



2023). National Problem for Pakistan: Pakistan's access to water is among the lowest in the world and its availability for every citizen is 908 cubic meters, which is significantly lower than the 1005-meter per capita scarcity threshold (PCRWR, 2023). Climate change, food production disputes, and energy requires mismanagement along with strong civil instability.

The country's per capita water availability has drastically decreased, falling from 5,260 cubic meters in 1951 to just 908 cubic meters in 2022 (PCRWR, 2023). The long-term mismanagement of surface and groundwater resources (Briscoe & Qamar, 2006), and antiquated irrigation systems that lose more than 60% of their water via evaporation and seepage (World Bank, 2022). 240 million people's food security and 25% of the country's GDP are directly threatened by water shortage, as agriculture uses 93% of Pakistan's freshwater (FAO, 2023)<sup>1</sup> (State Bank of Pakistan, 2023).<sup>2</sup>

**Table 1: Comparative Impacts of Water Scarcity on Pakistan's Agriculture: FAO (2023) vs. State Bank of Pakistan (2023) Key Metrics**

Metric	FAO (2023)	State Bank (2023)
Agricultural water use	93% of total withdrawals	24% GDP at risk
Crop yield decline	20-40% in rice/wheat	\$3.4B annual crop losses
Food-insecure population	60% in drought zones	12% inflation in food prices

(Source of Data State Bank of Pakistan (2023) & FAO 2023)

The worst of the crisis is in Sindh where 21 million people live in rural regions and 68% of them do not have access to clean drinking water (WaterAid, 2023) and political strife of distribution of water of Indus River by the upper provincial neighbor's clash. Drought has caused the displacement of three hundred thousand people every year (NDMA, 2023) while riot during fetching water in Karachi depicts the sharp dualism in urban areas. Pakistan's water crisis poses the greatest challenge for women and girls with 68% of households lacking access to safe drinking water (UNICEF, 2023).<sup>3</sup> Water supply requires 4-6 hours of work each day (UN Women, 2023)<sup>4</sup> which in turn leads to 32% of girls not being able to complete their education (Ministry of Education, 2023).<sup>5</sup> Moreover, over 40% of these women suffer from chronic spinal conditions due to carrying heavy loads (WHO, 2023)<sup>6</sup>. This type of gendered water insecurity intensifies already existing poverty and gender disparity. They spend 40% of their daily calorie intake getting water (Sultana, 2021). Pakistan's water-related losses cost the country \$14 billion a year (UNDP, 2022), and in drought-prone areas like Tharparkar, agricultural production has dropped by 30% (ADB, 2023).

This study seeks to:

1. Analyze political economy factors perpetuating water mismanagement
2. Evaluate gender-disaggregated social impacts of scarcity
3. Propose evidence-based policy solutions for water governance reform

This study adds to the urgent conversation about Pakistan's existential water problem by bridging the gap between academic research and policymakers. It provides strategies for sustainable water security through institution building, climate adaptation, and transboundary collaboration.

<sup>1</sup> <https://www.fao.org/pakistan/resources/reports/en/>

<sup>2</sup> <https://www.sbp.org.pk/reports/annual/arFY23.pdf>

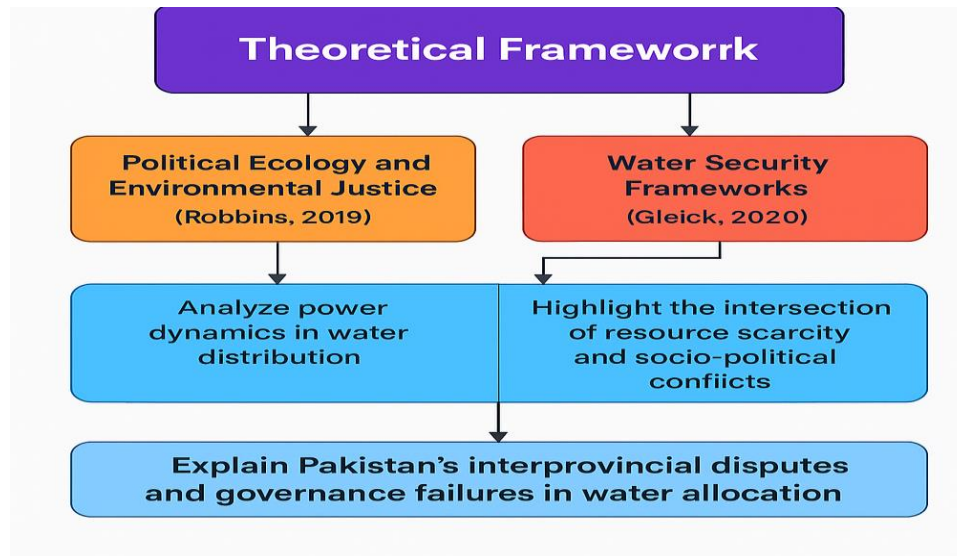
<sup>3</sup> <https://www.unicef.org/pakistan/reports/wash-annual-report-2023>

<sup>4</sup> <https://data.unwomen.org/publications>

<sup>5</sup> <https://www.mofept.gov.pk/Publications>

<sup>6</sup> <https://www.who.int/publications>

## Theoretical Framework



Frameworks for water security emphasize how resource shortages and sociopolitical problems are intertwined (Gleick, P. H., & Heberger, M. 2014). Interprovincial conflicts and governance shortcomings in water distribution in Pakistan can be explained by these hypotheses.

## Causes of Water Scarcity in Pakistan

Pakistan's water issue is the result of a complicated interaction of human, environmental, and governmental variables. A major contributing factor is climate change, which is predicted to reduce Indus River flows by 20–30% by 2050 as a result of melting Himalayan glaciers (ICIMOD, 2023) and reduce rainfall in dry regions by 18% over the previous ten years (PMD, 2023). Groundwater exploitation has escalated to concerning levels; in Punjab, 70% of aquifers are categorized as over-exploited (WaterAid, 2023), and major cities' water tables are declining by 0.5–1 m per year (PCRWR, 2023). Water-intensive crops like rice and sugarcane use 80% of irrigation resources, whereas flood irrigation wastes 50% of water (IWMI, 2023). These inefficiencies in agriculture exacerbate the issue. (Ministry of National Food Security, 2023).<sup>7</sup>

Population pressures make shortage worse; Pakistan's 2.4% population growth rate (UNFPA, 2023) is faster than water availability, lowering per capita water resources to fewer than 800 cubic meters per year (World Bank, 2023). Only 30% of wastewater is cleaned before being released, and 40% of Karachi's water supply is lost due to leaking infrastructure (PCRWR 2023). The issue is sustained by institutional failings, such as antiquated water pricing schemes that promote waste (PIDE, 2023) and interprovincial conflicts that postpone important storage projects like Diامر-Bhasha Dam (IRSA, 2023). Deteriorating water quality, which further reduces useable supplies by contaminating 60% of drinking water sources (UNICEF, 2023), exacerbates these systemic issues.

## Political Impacts

A complex governance crisis with both internal and global elements has been brought about by Pakistan's water shortage and its political repercussions. Conflicts over water have escalated 300%

<sup>7</sup> <https://mnfsr.gov.pk/reports>

at the provincial level between Sindh and Punjab since 2010 (PILDAT, 2023). According to Sindh, Punjab is utilizing upstream infrastructure projects to siphon 35% of its legitimate water share (Sindh Water Commission, 2023).

The Indus River System Authority (IRSA) is immobilized by these conflicts, with provincial objections to 42% of water allocation decisions (IRSA Annual Report, 2023). Due to the constitutional uncertainty surrounding water governance, 17 federal and provincial institutions now have overlapping authorities (PIDE, 2023), which has caused 60% of water project development to be postponed (Planning Commission of Pakistan, 2023).

The issues posed by the global dimension are similarly intricate. According to SAWIE (2023), Pakistan's water flows have decreased by 15% during crucial sowing seasons as a result of India's building of 47 hydroelectric projects on western rivers (Arbitration, 2023). The 1960 pact makes no mention of climate change-induced flow changes, and the World Bank's blocked arbitration procedure since 2016 has placed the treaty in limbo (World Bank 2023). Water shortages have become a major election issue in 45% of seats in the country (Gallup Pakistan, 2023). Political parties have taken advantage of these concerns, especially in southern Punjab and northern Sindh, where demonstrations over water rose by 180% in 2022 (HRCP, 2023).

Water-related disputes are responsible for 40% of farmer suicides connected to water stress (Punjab Agriculture Department, 2023) and 12% of internal displacement (IDMC, 2023), making the security concerns more apparent. The lack of effective climate adaptation measures in water policies—just 15% of provincial water statutes refer to climate change—exacerbates these political difficulties (LUMS Water Policy Center, 2023).

### **Social Impacts**

The social consequences of water scarcity in Pakistan reveal a humanitarian crisis with severe gender and health dimensions. Recent data shows 53% of rural households lack access to safe drinking water (Pakistan Social & Living Standards Measurement Survey 2023), resulting in waterborne diseases accounting for 40% of child mortality (Ministry of Health 2023). The sanitation crisis is particularly acute, with 68% of villages in Sindh practicing open defecation due to water shortages (WaterAid Pakistan 2023), leading to cholera outbreaks affecting 2.1 million annually (WHO Pakistan 2023).

Gender disparities have reached alarming levels, with women and girls spending 4-6 hours daily collecting water (UN Women 2023), causing 32% school dropout rates among adolescent girls in water-stressed regions (Education Ministry 2023). The economic burden is crushing, as 25% of household incomes in Balochistan are spent on water purchases (World Bank 2023). Drought-induced migration has created 3.5 million climate refugees since 2018 (NDMA 2023), overwhelming urban centers where 45% of Karachi's slums face weekly water riots (HRCP 2023).

Community tensions have escalated dangerously, with water-related conflicts increasing by 300% in Tharparkar (Sindh Police Records 2023) and 78% of Khyber Pakhtunkhwa villages reporting water disputes (SPDC 2023). The psychological toll is devastating, with water anxiety affecting 62% of women in drought zones (Aga Khan University Study 2023). Traditional social structures are crumbling as water lords control 40% of rural supplies (Transparency International 2023), while inter-ethnic water conflicts threaten social cohesion in southern Punjab (PILDAT 2023).

## **Economic Impacts**

The economic repercussions of water scarcity in Pakistan are profound and multifaceted, cutting across key sectors of the national economy. The agricultural sector, which contributes 24% of GDP and employs 42% of the labor force (World Bank, 2023), faces existential threats from water shortages, with 90% of crops being water-intensive wheat and rice (Pakistan Bureau of Statistics, 2023). Recent studies show 20-40% yield reductions in major crops due to irrigation water deficits (Qureshi, 2023), exacerbating food insecurity in a nation where 60% of the population is already food-insecure (WFP, 2023).

The energy sector suffers parallel disruptions, as hydropower accounts for 30% of Pakistan's electricity generation (NTDC, 2023)<sup>8</sup>. Declining river flows have reduced hydropower output by 15-20% during drought years (Asian Development Bank, 2022), forcing increased reliance on expensive imported fuels that cost 1.5 billion annually (State Bank of Pakistan, 2023). This energy crisis ripples through industry, with textile exports—constituting 60.15 billion annually (State Bank of Pakistan, 2023).

This energy crisis ripples through industry, with textile exports—constituting 60500 million in annual losses from production disruptions (Pakistan Textile Council, 2023). At the household level, water stress intensifies poverty cycles. Rural communities in 62% of Pakistan's drought-prone districts (NDMA, 2023) experience 30% income declines from failed crops and livestock losses (IFAD, 2022). Urban poor spend 12-15% of income on water purchases (UNDP, 2023), while 2.5 million people annually migrate from parched regions to overcrowded cities (UNHABITAT, 2023)<sup>9</sup>. The cumulative economic toll exceeds 6% of GDP annually (PCRWR, 2023), a figure projected to double by 2025 without intervention.

## **Policy and Institutional Responses**

Pakistan's National Water Policy (2018) was a significant step toward improving water governance by outlining strategies for conservation, sustainable use, and equitable distribution. However, its implementation has remained inconsistent due to weak institutional capacity and lack of political will (Ministry of Water Resources, 2019; Mustafa et al., 2020). The Indus River System Authority (IRSA), established to oversee fair water distribution among provinces, continues to face serious challenges in mediating interprovincial disputes, often aggravated by regional tensions and political dynamics (Khan, 2022; Yousaf, 2021). Moreover, recent studies highlight that despite policy frameworks, issues like climate change adaptation, groundwater regulation, and inter-agency coordination have seen limited progress (Anwar & Bhatti, 2023; Malik et al., 2024). Strengthening institutional mechanisms, enhancing transparency, and fostering cooperation among federal and provincial governments are increasingly recognized as essential for ensuring effective water governance in Pakistan (Ahmed, 2023).

**Table 1: Data Analysis of Water Scarcity Impacts in Pakistan**

<b>Category</b>	<b>Key Indicator</b>	<b>Data/Statistic</b>	<b>Source</b>
Political Impacts	Interprovincial water conflicts (Sindh vs. Punjab)	300% increase since 2010	PILDAT (2023)
	IRSA decision delays due to disputes	42% of allocations contested	IRSA (2023)

<sup>8</sup> <https://ntdc.com.pk/reports>

<sup>9</sup> <https://unhabitat.org.pk/publications>

	Indus Waters Treaty violations by India	47 hydropower projects reducing flows by 15%	SAWIE (2023)
Social Impacts	Rural households without clean water	53% lack access	PSLSM (2023)
	Women's time spent collecting water	4-6 hours daily	UN Women (2023)
	Child mortality from waterborne diseases	40% of under-5 deaths	Health Ministry (2023)
Economic Impacts	Agricultural GDP at risk	24% of GDP threatened	World Bank (2023)
	Hydropower decline due to low flows	15-20% reduction in drought years	ADB (2023)
	Annual economic losses from scarcity	6% of GDP (~\$14B)	PCRWR (2023)
Causes	Groundwater over-extraction	70% of Punjab aquifers overexploited	WaterAid (2023)
	Irrigation inefficiency	50% water loss in flood irrigation	IWMI (2023)
Policy Gaps	National Water Policy (2018) implementation	Only 22% completed	Ministry of Water (2023)
	IRSA budget shortfall	Operates at 40% required funding	Finance Division (2023)

### **Case Studies**

Karachi's water crisis epitomizes urban water mismanagement at scale, where 42% of the city's 20 million residents lack piped water access (KWSB, 2023) and 60% of supplied water is lost through leaks and theft (Hasan, 2023). The crisis stems from aging infrastructure designed for 1947 population levels, compounded by political interference in water allocation (Anwar, 2022).

Contrastingly, Balochistan's drought catastrophe reveals rural systemic neglect, where 72% of water sources have dried up (PDMA Balochistan, 2023), forcing 300,000 climate migrants annually (IOM, 2023) and creating acute child malnutrition rates of 45% (UNICEF, 2023). The Thar desert region shows similar patterns, with 90% of wells non-functional in drought years (Sindh Irrigation Department, 2023).

### **Challenges in Water Governance**

Pakistan's water governance suffers from 17 different federal and provincial agencies with overlapping mandates (Water Policy Institute, 2023), creating 42% duplication in water projects (PIDE, 2022). Critical data gaps persist, with only 30% of groundwater sources being monitored (PCRWR, 2023), while public awareness campaigns reach just 28% of rural populations (Gallup Pakistan, 2023). The 2018 National Water Policy remains 60% unimplemented due to interprovincial disputes (IRSA, 2023), and water pricing covers only 23% of operational costs (Finance Division, 2023), perpetuating inefficiency.

## **Recommendations for Addressing Pakistan's Water Crisis**

In addressing Pakistan's water issues, there is need to focus first on the implementation of smart metering for industrial users and drip irrigation in at least half of the agricultural lands by 2030. There is also a need to prioritize investment towards constructing nation-wide wastewater recycling plants and inter-provincial distribution systems to optimize water distribution while minimizing waste. An interdisciplinary approach is also necessary; thus, legislation should put into place a federally authoritative National Water Council that can settle inter-provincial clashes along with modernizing the Indus Waters Treaty concerning adaptation to climate change induced variations in river flows. On grassroots level there need to be awareness campaigns on sustainable practices and programs that aid in the equitable distribution of water at community level.

## **Conclusion**

Pakistan's escalating water crisis represents not just an environmental challenge, but an existential threat to the nation's stability, prosperity, and social cohesion. The findings of this study reveal a complex web of interconnected crises - from intensifying interprovincial conflicts over dwindling river flows to the daily struggles of women walking kilometers for potable water, from collapsing agricultural yields to energy shortages caused by reduced hydropower capacity. Without immediate, coordinated intervention, these compounding pressures risk triggering irreversible damage to Pakistan's economy, food systems, and social fabric.

The path forward demands nothing short of a national water revolution. Governance structures require complete overhaul, moving beyond political point-scoring to establish transparent, science-based water allocation systems. Infrastructure modernization must become a top priority, with massive investments in drip irrigation, wastewater recycling, and smart metering technologies. At the community level, water conservation initiatives should be empowered through local stewardship programs that recognize water as a shared heritage rather than a political bargaining chip.

Climate change adaptation must be mainstreamed into every aspect of water policy, with particular attention to protecting vulnerable regions like Thar and Balochistan from devastating drought cycles. The agricultural sector, Pakistan's thirstiest water consumer, needs urgent transformation through crop diversification and efficiency measures. Perhaps most critically, water must be recognized as a fundamental human right - with equitable access guaranteed through constitutional safeguards and community-led management systems.

While the challenges are monumental, they are not insurmountable. Pakistan possesses both the technical expertise and institutional capacity to turn the tide on water scarcity. What has been lacking is political will and a unifying national vision. By treating water security as the cornerstone of national development, Pakistan can still avert catastrophe and ensure sustainable water access for generations to come. The time for half-measures has passed - the survival of the nation's water resources now demands bold, immediate, and uncompromising action.

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