needs in a just manner. This is exactly what SDG 6 seeks to do: by expanding the Millennium Development Goal (MDG) focus on drinking water and basic sanitation to include water, wastewater and ecosystem resources, and together with target SDG 11.5 on water-related disasters, it covers all the main aspects related to freshwater in the context of sustainable development. Bringing these aspects together under one goal is a first step towards addressing sector fragmentation and enabling coherent and sustainable management, thus making SDG 6 a major step forward towards a sustainable water future (UN Water Report, 2016).

The UN has defined 8 Targets and 11 Indicators for SDG 6 "Ensure access to water and sanitation for all". Targets specify the goals and Indicators represent the metrics by which the world aims to track whether these Targets are achieved.Indicators will be the backbone of monitoring progress towards the SDGs at the local, national, regional, and global levels. A sound indicator framework will turn the SDGs and their targets into a management tool to help countries develop implementation strategies and allocate resources accordingly, as well as a report card to measure progress towards sustainable development and help ensure the accountability of all stakeholders for achieving the SDGs (SDSN Report, 2015).

6.1 By 2030, achieve universal and equitable access to safe and affordable drinking water for all

6.2 By 2030, achieve access to adequate and equitable sanitation and hygiene for all and end open defecation, paying special attention to the needs of women and girls and those in vulnerable situations

6.3 By 2030, improve water quality by reducing pollution, eliminating dumping and minimizing release of hazardous chemicals and materials, halving the proportion of untreated wastewater and substantially increasing recycling and safe reuse globally

6.4 By 2030, substantially increase water-use efficiency across all sectors and ensure sustainable withdrawals and supply of freshwater to address water scarcity and substantially reduce the number of people suffering from water scarcity

6.5 By 2030, implement integrated water resources management at all levels, including through transboundary cooperation as appropriate

6.6 By 2020, protect and restore water-related ecosystems, including mountains, forests, wetlands, rivers, aquifers and lakes

6.A By 2030, expand international cooperation and capacity-building support to developing countries in water- and sanitation-related activities and programmes,

including water harvesting, desalination, water efficiency, wastewater treatment, recycling and reuse technologies

6.B Support and strengthen the participation of local communities in improving water and sanitation management

Integrated Monitoring Guide for SDG 6 Targets and global indicators is a good resource for countries to develop water related policies and guidelines. According to UN Publication "Progress on Integrated Water Resources Management – 2021 Update" Indicator 6.5.1 tracks the degree of integrated water resources management (IWRM) implementation, by assessing the four key dimensions of IWRM: enabling environment, institutions and participation, management instruments and financing.

The Organisation for Economic Co-operation and Development (OECD) outlined a number of Principles on Water Governance in a new Policy Paper that are more relevant to Water Governance in Asia-Pacific countries.The OECD Water Governance Principles provide the 12 must-do's for governments to design and implement effective, efficient, and inclusive water policies. The OECD Principles on Water Governance intend to contribute to tangible and outcome-oriented public policies, based on three mutually reinforcing and complementary dimensions of water governance; effectiveness, efficiency and trust and engagement. The OECD Principles on Water Governance are expected to contribute to improving the "WaterGovernance Cycle" from policy design to implementation (OECD, 2015).

The OECD Principles on Water Governance provide a framework to understand whether water governance systems are performing optimally and help to adjust them where necessary. They can catalyse efforts for making good practices more visible, learning from international experience, and setting reform processes into motion at all levels of government to facilitate change where and when needed. They can also help avoid traps and pitfalls, learning from international experience.

Principle-1. Clearly allocate and distinguish roles and responsibilities for water policymaking, policy implementation, operational management and regulation, and foster co-ordination across these responsible authorities.

Principle-2. Manage water at the appropriate scale(s) within integrated basin governance systems to reflect local conditions, and foster co-ordination between the different scales.

Principle-3. Encourage policy coherence through effective cross-sectoral co-ordination, especially between policies for water and the environment, health, energy, agriculture, industry, spatial planning and land use

Principle-4. Adapt the level of capacity of responsible authorities to the complexity of water challenges to be met, and to the set of competencies required to carry out their duties

Principle-5. Produce, update, and share timely, consistent, comparable and policy-relevant water and water-related data and information, and use it to guide, assess and improve water policy

Principle-6. Ensure that governance arrangements help mobilise water finance and allocate financial resources in an efficient, transparent and timely manner

Principle-7. Ensure that sound water management regulatory frameworks are effectively implemented and enforced in pursuit of the public interest

Principle-8. Promote the adoption and implementation of innovative water governance practices across responsible authorities, levels of government and relevant stakeholders

Principle-9. Mainstream integrity and transparency practices across water policies, water institutions and water governance frameworks for greater accountability and trust in decision-making

Principle-10. Promote stakeholder engagement for informed and outcome-oriented contributions to water policy design and implementation

Principle-11. Encourage water governance frameworks that help manage trade-offs across water users, rural and urban areas, and generations

Principle-12. Promote regular monitoring and evaluation of water policy and governance where appropriate, share the results with the public and make adjustments when needed

The OECD Principles on Water Governance are developed on the premise that there is no one-size-fits-all solution to water challenges worldwide, but a menu of options building on the diversity of legal, administrative and organisational systems within and across countries. They recognise that governance is highly contextual, that water policies need to be tailored to different water resources and places, and that governance responses have to adapt to changing circumstances (OECD, 2015).

POLICY RECOMMENDATIONS, FEASIBILITY & IMPLEMENTATION STRATEGIES/ ACTION PLAN:

National monitoring is the most important level of monitoring and will rely on nationally defined sets of indicators. National ownership at all levels of the SDGs is critical, and national monitoring must respond to national priorities and needs. As recognized in The Road to Dignity by 2030, national monitoring of the SDGs should "build on existing national and local mechanisms and processes, with broad, multi-stakeholder participation." Countries can thus define the nature of the indicators, their specifications, timing, data collection methods, and disaggregation to suit their national needs and priorities (SDSN Report, 2015).

OECD evidence shows that there is not a one-size-fits-all solution to water challenges worldwide, but rather a large diversity of situations within and across countries. Governance responses should, therefore, be adapted to territorial specificities, and recognize that governance is highly context-dependent and important to fit water policies to places. There is now an enhanced recognition that bottom-up and inclusive decision-making is key to effective water policies (OECD, 2015).

OECD Principles can prove to be an effective instrument in improving the water governance in Pakistan but there are some country's contextual dimensions that need to be given priority in setting the right trajectory towards improved water governance and integrated Water Resource Management in Pakistan.

1. Incorporation of SDGs into policies and practices:

Mainstreaming SDGs-6 targets and indicators into national policies, institutional frameworks, planning and strategies and integrating the three dimensions of sustainability (Environmental, Social and Economic)are crucial for improved water governance in Pakistan.

The SDG-6 targets can serve as guidelines to develop implementation strategies, allocate budget and resources at local level. Similarly, countries can develop their own Indicators that are more relevant for local policy-makers and institutional working in order to be effective for monitoring and evaluating the progress at the local level. It can help in channelizing the concerted efforts instead of silos and minimizing the polarization in decision making.

In other words, synchronizing the institutional and organizational goals and objectives with SDGs will identify the priority areas that need to be expedited in order to achieve inclusive and measured success in water governance.

2. Highlighting the role of private sector and industrial cooperation:

The role of the private sector is important in not just watering down or balancing their abstraction but also to improve water governance in Pakistan. This may include information gathering, collection and dissemination related to water or supporting in replenishing the water resources to building an industrial cooperation on water infrastructure in Pakistan. This may include those private actors whose core area is not water but they use water in their processes like mining, beverages, snacks and so on. They work with communities and the service sector to produce goods and local business. Therefore, their experiences in shaping the policy and its implementation are also crucial at local levels. Private sector participation in water, sanitation and sewerage infrastructure projects can minimize the risks of social and political repercussions. There is also a dire need to develop accountability mechanisms for the private sector for their fair use of water resources.

3. Identifying the clear role and responsibilities of public authorities and operational management

Policy deficiencies stem from institutional problems including unclear, incomplete, or overlapping institutional mandates, and a lack of capacity in water institutions at all levels. Institutional responsibilities need to be better delineated at both national and provincial levels and between entities at these levels (Batool, T. 2009).

In Pakistan, the roles and mandate of water institutions in policy making, implementation, operational management, investment, regulations, service delivery, data and information, enforcement, licensing and monitoring, strategic planning and conflict management should be made clear and public. It includes all aspects of policy making, implementation, monitoring and evaluation, performance management and above-mentioned roles and responsibilities.

4. Fostering strong coordination among water institutions

The success of policies depends on cooperation and coordination among implementing institutions. Unfortunately, in case of Pakistan, coordination is badly missing and results

in erosion of statecapacity.Without strong coordination and cooperation among water institutions, Pakistan will not be ready to respond to the challenges stemmingfrom waterscarcity and its socio-political elements. With the strong coordination mechanism, a complete water ecosystem could be established within the country that will curb the duplication of resources and foster water management.Therefore, coordination is essential in a highly capital-intensive water market across decision-making, policy and project cycles.

5. Adopting cross-sectoral approach towards water management

There are many interlinked areas that exacerbate water insecurity in Pakistan including population growth, unplanned urbanization, unsustainable agricultural practices, increased demands in irrigation, paddy fields, unsustainable industrial practices, lack of sanitation infrastructure, water pollution, sewerage and many others. In order to address it, a cross-sectoral approach is essential.

The need for improved coordination and cooperation among key ministries, a plethora of public, private, non-profit stakeholders and researchers are essential for a holistic approach to address rising water scarcity and security.

6. Prioritization of sustainable practices over short-term benefits

While there's always political instability in the country, governments cannot perform their due roles in taking the country towards sustainable growth. Prioritizing sustainability in water means using water resources in a balancing way that meets current social, economic and environmental needs without compromising the ability to meet future needs. It requires long term planning and strategy which is purpose driven and that reflects its priorities of growth and development ranging from water supply and demand management, water economics, monitoring and modeling of water resources, allocation and recycling, rainwater harvesting, protection of water resources, controlling the movement of water, water in industry, water in domestic use, water in agriculture, subsurface drainage, and water policy.

Sanitation and health dimension of the water is very important for the overall hygiene and wellbeing of the citizens. Similarly, sewage and wastewater treatment technologies should be prioritized in the urban and rural areas.

7. Minimizing the dependence on Single River System

Pakistan needs to minimize its dependency on the single river system to fight water insecurity. It needs to build new water infrastructure, conserve and replenish its water resources, harvesting water and mechanizing the better distribution system. It also needs to take sanitation service/system to the villages and rural areas to conserve water and avoid water logging. Small catchments and localized solutions can support local communities and protect against floods. Given the political crisis of Indus River between India and Pakistan, it is also important for Pakistan to work on alternative resources and solutions to avoid conflicts and vulnerability of dependence on a single river system.

According to World Bank and other sources, snow melt and glacial melt at Upper Indus generate most of the average water flows in the Indus River basin and over three-fourths of total water resources of the country originate from outside of Pakistan. Currently, the

Indus River System makes up major source of total renewable water resources of the country, Pakistan's dependence on a single river system is unsustainable. Pakistan needs to focus more on managing water demand by building storages to capture the monsoon peak, harvesting more rainfall, constructing run-of-the-river facilities, better irrigation service delivery and better on-farm water management and promoting reforestation.

8. Availability of water related data and information

Water management requires data that is reliable, useful, sufficient, and accessible for informed decision making. It is not only restricted to the surficial data but the complete water information system including data in terms of water withdrawals and consumption, quality of water, household data, institutional data, glacier melt and snow melt data and Real time data. There is also a need for stakeholder engagement to determine what type of data is needed and improved mapping, modeling and forecasting of water resources.

For better managing the freshwater resources and information sharing among stakeholders, an effective monitoring of freshwater resources is essential. Real time data can help greatly in this regard. For instance, installation of dataloggers for the effective monitoring of water level fluctuations in the ground with the passage of time and recharging of aquifers directly through recharge wells. A Datalogger or Levelogger measures groundwater and surface water level and temperature along with the conductivity of the groundwater. The equipment is mounted on site permanently after lowering it into the observation well dug at sites along with the recharge wells. It collects the real time data that can be retrieved at times when required to be analyzed. Similarly, there are several Real time monitoring solutions are available that can support in better understanding the quality and quantity of freshwater resources.

A holistic approach to water management centralized database will help in evidence-based public health intervention and the protection of water resources. There is also a need for a data-sharing system between Pakistan, India and neighboring countries for transboundary management.

9. Replicating the best global practices in water sector that meet local dynamics

Countries have better access to new technologies and a chance to implement best practices under technological and financial cooperation between and among countries. Pakistan can also assess its needs based on the best practices that meet the local dynamics. The role of industries and private institutions is also important in this regard. For instance, heat recapturing, sludge treatment, efficient evaporation, optimized cooling towers. In industrial processes, cooling towards use abundant amounts of water. There are different methods that can be adopted to optimize the cooling tower system. For example, with the pH adjustment, pretreatment of the tower makeup and chemical scale inhibitors cooling tower cycles can be maximized. Similarly, from a water efficiency standpoint, maximizing cycles of concentration will minimize blow down water quantity and reduce make-up water demand. Water smart landscaping and irrigation, and accurate metering/measuring and managing are all best practices that can be followed and replicated according to local requirements. Government and financial institutions can provide subsidized access to these resources under water stewardship programs.

10. Working on Institutional capacity building to adapt to the future needs

There is a dire need to work on the institutional capacity building and workforce skills in the water sector so that they can meet the demands of future trends in the water sector. This should not be only limited to water but also the related areas like climate change, mountain ecosystem, food security, mitigation and adaptation knowledge, water information system, digitization and all cross-cutting subjects and fields. Only a well-equipped workforce and leadership can solve our rising issues and threats in the water sector.

11. Addressing the local conditions to mitigate climatic challenges related to water crisis

There are several climatic conditions that accelerate the water crisis in the country, without addressing them, water security cannot be achieved. Changing monsoon patterns, glacial lake outbursts, flooding, desertification, droughts and many other climatic events that originate in a local area may exacerbate water crisis and scarcity. That's the same reason for which cross-sectoral coordination is important for water governance in the country.

12. Transboundary water cooperation through Integrated Water Resource Management:

Although there is little progress on transboundary cooperation, it lacks scientific and technical cooperation, coordination and data sharing among countries to better understand the dynamics of river basins. Integrated Water Resource Management including Information and knowledge management, policy advice, shared watershed management, establishing trust and exchanging experience and combined strategy development should be promoted between India, Pakistan and neighboring countries. There is also a need to define a mechanism for validating the quality of the shared data between two countries and provision of access to the researchers' community.

Pakistan is already facing a looming water crisis and the Kabul River is the main river in the Khyber Pakhtunkhwa province of Pakistan which is augmented by the Swat River and its tributaries before it enters into the Indus River System at Attock. In downstream Pakistan, Kabul River is a major tributary of the Indus that irrigates thousands of hectares through four main canals and many people depend solely on it, more than Afghanistan. A number of barrages, irrigation canals and other infrastructure are already built in Pakistan's part of Kabul River and if Afghanistan plans to construct a multipurpose dam on upstream part to meet its increased demand for energy and agriculture, Pakistan in figure may not receive enough water. With a major reduction in the flows of the Kabul River into Pakistan can spark energy and food insecurity for Pakistan. A timely solution, therefore, requires a transboundary agreement to guide negotiations over the Kabul River Basin water supply and better management of freshwater resources including regional planning and data sharing cooperation options.

13. Provincial preparedness towards water crisis after Eighteenth Constitutional Amendment

After the 18th Constitutional Amendment, provinces are autonomous to develop their own strategies and water security working plans. All provinces are not equally ready and prepared to fight against rising water crises and there is no defined strategy in the

National Water Policy by which provinces can collaborate and coordinate for shared water management. Provincial preparedness is crucial in this regard; otherwise, development along one part of river Indus may not be effective if other provinces lack the capacity to manage it.

14. Mobilizing Water Finance and local Solutions

The State Bank of Pakistan can provide a comprehensive water finance policy and mechanism to support increased access to the water finance and nature-based solutions. They can also incentivize it for the private sector so they can imitate new Water Sanitation & Hygiene (WASH) and water related projects in the country.

Similarly, financing the local solutions should also be prioritized for an increased access to gender sensitive, unserved, marginalized communities.

15. Improving the role of academia, media and research Institutions

The role of media and research communities is also very crucial to advance the water governance in the country. A mass-scale awareness by media houses can lead to water conservation and management in the country. Similarly, the scientific community needs to play their role in proposing water efficient solutions in a country context.

16. New Public Management:

Performance based new public management is necessary in the water sector. Accountable staff and officials, transparent processes and a corruption free environment are a must do in order to accomplish improved water governance in the country.

SUMMATION AND CONCLUSION

Pakistan needs to pay more attention to the social and environmental dimensions of water security, which are undermining human capital and environmental sustainability (Batool, 2019). Business as usual policies and institutional power are not enough to fight against rising water insecurity in the region. There has also been a greater demand for stakeholder engagement, transparency, capacity building, coordination, evidence-based decision making and long-term policy making. Successful resolution requires redesigning our priorities so that we prioritize sustainability over short term profits.

Climate change will exacerbate water insecurity. It will increase water demand and the variability of water supply. Sea-level rise and coastal storms will present additional challenges for management of the Indus delta and groundwater in the lower basin (Batool, 2019).

The Sustainable Development Goals of the UN also provide a global roadmap for countries to track their progress in all areas including Water and Sanitation. The targets and indicators set by global goals are measurable and globally recognized. Similarly, Organization for Economic Co-operation & Development (OECD) defined some principles for developing countries to achieve good governance in water.

In Pakistan, current policies and legal frameworks couldn't resolve the transboundary and domestic conflicts neither are sufficient to fight against the water insecurity and future demands. Right-based sustainable, gender-responsive and inclusive approach imbued in country contextual framework that addresses local challenges and benefit

community when combined with global best practices and stakeholder ownership shall provide the roadmap to improved water governance in the country.

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