THE WATER CRISIS LOOMS LARGE IN PAKISTAN WHICH MAY FACE ABSOLUTE SCARCITY

Afshan Mahfooz
MPhil Research Scholar
Greenwich University
Karachi – Pakistan
talalnadeem1692@gmail.com

Abstract

Pakistan has the fourth-highest rate of water use in the world, as reported by the IMF (International Monetary Fund), and is the 3rd greatest water-stress country in the world.Water can be scarce for many reasons: water supply is very low compared to demand, infrastructure is inadequate, and institutions fail to balance every person's daily needs. Water scarcity is a global problem, with the most badly and worse affected communities. In this thesis we can measure Pakistan's water scarcity with the four main indicators. The four main indicators can be measured in a country's water scarcity: The Water Poverty Index, Water Resources Vulnerability Index, the Falkenmark indicator, and Physical and Economic Water Scarcity Indicators. Currently, Pakistan is one of the countries where demand of water exceeds over available water supply with the giving of these 4 indicators. There are many reasons for Pakistan's water scarcity, being increased populace, citified and computerization, climate change, unsatisfactory warehouse, residues in the existing tank, corrupt system efficiency, irrigational problem and traditional methods of farming, and insufficient finance. The possible alternatives to overcome these issues are the construction of small and large dams where possible, the construction proper irrigation system, improving the surface water governance with suitable pricing, controlling the increase in population, improving transportation, changing the existing harvesting patterns by accepting low delta crops and using saline groundwater, in conjunction with independently with salt accepting crops. Nevertheless, a unified approach is required to optimally use water resources.

Keywords: Irrigation system, Reservoirs, Urbanization, Inadequate, ground water, water scarcity.

Introduction

When an individual hasn't easily found cheaper and healthy water to satisfy basic demands, we refer that people water diffident. While a majority peoples in a country are water diffident for a major time, that country represent a water deficient country. Water that is domestic used like preparing food and drinking, and also used in agriculture this water quality also has poor quality leads to water deficiency. Pakistan has one of the largest irrigation systems in the world. On the

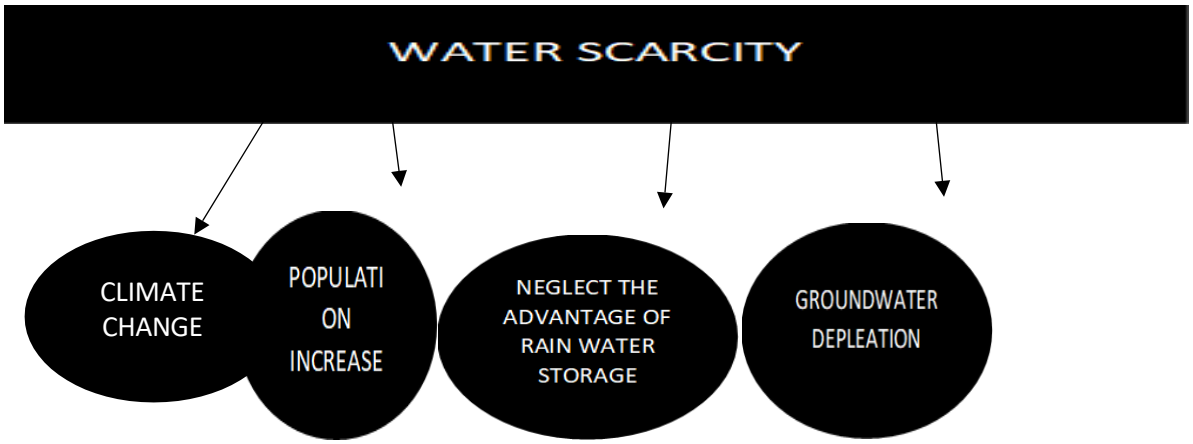
report of the Large Dams International Commission, Pakistan has 73 large and small dams, tanks and basins. In terms of structural volume, the Tarbela Dam is the second-largest dam in the world and the biggest overall. The Sabakzai Dam is the seventh largest dam and has also a flood stock, Mirani Dam is another largest dam in the world in because of volume for flood protection. The nation's economy is based mostly on irrigated agriculture, which uses over 93% of the water resources available to it. On about 80% of all arable land that means where we can grow crops, irrigation is used in these lands to produce approximately 90% of the required food and fibre. The contribution of agriculture in the Gross Domestic Product (GDP) of Pakistan is one the largest sector of the country's economy. The agriculture sector contributes half about labour strength and largest source of international exchange pays (Raza et al., 2018). However, due to the increase in population growth, the food demand is also increasing and can stress the agriculture sector (Imasiku, & Ntagwirumugara, 2020). By having both direct and indirect influences on agricultural growth processes, climate change will impact the efficiency of food production. Modifications to the availability of carbon dioxide, rainfall, snow and temperatures are examples of direct effects. The availability of water resources and the predictable changes in the seasons are the examples of indirect effects (Prasad et al., 2021). According to the Pakistan Bureau of Statistics, the utmost significant crops in our country are maize, oilseed, wheat, pulses, rice, orchard, cotton, sugarcane and vegetables. (Matloob et al., 2020). Overall eighty percent of Pakistan's cultivated area are fertile and irrigated (Mahmood et al., 2022).

Pakistan is one of the top ten cotton-producing countries. Total cotton production during 2020 was 1.83 million tonnes. Cotton is cultivated in 14% of the cultivated area. (Abbas, S 2022). Over 80 mega hectares make up Pakistan's entire landmass, nearly 80 percent of which is moistened, with the remaining 12 mega hectares used for agricultural dehydrated land. It rains during the monsoon season for more than 70 percent during the time (3rd Quarter of the calendar year). Less than 10 percent of the nation's agricultural output is produced in the dehydrated lands, and the water needs of these regions are wholly reliant on rainfall. If the rainfall is not regular and insufficient, this input may further decline (Iqbal et al., 2012).

District of Columbia (Washington-USA): In South Asian countries the growing fresh water supply is major owing to the consequence of changing climates and increasing populations, particularly for Pakistan which could experience of deficiency of water by 2040. According to a Washington based publication mentioned that as per International Monetary Fund (IMF), has ranked 3rd to Pakistan on the list of the countries with severe water deficient. Moreover, the per-person drinking water resources have reduced in Pakistan below the 1,000 cubic feet of insufficient criterion from 3,950 cubic yards in 1961 to 1,600 square yards in 1991.

The numbers of experts over the world predicted and worry about that the per capita quantity of clean water in Pakistan might even decline to 860 million cubic meters by the Year 2025 and the nation of the country may have experience complete water scarcity by the year 2040, according to Mr. Nasir Javaid (Senior Research Analyst at the Urban Unit, Govt of Punjab).
Due to the absence of facilities and life-threatening global warming, increasing number of peoples over the country, and contamination are just a few of the causes that contribute to the limitations of safe and clean water. These obstacles negatively impact the peoples of any country in the nation of any developing country. Moreover, a well- known instance of a problem that is causing destruction for both the life of human beings as well as plant and animal is the deficiency of water (Jury, W. A., & Vaux Jr, H. J, 2007). The lack of access to healthy and unpolluted water has a huge influence on consumption as well as everyday cleanliness routines

in households, workplace of any organization / industry / corporate sector etc., educational institutions, etc. The water scarcity is heavily impacted to everyone who lives in a society, including all types of creatures including human being. This can be result in our overall life behaviour from minor sickness to widespread turmoil in society and politics, impeded child development, and the spread of diseases (Debata, B., Patnaik, P., & Mishra, A. (2020). COVID-19 pandemic! It's impact on people, economy, and environment. *Journal of Public Affairs*, *20*(4), e2372)



WATER SCARCITY PROBLEM TREE

Figure 1:Water Scarcity Problem Tree

The need for clean water for various segmental water uses is significantly rising as the world's population expands (e.g., irrigation uses, household uses, power uses, and industrial uses) (Biswas & Tortajada 2018). Water quality dilapidation is worsened, especially in developing nations, by the rise of agriculture, urbanisation, water taking out, consumption and industrialization (Macdonald et al 2016, UNEP 2016, and Sinha et al 2017).

Pakistan has been experiencing a reduction or fluctuation in the quantity of water available in the IBIS canal network due to climate change and other issues, which include water mismanagement and wasting of water. Therefore, because of this inconsistency, farmers have no way to nurture their crops with the appropriate amount of water. Due to a water shortage in the canal water system, farmers or landowners who are unable to get the necessary amount of water according to their needs can face more complicated issues. Additionally, modifications to the distribution of rain and warmer weather are the major causes due to the effects of global warming. Due to growing precipitation and reduction levels of underground water, Pakistan is also facing the experiencing a shortage of water in the different areas of country. Moreover, the water table of earth is dropping dramatically. In addition to global warming, unrestricted well bore usage and the freedom to draw any volume of water also lowers the quantity of groundwater. In terms of the economy, society, and the ecological problem of disproportionate supply and demand of water, Pakistan has made significant progress in recent times. The necessity to adopt weather-resistant methods to ensure more effective water monitoring in all sectors has been brought to light by the arid surroundings brought on by rising temperatures in recent years. In Pakistan, finding water was not too difficult. Water shortages will begin to occur in Pakistan in 2025, and

by 2040, shortages are predicted to intensify.

Roughly the overall numbers of farmers in terms of percentage are approximately 86% who are the holder of small agriculture land (Attaining land less than 12.50 acres) (GOP, 2019) (Khan et al., 2021). Pakistan is the sixth-most populous country in the world, with an estimated 190 million people, according to the records that are currently available for the year 2014. Rapid population growth is causing urbanization to increase, which will have a significant impact on the social analysis of the country since cities are growing at a never- before-seen rate. Therefore, there is a growing need for additional water, as people in this circumstance depend on it for survival, and the water supply is being negatively impacted by water scarcity. Where there is an inversely proportionate tendency in population growth, there is a corresponding requirement for additional water to support the growing population or to grow crops for food.

Hence, this factor is very much alarming and in the coming year, the community will face the water deficit (Khoso et al., 2015). Due to water limitations, rainwater harvesting (RWH) is generally acknowledged as a substitute of water source for home water supply in many parts of the world. Due to a rise in population concentration and a failure in permeable surfaces, Pakistan's primary problem is a lack of readily available drinking water. In this situation, rainwater can serve as a dependable additional for fresh water capitals (Siddiqui, R., & Siddiqui, S. (2019). In order to mitigate the water deficit in certain regions of the nation, it is beneficial and useful to preserve the groundwater resource in arid and semi-arid regions by retaining rain water. Nevertheless, it can be challenging for water resource directors and executives to evaluate the potential for rainwater collection and choose appropriate sites for a range of fresh water harvesting structures, particularly in large areas.

Scope of the Study

Based upon the subject research helps on the way to measure water scarcity. Find out the specific problems and their solutions to overcome these problems. In this study we use different indicator to measure water scarcity. If water scarcity exists in Pakistan, we will further find out the main problems and suggest the solutions. Approximately 1/3rd of the population in developing countries seems to be experience acute water shortages by the end of Year-2025 (Seckler et al., 1998).

The assets of water should be controlled with the aim of proportionately optimising both welfare and financial well-being while maintaining the efficiency of the atmosphere. Speaking to the lack of water demands an integrative strategy. Still, a lot of water pours into the sea every year in many areas that are measured to be water-scarce. Part of this floodwater is allowed to flow in order to maintain estuarial and coastal environments' ecological integrity and to remove salt and other worse substances from the system. (Molden 1997). Water scarcity also attach with the GDP. Because when water scarcity increases it hits the GDP.

Research Objectives

The objective of the subject research was to firstly examine If water scarcity in Pakistan exists or not. Moreover, if water scarcity exists, then we can further find the level of water scarcity. Identify the reasons behind this scarcity and suggest the effective ways to eliminate the scarcity of water. We can continue on to compare other countries new technology with Pakistan to suggest Government of Pakistan to eliminate this problem before it turns into a crisis. because

this problem will not only affect every individual of Pakistan but their economy will pay heavily too.

Studying how Pakistan's economic growth is impacted by the water shortage is one of the main detailed thoughts. Because most of the issues, such as increasing numbers of people, inadequate water storage, and groundwater depletion, still remain, the current study also intends to report on the boundaries and gaps that the available literature on food in water shortages highlights. Since these resources are essential for maintaining the water supply and the ability of the environment to persist, this thesis looks into the challenges of managing Pakistan's water resources, evaluates previous ingenuity, and offers suggestions for future roadmaps.

Literature Review

We have examined a large body of literature review from sources of numerous countries such as: Ethiopia, Iran, Afghanistan, U.S.A (United States of America), China, India, Bangladesh, Afghanistan, Australia etc. which is used to form preposition for this topic. In literature review we have explained the factors like population growth, climate change, ground water depletion and the negligence in storage of rain water. As these issues have a severe effect on water crisis.

Research Gap

Irrigation with fresh water is necessary, to keep creatures that live on the planet alive. Being able to access clean freshwater has become a requirement for ensuring adequate nutrition as well as raising living standards. Clean supply is falling short of need, which is growing, widening the supply-demand mismatch. A larger liquid dam might be built to accommodate the vacancy. Every provincial region of Pakistan has a persistent water-related conflict. Researchers are additionally searching for a way to fill up the hole among the shortfall in supplies and the rising need for groundwater. According to the present level of populace development, a dearth of drinking fluids is predicted at 31 percent for the country of Pakistan until 2025 because the difference between availability and the need for fresh water has grown fast (Sheikh A.A 2017).

On a yearly basis, countless Pakistanis perish due to fresh liquid scarcity. There are multitudes of citizens who lack access to pure freshwater, irrespective of the 229 million inhabitants in the country (Zulfiqar 2018). As a way to meet the rising requirements of the nation's increasing populace, the country's household, commercial, and especially farming industries have boosted their surface liquid preoccupation during the last several years. (Wada et al., 2012) and (Hussain et. al.2019). But still, water reservoirs have been a vital issue for continual productive development. Assets deteriorate as a result of the growing disparity between groundwater availability and need, while investor conflicts rise as an outcome. In addition to this growing disparity, additional challenges like incredibly hazardous drinking water standards, environmental degradation, consumer requests exceeding supplies, insufficient clean liquid usage costs, weak electoral support, gentrification, and a lack of public understanding are also major factors in water- related problems. The primary roots of the drinking water difficulties in the country are dual: secondary as well as functional. Secondary triggers are related to the circumstances surrounding bad groundwater administration procedures, whereas functional triggers are related to the circumstances surrounding electoral (regional) and societal (bad groundwater administration) problems. In order to address these difficulties in relation to communal, profitable, governmental, and ecological issues related to the clean water sector, updating information and instruments (technology, regulations, and organizations) are required (Climate Energy & Water Research Institute. Water Policy and Governance Program Available online: http://www.parc.gov.pk/index.php/en/caewri-rshprog/caewri- wrpp (accessed on 20

November 2020). Inadequate fresh water supplies, an ineffective country's freshwater strategy, an absence of local and community support, destruction of forests, risks to the nation's savings, and wrong national water policies can all have a negative impact on provincial plant and animal life, agriculture, and the environment (Zhang et al., 2020). Pakistan has been placed third worldwide among nations that are experiencing an adequate scarcity of groundwater by the IMF, which stands for the International Monetary Fund, and it is predicted that by the year 2024–25(Khan, A., & Awan, N. 2020). There will not be enough pure drinking water available in the entire nation due to increasing numbers of people, global warming, reduced fresh or clean water availability, excessive consumption of water, and an absence of infrastructure to store it (Nabi et al., 2019).

Jahangir's World Times (JWT) monthly magazine published an article National Water Policy, A Ray of Hope for a Water-Scarce Pakistan on 18 November 2020: Pakistan's aquatic assets are in an immediate situation of danger, according to a number of investigations and books published by different organizations. The nation is experiencing an acute shortage of groundwater and an imminent risk to the availability of nutrition due to its fast-expanding number of people. Pakistan's per unit of population access of fresh water had decreases from 5650 m3 in 1951 to a risking level of 908 m3 every year, it is pushing our nation to the edge water deficiency. Our nation would stock only ten percent of its yearly streams course as compare forty percent to the mean of the entire planet, said Lieutenant general Sajjad Ghani (Retired), WAPDA Chairman. Through the year 2025 this amount could further decrease. Pakistan's shift from "stress of water" to one with "deficient of freshwater." (Nabi et al., 2019) and (Mikosch et al., 2020). The aforementioned gap illustrates how urgent the problem of water deficiency in this nation is and portrays an ominous outlook for the coming years. Availability of fresh water is also an issue of national policy, and it takes a long time to get an agreement between the associations and districts with the goal of reaching choices that are eventually suitable to each region. In order to effectively maintain the availability of clean water, a country must take every area of the nation into account and make basic modifications. To establish precise targets, aims, strategies for execution, and timeframes for success, strategies ought to remain brief. Twenty percent of Pakistan's GDP comes from the agriculture sector. Between 2010 and 2020, the country had the greatest annual economic expansion at 5.28 percent, with the agriculture industry experiencing a significant increase between 0.27 percent and 3.46 percent. The quantity of freshwater utilised for agriculture in Pakistan, which includes water from the surface as well as water in the ground, is estimated to be substantial. In Pakistan, underground liquid is extensively used for farming, making up over seventy-three percent of the total, with surface-level liquid accounting for the rest of twenty-seven percent. (Qureshi, A.S 2020).

Major Causes of The Water Crisis

An Increase in Population and Shortage of Water

According to the **Pakistan Bureau of Statistics – in June 2023** Pakistan is the world's fifth-most populous country. With an estimated population is 241,159,956 million and an annual rate of development (revised) of 3.50 percent, it's expected that Pakistan will become the fourth-largest nation on earth in population terms by 2050 (Salman et al., 2022).

The total population in Pakistan was estimated at 235,824,862 million people in 2022. Given below table shown the latest census and projections from Trading Economics. Source: World Bank

As shown in figure 2.1.1, a resident of Pakistan is thought to be one in every 37 persons on the earth, according to the population of Pakistan, which represents approximately 2.83% of the entire population of the world.

Table 1:An Increase in Population and Shortage of Water

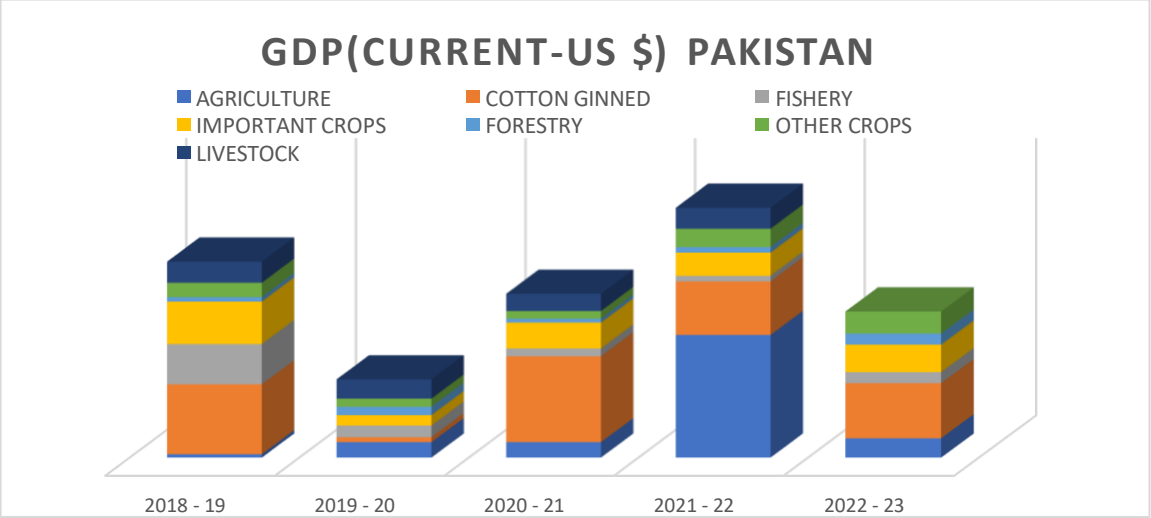
Related	Last	Previous	Unit	References
Population	240.50	235.82	Million	*june* 2023

Note: Source "World Bank" [https://www.worldbank.org/en/country/pakistan**]**

According to the Pakistan Bureau of Statistics GDP from agriculture is targeted in 2022 is 3.5%. Taking a larger view of the contribution of agriculture to the gross domestic product and integrating related support services, agriculture is a sector that is crucial to a nation's success (Hoekstra, A. Y., & Chapagain, A. K. 2007).

Global financial crisis, smart lockdown strategies, and the COVID-19 spill over impacts: A global perspective implication from Southeast Asia. *Frontiers in Psychiatry*, *12*, 643783. Pakistan places a huge importance on agriculture. Pakistan's economy was mostly dependent on agriculture when it attained independence. But, as industry spread, Pakistan steadily grew to be a more varied nation (Wang et al., 2021). Agriculture still exists in Pakistan, despite the fact that it is part of the economy has extremely declined since its inception due to the growth of other industries. Pakistan is still referred to as an agricultural country because of the importance of agriculture to its economic wealth (Alavi, H. 1976).

The role of Agriculture in GDP during 2018-23. (Table 2.1) Source: Pakistan Bureau of Statistics



Note: Source "Pakistan Bureau of Statistic [https://www.pbs.gov.pk/]

Figure 3:The role of Agriculture in GDP during 2018-23

The shortage of water and embedded problem of poor water (majorly stomach related) to incurred huge cost and it is impact on GDP is approximately 1.440 percent and huge impact on GDP is due to over 80.0% of the water that is given is deemed dangerous. Now we need to coordinate national policy on water. Our Country (Pakistan) belongs to one of a farm-based nation, with the farming industry helping as an important instrument for the generation of revenue for the country's economy, generating revenue in other currencies, and providing the main means of subsistence for a significant portion of its citizens (Lak, A., & Khairabadi, 2022). It also provides for a healthy diet, serves as a tool to fight food shortage in the countryside, and serves as a supplier of essential supplies for multiple sectors of the industries (Moran, J. 2009). Part of the entire area of 79.6 million hectares, the major areas i.e., approximately 22.1 million hectares are used for agriculture in the country, and over eighty percent (80%) of them are provided with water and maintained by the Indus Valley Bay Agricultural Infrastructure, the biggest consecutive water supply system as compare to the entire world. But this framework majorly depends over seventy-seven percent (77%) on the waters across borders (Khan, A. N. 2013). An imminent freshwater situation has been exacerbated by rising numbers of people plus intensification. The continually altering environment has generated this scenario. Ice and snow melting in the Hindu-Kush Karakoram region of the Most Significant Himalayas is thought to account for more than sixty-nine-point nine percent (69.9%) of the aggregate monthly outflows in the Indian River Basin. Due to the unpredictable patterns and the periods of rainfall, along with shifts in glacier and ice runoff brought on by warming temperatures, there could be serious consequences regarding controlling the valley's water supplies (Palazzi et al., 2013).

The agriculture industry in Pakistan badly impacts due to debt, electricity, fertiliser costs, and pricing for agricultural tube wells. In Pakistan, important crops are not shaped to their full probable due to a variety of factors, including a lack of water. This has been found in numerous studies. The country's long-term security and sustainability are at risk due to the water problem (Aftab, M. Y., & Ali, N. G. 2023). Disaster prevention requires quick, well-thought-out planning and operation. In this detailed thesis, the sources of water and the causes of Pakistan's growing water scarcity at the farm level are evaluated critically. An all-inclusive, socio-technical factor investigation required the gathering of data for the study.

Summary And Discussion with Solutions To Water Scarcity

This research is yet to compare different countries development and strategies for domain of water crisis which may face absolute scarcity to get rid of future water crisis in Pakistan. After using four indicators we identify that Pakistan has serious water crisis issues. The Government of Pakistan needs to measure these issues and will take the action. Here we can suggest some solutions to overcome the water scarcity in Pakistan.

Government Challenge, Policy and Modification

As we are starting the discussion of the characteristics of water. Water is mutually an egregious issue due to its related difficulty and in the wide range in both the benefits and shortcomings of water administration in a community and a lightly chaotic issue due to a shortage of agreement regarding the core reason of the issue and the principles that must be applied when dealing with

freshwater (DiResta et al., 2022). The whole management who relates to politics and participants needs to own the immense provocation of Pakistan's water problems and state the target for report it (Akhter, M. 2022).

Michael Kugel man (writer and director of the South Asia Institute) said that "In order to address this situation, Pakistan's administration and participants must first acknowledge their responsibility of it. Nothing will change if prior administrations or accusing other country (India) are solely held responsible for the issue". The major international analyses of water issues and recommendations for the strategy of infrastructure of water reforms frequently overlook the interdependence of concrete, organisational, and ancient civilization factors (Tok et al., 2022). Whereas, the newly bought market-driven approaches to stop and control the floods and droughts, maintain the cleanliness of water, provide an adequate quantity of water, and support the environment are being addressed and put into reality, issues with resolving ingrained inconsistencies in the water finances necessitate a thorough analysis of legislative views and techniques, which forces rethinking and modifying the established techniques and strategies for handling the water assets of the world (Tarrow, S. 2022).

There is a need to develop a bridge between policy and governance because without formulating by implementing a detailed plan we never succeeded. **Sir Sabot Hussain** (banker and economist, dean of the Institute of Business Administration) said that "Instead of a freshwater catastrophe, we are experiencing poor governance of water- related concerns"

Pakistan ought to regulate water demand and optimise the use of every ounce of water instead of concentrating on a lack of water. In order to promote appropriate use of water, we need to improve the effectiveness of issuance of freshwater and equity and provide benefits that take into account that how limited water is (Bose, S., & Jalal, A. 2022). One of the government's necessities is to establish the main model that encourages the most careful usage of water. That would contain saving's water, modern technologies, managing water, safeguarding the water and organized different alertness programs (Wolf et al., 2017).

Water Pricing and Wastewater Recycling

There are many ways to deal with the lack or deficiency of water, and to deal with each factor is going to need more money. Incentivizing the consumers to adopt water- saving practises and habits, such as taking a bath instead of going to a spa and consume more water, can both slow the rate of consumer development and increase productivity, for example, through lower communication costs and the drip input crop method (Fanish et al., 2011). There are unique conditions to each nation to determine how the various strategies could be balanced. Better-quality filtration of conventional resources, adoption of unconventional alternatives, and/or repurposing of sewage — which entails treating sewage and employing it in productive ways — can all enhance the availability (Li et al., 2021). Captured sewage is becoming a more attractive choice for fulfilling domestic water needs as shortages of water spread across the globe, particularly in cities (Narayanamoorthy, A. 2004). However, people continue to be reluctant to apply recycled water, nonetheless. It is uncommon for cleansed sewage to be put straight into the water for consumption availability; instead, fixed recycled sewage water operations, in which filtered water is infused into a natural reserve prior to reaching the water's consumption supply network, are more common (Taylor, R., & Zilberman, D. 2017). Using sewerage regeneration as a starting point, experts should revaluate water policy to reutilize the water which is already gone during the process of utilization in the home or industry (Yuan et al., 2022). Singapore and Israel

both employ the very similar system. Several nations made use of the method built around the concepts of adequate water price and private sector participation. Israel, which had 70 percent of its land covered in desert and was water-insecure, has attained water security by recycling almost 90 percent of its sewerage. They used this wastewater mainly for irrigation, meeting around 1/4 of the nation's need for water. Singapore is one of the water-threatened nation – is conference 40 percent its need of water from reuse it's sewerage, and is estimated reach to 55 percent by 2060's (The Korea Times 2021).

To create a culture of the most effective use of the amount of water that is readily accessible, suitable extreme-efficiency programming gadgets, such as rainwater harvesting, drip harvesting, and sprinkle harvesting, are sometimes advocated (Yang et al., 2020). Putting preservation first and supplying landowners using water-efficient farming methods are both necessary. In some of the cases, farmers are possibly motivated to undertake trench cultivation, particularly when it comes to producing crops (Brar et al., 2022). The metering of water is one more solution for all users from agriculture, domestic and industrial components. First, the amount of utilization is identified, and after that better management and achievable planning of the valued resource are enabled (Griffin,R. C. 2001). The present pricing offers few incentives to consumers to conserve water. Pricing is inversely proportional to income levels, so growing the charge of water will not only force buyer to usage water with most intelligently but correspondingly produce profits for the preservation of set-up and different preserving water machineries (Li etal., 2022).

Increase Efficiency of Agricultural System and Water Storage

Many countries like Germany, China, USA, India and Israel use different types of methods of irrigation to reduce the water shortage like drip irrigation, sprinkle irrigation, micro irrigation (Madramootoo, C. A., & Morrison, J. 2013). Drip irrigation and sprinkle irrigation are mostly use by different nations of the countries because of reduced water evaporation. The overuse of electronic devices in the usage of sprinklers leads to consumers typically replacing labour or human resources with different scientific devices that can have a number of beneficial effects for cultivators, such as better or increased numbers of production (de Deus et al., 2020). When compared to the full application of standard agriculture, techniques for handling across various circumstances are relatively easy and uncomplicated. As a result, despite the fact that modern sprinkler irrigation methods have the capacity to execute innovative irrigation techniques to boost the efficiency of water crop per unit of water, which is significantly greater than what is now employed, substantial savings in irrigation water or electrical consumption have not been achieved (Santra, P. 2021). In addition to choosing the invention carefully to ensure that it provides the intended outcome, which is essentially what the nation wants, it is important to enforce technology for effective water consumption. Instead of filling their fields to the brim, farmers can employ the necessary watering (Dalvi et al., 1999). Drip water supply is one of the most important modern agricultural technologies. The most effective method of providing vegetation with nutrients and water is drip irrigation. It precisely provides water and nutrients in the appropriate proportions at the right times to the plant's roots, ensuring that each plant receives what it needs to thrive to its full potential (Mateos et al., 1991). By using less water, manure, and labour, farmers may achieve larger farms. Nonetheless, water- comprehensive yields such as rice crop, sugar cane crop and soybeans may be exchanged for decrease-demanding water yields. Each of the major mishaps involved in the leakage into the surface of earth and the wastewater discharges to the river, both of which are later on utilised through the hydraulic pumping or diversion downstream (Miran et al., 2022). In fact, the exceptionally

elevated and expanding amounts of drinking of freshwater in the watershed are supported by canal seepage and percolation into the aquifer. The issues with watering are more related to the inequitable and inadequate allocation of liquid, as well as the low yields of commodities in regards to harvest and economic worth per unit of water consumed (Alam, M. M., & Bhutta, M. N. 2004). In areas with the limited water resources, the utilisation of freshwater for crop cultivation calls for creative and effective innovation as well as the proper transmission of methods.In particular, the utilisation of processed sewage and acidic water for directly watering operations is covered in this work. There are number of theories about water deficiency or shortage, including those related to dryness of the land, deforestation, extreme heat, and water shortage, as well as strategies for dealing with such moisture-harass environments (Engelbert et al., 1997). A broad approach is taken while reviewing theoretical solutions to the agricultural effectiveness, water consumption, and water usage reduction (Swamee et al., 2000). The administration of resources to address a lack of water is later on discussed, with the special focus on the application of sewage and inadequate waters and the corresponding consequences for human wellness and the surroundings as water's limited availability is forcing beneath-ground waters to be applied to watering more and more. There are many different aspects regarding handling water in crop irrigation when it is scarce. These are related to the basis of current issues as well as the very dry system, and they are the reason for shortages of water (Smith et al., 2009).

Through creating new, tiny dams to create new reserve basins. The Indus and its channels have the ability to hold more than 59 BCM of water, according to the Water and Power Development Authority (WAPDA). But no significant storage has been constructed for the nation. The governments' attention has been on the construction of small dams as a result of interprovincial disputes (Qamar et al., 2022). Tiny dams have a number of benefits, including providing irrigation water, replenishing the groundwater, limiting water loss, delivering water for personal and commercial reasons, existing nearby the point of use, providing recreational activities, and also assisting in the development of fisheries (Crank, K., Petersen, S., & Bibby, K. 2019).

Because of the significant surface area to volume proportion, minor reservoirs have some restrictions because they lost 50 percent of their reserved through evaporation. Therefore, wherever it is feasible, mini dams should be built. Also, due to safety concerns, they cannot handle the overflow during severe weather conditions due to their small storage capacity, which prohibits seasonal or yearly waste. Comparing small and large dams, the unit cost of water in small dams is greater (Sakthivadivel, 1997, Keller, 2000).

There is a lot of water stored in the big dams that can be used for the supply of water. A hybrid power system, the most affordable energy source, satisfies the riversenvironmental flow requirements (Khagram, S. 2018). During the dry season and drought periods, these reservoirs serve as barriers and storm water management structures (Nayak,A. K. 2010). Many times, floods destroyed everything in Pakistan (Barik, B. C. 1997). Thousands of homes have been damaged, even though many hospitals, roads, and schools have been destroyed (Ali et al., 2022). These are all the calculations of big disasters even though many small floods also come and affect many areas also. Figure shows Pakistan's affected areas and death.

References

Anik, A. R., Rahman, S., & Sarker, J. R. (2017). Agricultural productivity growth and the roleof capital in South Asia (1980–2013). *Sustainability*, *9*(3), 470.

Asghar, N., Amjad, M. A., Ur Rehman, H., Munir, M., & Alhajj, R. (2022). Achieving sustainable development resilience: Poverty reduction through affordable access to electricity in developing economies. *Journal of Cleaner Production*, *376*, 134040.

Ashraf M, Bhatti ZA, Zakaullah (2012) Diagnostic analysis and fine tuning of skimming well design and operational strategies for sustainable groundwater management - Indus basin of Pakistan. International Journal of Irrigation and Drainage 61: 270- 282

Ashraf M., Hassan F.U., Khan M. A. 1999. Water conservation and its optimum utilization in barani areas Science Technology and Development 18(1), 28-32.

Ashraf, M., & Khan, M. A. (2000). Sustainable environment management: impact of agriculture. Science Technology and Development, 19(4), 51-57.

Ashraf, M., Kahlown M.A. Ashfaq A. (2007) Impact of small dams on agriculture and groundwater development: a case study from Pakistan.Agricultural Water Management 92: 90-98.

Ashraf, M., Nasir, A., & Saeed, M. M. (2010). Evaluation of the existing water productivity in the lower Bari Doab Canal (LBDC) command-A case study. Pak. J. Agri. Sci, 47(4), 389- 397.

Aslam, K., Rashid, S., Saleem, R., & Aslam, R. M. S. (2015). Use of geospatial technology for assessment of waterlogging & salinity conditions in the Nara Canal Command area in Sindh, Pakistan. *Journal of Geographic Information System*, *7*(04), 438.

Baloch, M. A., & Thapa, G. B. (2018). The effect of agricultural extension services: Date farmers' case in Balochistan, Pakistan. *Journal of the Saudi Society of Agricultural sciences*, *17*(3), 282-289.

Brookshire, D. S., & Whittington, D. (1993). Water resources issues in the developing countries. *Water Resources Research*, *29*(7), 1883-1888.

Brown, L. R., Gardner, G., & Halweil, B. (2014). *Beyond malthus: The nineteen dimensions of the population challenge*. Routledge.

Butt, A., Shabbir, R., Ahmad, S. S., & Aziz, N. (2015). Land use change mapping and analysis using Remote Sensing and GIS: A case study of Simly watershed, Islamabad, Pakistan. *The Egyptian journal of remote sensing and space science*, *18*(2), 251-259.

Butt, M. J., Mahmood, R., & Waqas, A. (2011). Sediments deposition due to soil erosion in the watershed region of Mangla Dam. *Environmental monitoring and assessment*, *181*, 419-429.

Cech, T. V. (2018). *Principles of water resources: history, development, management, and policy*.

John Wiley & Sons.

Dalstein, F., & Naqvi, A. (2022). 21st Century water withdrawal decoupling: A pathway to a more water-wise world? *Water Resources and Economics*, *38*, 100197.

Dalvi, V. B., Tiwari, K. N., Pawade, M. N., & Phirke, P. S. (1999). Response surface analysis of tomato production under microirrigation. *Agricultural water management*, *41*(1), 11-19.

Damkjaer, S., & Taylor, R. (2017). The measurement of water scarcity: Defining a meaningful indicator. *Ambio*, *46*(5), 513-531.

Davis, D. K. (2016). *The arid lands: history, power, knowledge*. MIT Press.

de Deus, F. P., Mesquita, M., Ramirez, J. C. S., Testezlaf, R., & de Almeida, R. C. (2020). Hydraulic characterisation of the backwash process in sand filters used in micro irrigation. *Biosystems Engineering*, *192*, 188-198.

de Sá Silva, A. C. R., Bimbato, A. M., Balestieri, J. A. P., & Vilanova, M. R. N. (2022).

Exploring environmental, economic and social aspects of rainwater harvesting systems: A review. *Sustainable Cities and Society*, *76*, 103475.

Debata, B., Patnaik, P., & Mishra, A. (2020). COVID-19 pandemic! It's impact on people, economy, and environment. *Journal of Public Affairs*, *20*(4), e2372.

Dewan, C. (2022). 'Climate Change as a Spice': Brokering Environmental Knowledge in Bangladesh's Development Industry. *Ethnos*, *87*(3), 538-559.

Janjua, S., Hassan, I., Muhammad, S., Ahmed, S., & Ahmed, A. (2021). Water management in Pakistan's Indus Basin: challenges and opportunities. *Water Policy*, *23*(6), 1329-1343.

Jeuland, M. (2020). The economics of dams. *Oxford Review of Economic Policy*, *36*(1), 45-68.

Johnston, B. F., & Mellor, J. W. (1961). The role of agriculture in economic development. *The American Economic Review*, *51*(4), 566-593.

Jury, W. A., & Vaux Jr, H. J. (2007). The emerging global water crisis: managing scarcity and conflict between water users. *Advances in agronomy*, *95*, 1-76.

Mikosch, N., Becker, R., Schelter, L., Berger, M., Usman, M., & Finkbeiner, M. (2020). High resolution water scarcity analysis for cotton cultivation areas in Punjab, Pakistan. *Ecological Indicators*, *109*, 105852.

Miran, S., Tamoor, M., Kiren, T., Raza, F., Hussain, M. I., & Kim, J. T. (2022). Optimization of standalone photovoltaic drip irrigation system: A simulation study. *Sustainability*, *14*(14), 8515.

Moench, M. H. (1992). Chasing the watertable: Equity and sustainability in groundwater management. *Economic and Political Weekly*, A171-A177.

Molden, D. (1997). Accounting for water use and productivity (No. 42). Iwmi. Raskin, P., Gleick, P., Kirshen, P., Pontius, G., &

Moran, J. (2009). *Business management for tropical dairy farmers*. Landlinks Press.

Mulwa, F., Li, Z., & Fangninou, F. F. (2021). Water scarcity in Kenya: current status, challenges and future solutions. *Open Access Library Journal*, *8*(1), 1-15.

Nabi, G., Ali, M., Khan, S., & Kumar, S. (2019). The crisis of water shortage and pollution in Pakistan: Risk to public health, biodiversity, and ecosystem. *Environmental science and pollution research*, *26*, 10443-10445.

Narayanamoorthy, A. (2004). Impact assessment of drip irrigation in India: the case of sugarcane. *Development Policy Review*, *22*(4), 443-462.

Nasim, S., & Helfand, S. (2016). Optimal groundwater management in Pakistan's Indus water basin. *International Food Policy Res Institute*, *34*.

Nasseri, A. (2023). Effects of tillage practices on wheat production using groundwater- based irrigation: multidimensional analysis of energy use, greenhouse gases emissions and economic parameters. *Environment, Development and Sustainability*, *25*(7), 7047-7074.

Nawaz, A., Shah, S. A. R., Su, X., Dar, A. A., Qin, Z., & Albasher, G. (2022). Analytical strategies to sense water stress level: an analysis of ground water fluctuations sensing SDGs under pandemic scenario. *Chemosphere*, *291*, 132924.

Nayak, A. K. (2010). Big dams and protests in India: A study of Hirakud dam. *Economic and Political Weekly*, 69-73.

Prasad, K., McLoughlin, C., Stillman, M., Poplau, S., Goelz, E., Taylor, S & Sinsky, C. A. (2021). Prevalence and correlates of stress and burnout among US healthcare workers during the COVID-19 pandemic: a national cross-sectional survey study. *EClinicalMedicine*, *35*.

PRATS, E. V. (2020). *WHO guidance for climate-resilient and environmentally sustainable health care facilities*. World Health Organization.

Qamar, K., Nchasi, G., Mirha, H. T., Siddiqui, J. A., Jahangir, K., Shaeen, S. K & Essar, M. Y. (2022). Water sanitation problem in Pakistan: A review on disease prevalence, strategies for treatment and prevention. *Annals of Medicine and Surgery*, 104709.

Qureshi AS (2011) Water management in the Indus Basin in Pakistan: challenges and opportunities. Mountain Research and Development, 31(3): 252-260.

123(3), 1170-1189.

Seckler, D., Amarasinghe, U., Molden, D., de Silva, R., & Barker, R. (1998). World water demand and supply, 1990 to 2025: Scenarios and issues. Research Report 19.

Shafique, O., & Khan, R. M. N. (2020). An Empirical Study on the Impact of Micro- Credit Financing on the Socio-Economic Status of Small Agriculturists in Pakistan. *Journal of Business and Social Review in Emerging Economies*, *6*(3), 1051-1061.