TURNING FLOODS INTO OPPORTUNITY

Reframing Pakistan’s Water Future

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EXECUTIVE SUMMARY

Pakistan's floodwater management challenges reveal a hard truth; our current systems are working exactly as designed and that is why they keep failing us.

Since 1950, Pakistan has suffered 28 major floods, causing USD 53 billion in losses, 15,000 deaths, and submerging over 212,000 villages. Their frequency is rising, especially since 2010, with major floods striking almost every year ever since. Floods are not merely acts of nature; they are symptoms of deep-rooted cultural and governance weaknesses. The prevailing reactive mindset treats floods as unavoidable disasters, leading to cycles of relief and rehabilitation without addressing underlying causes. Absence of a clearly defined national direction, fragmented approach, overlapping institutional mandates, weak local governance and underfunded operations have collectively reinforced vulnerability, leaving millions exposed to repeated flood and water scarcity events.

Public policy reflects a flawed approach that confronts flood only after they gain full momentum downstream, while neglecting upstream watershed management that could reduce their force. The engineering mindset dominates, relying on dams, levees, dykes, and other concrete defences, while overlooking cost-effective, traditional, nature-based solutions. As a result, these costly structures are repeatedly overwhelmed and washed away by the next flood. Culturally, floods are framed as a curse, which further inhibits long-term planning and resilience-building.

Institutional gaps are stark: federal agencies operate in overlapping silos, while provincial and local governments lack the capacity, resources, and authority to act effectively. Urban areas are particularly exposed due to inadequate institutional and urban planning, encroachment of floodplains, inefficient stormwater drainage, and poorly managed solid waste, which clogs waterways and amplifies flood damage. Floods are further compounded by underinvestment in river basin level management, groundwater regulation, and climate-informed infrastructure. Reliance on external expertise and donor-driven strategies has often displaced domestic ownership and weakened continuity. The immense potential of social capital (trust, communication, reciprocity, and indigenous knowledge, experience and leadership) has been totally ignored to effectively deal with floods.

Global experience shows that floods can be managed effectively through integrated, innovative, and adaptive approaches. Countries such as the Netherlands, the United States, South Korea, China, Singapore, Australia and India have combined robust infrastructure, nature-based solutions, watershed management, urban planning, and community engagement to turn flood risks into opportunities. Pakistan's own experience with the National Command and Operational Council (NCOC) during COVID-19 demonstrates the potential of unified command, coordination, and data-driven decision-making.

The way forward is a adopting a national water action plan by engaging government, communities, private sector, academia, NGOs and development partners to design and apply a system-based, nationally owned, climate-informed approach that integrates policy, institutions, and technologies towards a national goal, following the model of the Australia's National Water Initiative (2004). Effective flood management in Pakistan requires flexible solutions that reflect the climatic, geographic, social, and economic diversity of the Indus Basin. This means moving beyond one-size-fits-all approaches toward basin-wide, context-specific strategies, supported by strong federal–provincial

coordination and inclusive governance mechanisms. Key principles for this approach should include treating floods as opportunities rather than curses, adopting a watershed-to-coast perspective (Indus basin approach), prioritizing risk reduction over reactive response, and leveraging climate finance, technology, and social capital. A comprehensive national water action plan should follow to focus on: modernizing institutional roles, strengthening federal-provincial-local coordination, employing the 3R strategy (reduce, retain, reuse), enhancing floodplain management, urban planning, and drainage rehabilitation, controlling solid waste to protect waterways, expanding storage through detention and retention ponds, network of flood canals, and reservoirs, restoring wetlands and watersheds, and mobilizing community and private sector participation.

If fully implemented, this plan could reduce, retain, and reuse about 30 million acre-feet (MAF) of floodwater, which could halve flood damages within a decade (saving USD 15 - 20 billion), boost agricultural GDP by 20–25% (USD 5 - 7 billion annually), recharge aquifers, restore ecosystems, and enhance national water security.

Financing this agenda will require reallocation of public development funds, strategic donor engagement, water pollution taxes, private sector investment, and innovative instruments such as impact bonds and performance-based financing.

Ultimately, the choice before Pakistan is stark: remain locked in cycles of disbelief, traditional approach, loss and relief, or seize this moment to reset water governance (institutions, polices, investments and capacity). If it chooses the latter, floods can become a unifying force, reshaping governance, strengthening resilience, and securing a sustainable, dignified future for generations to come. Lastly, Floods could be transformed into Pakistan's 'Blue Oil,' a strategic resource in a thirsty region that is home to 40% of the world's population.

The good news is that Pakistan has sufficient policies, institutions and experts; what's missing is a shared national will. Pakistan's floodwater management challenges highlight a clear opportunity: by redesigning systems that are delivering poor results, we can build resilience and secure a safer water future.

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1. INTRODUCTION

1.1. Background

For more than five millennia, Indus River – the darling of conqueror - has shaped the social, economic, and political life of what is now Pakistan. From the vast reservoirs of Mohenjo-Daro to the modern Indus Basin Irrigation System, water has sustained agriculture, driven institutional innovation, and influenced state formation and community identity. In many ways, the story of Pakistan is the story of the Indus Basin and its floods.

For centuries, seasonal floods enriched the plains with silt and clay, creating one the world's most fertile soils. What once brought prosperity, however, has increasingly turned into disaster. Human interventions, weak governance, and rapid urbanization have transformed natural cycles into recurring humanitarian crises. Climate change is further amplifying the threat by altering rainfall patterns, increasing the intensity and frequency of floods, and creating uncertainty that could bring severe droughts as well.

"90% of Pakistan's people and more than three quarters of its economy resides in the Indus Basin. More than 80% of Pakistan's arable land is irrigated by its waters. 9 out of 10 largest cities in Pakistan are situated within 50 km or less, of the waters of Indus."

The monsoon devastation of 2025 has once again exposed the fragility of Pakistan's climate resilience and water governance. These floods are not isolated shocks but part of a recurring pattern, echoing the super flood of 2010 and the climate-driven catastrophe of 2022. Each disaster has revealed the same truth: climate extremes are intensifying while institutions remain reactive, fragmented, and short-term in their responses. Glacial retreat, accelerated snowmelt, intense monsoons, cloudbursts, glacial lake outbursts, and unchecked urban sprawl are turning seasonal rains into widespread destruction.

Breaking this cycle requires a shift in policy and mindset. Instead of fighting floods year after year, Pakistan must learn to live with them - storing excess water, recharging aquifers, restoring wetlands, protecting deltas, and safeguarding cities through zoning and stormwater master plans. Investments must go beyond concrete structures to embrace nature-based solutions, watershed and hill-torrent management, reforestation, and climate-smart infrastructure. Disaster response, too, must evolve into a unified federal, provincial, and district system that empowers communities and ensures efficiency, accountability, and synergy across government, civil society, the private sector, and development partners.

Floods, however, are not only a curse. Managed well, they can provide surplus water for dry seasons, revive wetlands and mangroves, and recharge depleted groundwater. They also open a policy window to access international climate finance, particularly the Loss and Damage Fund, while mobilizing private partnerships and strengthening community resilience.

The 2025 monsoon, therefore, is not just another calamity. It is the predictable outcome of systemic neglect, weak institutions, and rising climate risks. Yet within this crisis lies an opportunity: to transform floods from recurring tragedies into assets for water security, ecological restoration, and sustainable growth. Pakistan must now reframe water investments, from projects to systems, from relief to resilience, and from fragmented

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initiatives to coordinated governance. The choice is stark: repeat the cycle of loss, or seize this moment to build a resilient water future.

1.2. Context – the Interplay of Geography, Climate, Hydrology

Pakistan sits like a "soup bowl," a downstream nation where nearly 80% of its water flows in from upstream neighbours, China, India, and Afghanistan. About 60% of its territory is mountainous, dominated by the towering Himalayas, Hindu Kush, and Karakoram ranges in the north, and the Sulaiman and Kirthar ranges in the west. These mountains, rising 3 to 8 kilometres high, not only intercept clouds from the Bay of Bengal, the Arabian Sea, and the Mediterranean, feeding both summer and winter monsoons, but also host one of the largest reserves of glaciers and seasonal snow outside the polar regions. The meltwater from these ice and snow reserves sustains river flows long after the rains have ceased, converging downstream to form the vast Indus Plain, Pakistan's agricultural heartland. Pakistan's hydraulic geography is defined by the interplay of glacial melt, monsoon rains driven by heat, winds, and clouds, mountains channelling rivers, and plains spreading their waters, nourishing aquifers along the way before dispersing through the Indus Delta.

Yet Pakistan is an arid to semi-arid country, with average rainfall of just 250 mm a year, 80% of which falls during the three monsoon months. Temperatures have already risen by more than 1°C since the industrial revolution, amplifying risks of extreme rainfall, glacial melt, and heat waves. Every rupee of development investment is now at risk of being undone by climate shocks. With rising temperatures[1], accelerated glacier and snow melt, and increased rainfall due to climate change, Pakistan is likely to experience more frequent and intense floods. Unchecked population growth and unplanned urban sprawl further compound these crises. Yet, climate change must not become a convenient scapegoat for longstanding mismanagement of water and development systems.

The Indus River System dominates Pakistan's hydrology, fed by glaciers (41%) and snowmelt (22%), monsoon rains (37%). The Indus River System receives an annual influx of about 138 MAF of water. Pakistan is also home to the world's fourth-largest groundwater aquifer, with an estimated storage capacity of over 1,000 MAF with an annual discharge of 50 MAF. The Indus River System sustains the world's largest contiguous irrigation system. But inefficiencies, unchecked groundwater extraction, poor drainage, and untreated wastewater have weakened resilience. Flood risks now come from multiple sources: riverine floods, flash floods, local rainfall surges, urban flooding, and glacial lake outbursts. Each is growing in intensity and frequency.

Pakistan's economy magnifies its exposure. High debt, low growth, and weak fiscal capacity limit the state's ability to invest in preparedness or mount effective disaster responses. Poverty pushes communities into informal settlements on floodplains and city slums, where inadequate housing and infrastructure multiply losses. When disasters strike, people are left relying on international aid and community solidarity rather than state protection.

For an arid country where water scarcity is rising, floods also present unique opportunities. Concentrated rainfall in three months could, if captured, provide year-round supply and recharge aquifers for economic, social and environmental outcomes. In coastal areas, floodwaters can restore mangroves, strengthen ecosystems, and support a blue economy. Regionally, Pakistan's freshwater is as valuable as "blue oil" in a neighbourhood of water-stressed countries. Globally, Green Climate Fund, climate pledges, including the Loss and Damage Fund, offer financing opportunities not just for recovery, but for systemic reform.

[1] A one-degree Celsius rise in temperature increases the atmosphere's moisture-holding capacity by about 7%**,** intensifying the risk of heavy rainfall and floods (Trenberth, 2011; IPCC, 2021).

2. THE DILEMMA - TOO MUCH AND TOO LITTLE WATER

Pakistan stands at the heart of a paradox: it suffers from both too much and too little water, and, increasingly, too polluted water. For three months of the year, floods overwhelm cities, villages, and farmland; for the remaining nine months, scarcity grips agriculture, households, industries, and ecosystems. Pollution compounds the crisis by rendering much of the available water unsafe for human or agricultural use.

2.1. Too Much Water (floods)

A flood occurs when rivers, canals, or lakes exceed their capacity, or when intense rainfall overwhelms natural and manmade drainage systems. In Pakistan, floods come in multiple forms, each with its own drivers and risks:

- **Fluvial (Riverine) Floods** – Triggered when rivers overflow due to excessive rainfall, snowmelt, or upstream water releases. Example: the Indus River floods of 2010, and the Chenab, Ravi, and Sutlej floods of 2025.
- **Pluvial (Surface Water) Floods** – Occur when heavy rainfall overwhelms urban or rural drainage systems, even without rivers breaching their banks. Example: the 2022 floods across Punjab and Sindh, and urban flooding in Karachi after the 2025 cloudbursts.
- **Hill Torrents (Flash Floods in Hilly Areas)** – Intense rainfall in mountains and foothills produces sudden torrents that rush downstream at high velocity, destroying homes, farmland, and infrastructure. Example: hill torrents in Dera Ghazi Khan and Rajanpur during 2022, 2024, and 2025.
- **Glacial Lake Outburst Floods (GLOFs)** – Caused when lakes formed by melting glaciers are suddenly released after the collapse of ice or moraine dams, often triggered by heatwaves, rainstorms, or seismic shocks. Example: GLOF disasters in Gilgit-Baltistan and Chitral in 2022, 2023, and 2025.
- **Coastal Floods** – Driven by storm surges, high tides, or cyclones pushing seawater onto coastal land. Example: flooding along the Sindh coast during Arabian Sea cyclones.

Between 1950 and 2025, Pakistan has endured 28 major floods, resulting in economic losses of over USD 53 billion, claiming around 15,000 lives, and inundating more than 212,000 villages across the country. The scale of these events is alarming. For example, the 2010 Super Floods inundated nearly one-fifth of the country, affecting 20 million people, destroying 1.6 million homes, and causing over USD 10 billion in losses, while exposing fragile embankments and weak coordination. Similarly, the 2022 Floods, fuelled by rainfall three times the average, submerged 12 percent of the country, affected 33 million people, and caused USD 15 billion in damages. They prompted global recognition of Pakistan's vulnerability and helped accelerate the creation of the Loss and Damage Fund but with no substantial outcomes.

The 2025 Floods have carried the crisis into a new chapter. Intensified by cloudbursts, glacial lake outbursts in the north, and historic rains in India that swelled the Chenab, Ravi, and Sutlej rivers, these floods displaced nearly 4 million people, killed 1050,

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and injured more than 1,000 by early September 2025. With waters still standing in vast areas, the true scale of the losses remains uncertain. Once again, communities were the first responders, while formal state systems struggled to keep pace.

2.2. Too Little Water (Droughts)

Pakistan often swings between devastating floods and crippling water shortages, with the latter posing a growing threat to cities, agriculture, and rural livelihoods. These cycles of scarcity underscore that Pakistan's challenge is not just managing too much water during floods but also confronting the harsh reality of too little water, which is increasingly frequent due to climate variability and mismanagement.

Outside monsoon months (July – September), Pakistan faces water scarcity for the rest of nine months (October – June). Per capita availability has fallen from 5,000 cubic meters in 1951 to under 1,000 today. With just 30 days of surface storage capacity, compared to the global norm of 120, Pakistan is dangerously exposed to water shortages. Groundwater is overdrawn, glaciers are retreating, and water quality is deteriorating, over 80% of water is unsafe due to pollution.

Urban centres like Karachi, Lahore, Quetta, and Islamabad face chronic shortages as aquifers are overmined. In Karachi alone, nearly 40% of water is lost to theft and leakage, while tanker mafias exploit the crisis by stealing from public pipes and reselling at inflated prices. Southern Khyber Pakhtunkhwa, southern Punjab, northern Sindh, and almost all of Baluchistan, experience persistent water scarcity, undermining agriculture, livelihoods, and food security.

Drought, therefore, is not merely the absence of water; it is the presence of systemic failure. Just as with floods, Pakistan's vulnerability to drought is not solely a product of climate change, it is magnified by weak governance, poor planning, and inequitable access.

2.3. Key Lessons

Pakistan's water crisis is not fundamentally about abundance or scarcity; it is about mismanagement. Floods, too often framed as isolated natural disasters, are in reality symptoms of deeper structural failures: fragmented institutional mandates, weak enforcement of land-use zoning, neglect of watershed management, and a culture of reaction rather than prevention.

Yet within destruction lies opportunity. Floodwaters, if captured and managed, can become a vital resource, buffering against drought, replenishing aquifers, restoring wetlands, and revitalizing ecosystems. What is today a hazard could, with foresight, become the foundation of resilience.

Communities across Pakistan repeatedly show extraordinary resilience, stepping in as first responders when formal systems falter. But their capacity is eroded by the absence of sustained institutional backing, investment, and coordination.

The central lesson is clear: Pakistan must shift from short-term, defensive measures to long-term, integrated water and resilience planning. Only by reframing floods from calamities to catalysts can the country break the cycle of loss and move toward water security, climate adaptation, and sustainable growth.

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2.4. Opportunities

To escape the cycle of devastation during floods and crippling shortages during droughts, Pakistan must begin to see floods not only as disasters but as opportunities for resilience. Floodwater itself can be treated as an economic resource, captured, stored, and reused through investments in surface and underground storage such as dams, lakes, wetlands, ponds, and aquifer recharge systems.

Seizing this opportunity requires cultural shift and systemic reform. Pakistan must move beyond fragmented, event-driven responses toward watershed-scale planning, coordinated institutions, and nature-based solutions that work with, rather than against, natural systems.

Institutional coherence is critical. A unified disaster command structure, linking federal, provincial, and district levels, should bring together government, communities, the private sector, donors, and the media under one platform for preparedness and response.

At the same time, Pakistan can turn its vulnerability into strength by tapping global climate finance. Well-designed, bankable, and systemic programs can unlock funding from mechanisms such as the Green Climate Fund and the Loss and Damage Fund, converting crises into pathways for long-term reform.

Most importantly, community empowerment must become central. Local disaster committees, if formalized, trained, and financed, can harness the strong social capital communities already display in every crisis. Building resilience from the ground up will ensure that Pakistan's response is not only stronger but also more inclusive and sustainable.

3. POLICY LANDSCAPE

Pakistan's water governance has been shaped by colonial legacies, post-independence reforms, mega-investments, and repeated studies by national and international bodies. Yet despite abundant analysis and ambitious plans, the system remains fragmented, reactive, and unable to address the triple challenge of too much, too little, and too dirty water. The prevailing policy approach fights floods the wrong way - fixated on downstream defences, reliant on concrete solutions, and locked in an engineering-against-nature mindset. Instead of building resilience, such policies fuel vulnerability and keep the country trapped in cycles of damage and repair. In the process, a huge opportunity is lost: to view floods not merely as disasters, but as an economic resource that can be harnessed for agriculture, domestic and industrial uses, groundwater recharge, soil fertility, energy, and long-term water security. The following sections examine this evolution: first, the colonial foundations of water management, and then the post-independence reforms that shaped the system Pakistan relies on today.

3.1. Colonial Legacy: Pre-Independence Water Policies

When the British assumed control of the Indus Basin in the mid-19th century, irrigation was limited to 3 to 4 million acres, largely through Sindh's delta canals and rudimentary channels in Punjab. Agriculture depended precariously on seasonal floods, leaving food security fragile.

Seeking to consolidate power and extract revenue, the British launched one of history's most ambitious irrigation transformations. Between 1859 and 1947, they built a colossal gravity-fed hydraulic system of perennial canals, barrages, and headworks that expanded irrigated land eightfold to 31 million acres (see Table 2). Punjab's canal colonies, anchored around the Chenab, Jhelum, Ravi, and Sutlej, turned scrubland into some of the subcontinent's most productive farmland. The Sukkur Barrage (1932) alone added nearly 7 million acres under cultivation.

This hydraulic revolution had profound social, economic, and political impacts. Entire settlements were engineered, creating new classes of landlords and peasants in 9 canal colonies. Reliable irrigation spurred towns and cities, reshaping Punjab and Sindh. The Indus became a global laboratory for hydraulic science, with pioneers like Lacey and Kennedy[2], developing theories that influenced irrigation engineering worldwide.

Yet the system was designed primarily to maximize crop yields and colonial revenue, not to manage floods, recharge aquifers, or ensure sustainability. By diverting rivers into regimented canals, wetlands and floodplains lost their capacity to absorb excess flows. Flood control, drainage, and groundwater management were largely ignored.

Colonial laws cemented this extractive legacy. The Canal and Drainage Act of 1873 institutionalized large-scale canal networks but neglected equity and efficiency. Rooted in this Act, "the Pakistani state form is still colonial in nature, and the state apparatus in water resources is characterized by a hierarchical bureaucracy, more focused on policing the population than providing public services." This top-down, control-oriented mindset continues to shape water governance today. It must give way to an approach that values and harnesses the basin's geographic, climatic, social, and economic

[2] **Gerlad Lacey,** Professor, 1916-17, 1928-31, Last British Principal, 1945-46, University of Roorkee, near Delhi, Founder of Lacey Regime Theory

R G Kennedy, Executive Engineer Punjab PWD 1895, Kennedy Silt Theory on Upper Bari Doab canal

diversity. Uniform, one-size-fits-all solutions should be replaced with democratic, inclusive, transparent, and accountable systems, that draw upon and strengthen the immense social capital. The Easement Act (1882) entrenched private water rights without foreseeing over-extraction. The Government of India Act (1935) centralized river authority, a legacy that still fuels federal–provincial disputes. These laws were rigid tools for expansion, poorly suited to today's climate variability, urban demands, or groundwater stress.

In essence, Pakistan inherited the world's largest contiguous irrigation system: efficient at diversion, but fragile against extremes. It was a machine built for extraction, not resilience. Today's floods overwhelm embankments never designed for such magnitudes, while waterlogging, salinity, and groundwater depletion reflect neglected drainage and aquifer management. This colonial legacy still underpins Pakistan's centralized, fragmented approach to water management. Yet, the system also had its strengths: it operated on zero energy by harnessing gravity, and by spreading river waters thinly across the plains, it not only enabled crop production but also helped replenish aquifers.

3.2. Post-Independence Reforms: Mega-Infrastructure and Fragmentation

3.2.1. *National Water Policy Frameworks*

Partition divided the Indus Basin into upper and lower riparian units, creating long-term challenges for water management. What was once a single river system governed by natural flows became fragmented after Partition, when the Indus Basin was divided between India and Pakistan. The Indus Waters Treaty (1960) provided a framework for water sharing but left critical gaps in joint basin management. Today, this single river system is governed simultaneously through regional treaty arrangements and by national, provincial, and local bodies within Pakistan. This institutional fragmentation, marked by overlapping mandates and weak coordination, makes flood management highly challenging. To overcome this, Pakistan needs to streamline roles and strengthen basin-wide flood governance, learning from models such as Australia's National Water Initiative, which harmonizes federal and state responsibilities under one coherent framework.

Rather than addressing problems holistically, FFC often tailored problems to fit pre-conceived solutions (projects).

After independence, reforms deepened the colonial trajectory rather than reversing it. The WAPDA Act (1958) centralized water and power, enabling iconic projects like Mangla and Tarbela Dams under the Indus Waters Treaty (1960). While these boosted irrigation and energy, they reinforced an engineering-heavy, supply-side model that neglected demand management and ecological health. The 1973 Constitution devolved water to provinces while leaving inter-provincial rivers federal, deepening disputes.

Established in 1977, the Federal Flood Commission (FFC) functioned largely as a project-driven entity, consolidating schemes from provincial and federal agencies, acting more as a post office than a strategic authority. Rather than addressing problems holistically, FFC often tailored problems to fit pre-conceived solutions (projects). Similarly, the National Flood Commission responded to recurring floods without a coherent national direction, measurable targets, or defined outcomes. Its reliance on embankments, coupled with the neglect of urban planning and land-use management, perpetuated Pakistan's vulnerability to flood disasters.

The IRSA Act (1991) attempted to regulate water sharing under the Water Apportionment Accord but remains constrained by limited storage, outdated data, and weak forecasting. The EPA Act (1997) set

water quality standards, yet enforcement is weak, with 80% of water unsafe for drinking. Provincial reforms through the PIDA Acts (1997) introduced farmer participation, but under-resourced organizations and political resistance stalled progress and reversed the reforms after three decades of failed experiment.

River basin management, watershed management, river ecology, flood plain management, stormwater management (urban flooding), groundwater and water quality remained either superficially addressed or entirely neglected in policy discourse, which has long been dominated by an engineering-centric mindset.

Broadening the agenda to environmental and sectoral concerns, Pakistan introduced the National Environment Policy (2005), National Drinking Water Policy (2009), National Rangeland Policy (2010), and National Forest Policy (2015). While these frameworks acknowledged critical environmental linkages, they lacked effective enforcement. Forest cover remains below 5%, wetlands continue to degrade, and urban water quality is in crisis. The National Energy Policy (2013, updated 2021) elevated hydropower, but in doing so reinforced a heavy dependence on large dams.

Toward integration of water and climate policies, the National Water Policy (2018) marked the first comprehensive water framework developed on consensus by the four provinces, emphasizing efficiency, conservation, and climate resilience. Its Framework for Implementation (2018) set targets but lacked political and institutional ownership, financing and coordination. The National Climate Change Policy (2021) placed water at the centre of resilience, but integration into planning and investment has been weak, as shown by the 2022 and 2025 floods. In essence, Pakistan is very good at framing policy documents, mostly funded and steered through donor support, yet its homegrown ownership and implementation remained a nightmare. Policy is often mistaken for a fancy document. In reality, it is the intent and commitment of policymakers, placed firmly at the centre of the political agenda.

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3.2.2. Provincial Policy Frameworks

Despite a wave of policies, laws, strategies, and plans, often triggered by donors or court directives for water reforms, provinces have failed to manage floods in an integrated way that maximizes societal benefits and minimizes damage. The Punjab Water Act (2019) was the first provincial attempt at Integrated Water Resources Management (IWRM), creating regulatory bodies and emphasizing licensing, conservation, and quality control. Yet enforcement is weak, groundwater use remains unregulated, and coordination with local governments is poor, leaving Punjab without a coherent system to balance scarcity, floods, stormwater, and pollution under climate stress. The Khyber Pakhtunkhwa Water Act (2019), modelled on Punjab's law, established similar institutions but lacked the will, resources, and monitoring capacity for effective implementation, keeping the province exposed to flash floods, droughts, and irrigation inefficiencies. Sindh adopted its Water Policy in 2023, introducing a Water Resources Council and integrated governance, yet weak enforcement of groundwater, pollution, and floodplain controls continues to expose it to recurrent riverine floods and coastal intrusion. Baluchistan has developed an Integrated Water Resources Management Policy (2024) with World Bank and FAO support, aiming to strengthen institutions, regulate groundwater, and promote equitable allocation. However, limited resources, weak enforcement capacity, and chronic droughts leave the province highly vulnerable.

Collectively, the provinces lack direction, effective implementation and basin-wide coordination, perpetuating cycles of water insecurity and flood damages. The absence of strong social pressure,

political will, administrative capacity and modern frameworks leaves these provinces highly vulnerable to both floods and droughts.

3.2.3. Local Government Policy Frameworks

Repeated reforms through Local Government Acts (1979–2019) devolved water supply, sanitation, and drainage to municipalities. Yet chronic underfunding, weak autonomy, capacity and political rollbacks left them ineffective. Cities like Islamabad, Karachi and Lahore face stormwater flooding, collapsing groundwater, and unsafe drinking water, challenges that cannot be solved without empowered and accountable local governments. In water governance, even if policies, institutions and infrastructure are strong, failure at the local government level (the "weakest link") can break the entire chain of service delivery.

In water governance, even if policies, institutions and infrastructure are strong, failure at the local government level (the "weakest link of the chain") can break the entire chain of service delivery.

3.3. Reports and Studies: Diagnoses Without Ownership for Implementation

Alongside laws and reforms, dozens of major reports have repeatedly diagnosed Pakistan's water challenges, yet their recommendations remain largely unimplemented.

- **ADB Water Sector Strategy (2002):** Called for institutional reform, cost recovery, and irrigation efficiency — challenges still unresolved.
- **WAPDA Vision 2025 (2003):** Focused on mega-dams (Mangla Raising, Diamer-Bhasha, Kalabagh), reinforcing an engineering-heavy model while sidelining resilience and demand management.
- **World Bank – Briscoe's "Pakistan Economy Running Dry" (2005):** Warned Pakistan's irrigation economy was unsustainable without governance reform. His warning remains relevant as productivity lags.
- **WWF Indus Basin IRBM (2012):** Advocated ecosystem-based basin management, wetlands, and environmental flows, still ignored in Pakistan's supply-centric approach.
- **Friends of Democratic Pakistan (2012):** Linked water reforms to productivity and resilience; neglect of these reforms is evident in today's drought and flood risks.
- **Planning Commission Vision 2025, Pillar IV (2014):** Set efficiency and conservation goals, but targets remained aspirational amid weak provincial execution.
- **World Bank – Getting More from Water (2019):** Urged "more crop per drop," pricing reforms, and integrated management but reforms stalled on political resistance.
- **World Bank – Groundwater Prospects (2021):** Highlighted unsustainable aquifer depletion and salinity, warning of collapse without regulation, a risk still unaddressed.
- **Dutch - Improving Flood Resilience in Pakistan: A White Paper (2022):** Recommended the strategy of Reuse, Retain, Reduce and Remove, clear mandate to manage floodwaters at a Federal Level, trust-based governance among provinces, room for the river and zoning; Pakistan still prioritizes embankments over non-structural solutions.
- **Government of Pakatan - Living Indus (2023):** A holistic USD17 billion program (25 interventions) to revive and sustain the Indus Basin's ecosystems, livelihoods, and cultural heritage. It aims to balance water, people, and nature through integrated, climate-resilient management. While it marks a welcome departure from the traditional brick-and-mortar based fragmented approach, it remains largely on paper, hampered by lack of political will, ownership and continuity.
- **FFC - Framework for Implementation of National water Policy (2018-2030) -** The Framework operationalizes Pakistan's National Water Policy (2018) by translating its principles into time-

bound actions through 111 initiatives under nine priority areas by assigning clear roles to federal, provincial, and local institutions, to ensure that policy goals are pursued consistently through 2030.

- **PCRWR - National Water Conservation Strategy for Pakistan (2023-27) (A Guiding Document) -** Pakistan faces worsening water scarcity from mismanagement and rising demand, and its National Water Policy (2018) calls for conservation, efficiency, and sustainable use across all sectors.
- **Provincial Water Strategies:** Despite the adoption of policies and laws, including KP IWRM Strategy (2015) and KP Water Act (2020), Punjab Water Act (2019), Sindh Water Policy (2023), and Baluchistan IWRM Policy (2024), weak political will, limited capacity, and poor enforcement reveal a lack of genuine commitment to integrated water governance.
- **IFPRI/IWMI & Donor Research (ongoing):** Consistently stress climate-smart agriculture, groundwater governance, and the water–food–energy nexus. Uptake remains slow.

Common threads across these reports are unmistakable:

- Governance, not scarcity, is the root problem.
- Efficiency is more critical than new projects.
- Groundwater regulation is urgent.
- Floods can be opportunities if managed.
- Climate change is a threat multiplier.

In summary, Pakistan has never been short of policies, analyses, institutions, or experts; what it has lacked is a national will, a shared vision, and the commitment to translate plans into action through effective coordination among key stakeholders. From colonial laws to the National Water Policy 2018, from Briscoe's warnings to the 2022 Dutch DRR studies, Pakistan has developed abundance of policies and reports. Institutions abound as well, from WAPDA to Federal Flood Commission (FFC) and provincial Irrigation Departments, there is a long list of federal and provincial institutions to deal with all facets of water management. Similarly, Pakistan has one of the world's best professional individuals who excel in all forms of water management and the country remained a holy place for technical and professional competence in the past. What it lacks is a national will, serious homegrown planning, implementation, coherence, and courage to reform entrenched systems. Donor-funded, infrastructure-driven, fragmented, and reactive governance leaves Pakistan exposed to its water paradox: too much, too little, and too dirty water. Unless the country reframes water policies into a system-based, climate-resilient, multi-level and inclusive framework, it will remain trapped in cycles of disaster and recovery. The following section turns to the institutional landscape that underpins these policies, revealing both its strengths and persistent structural weaknesses.

Pakistan has never been short of policies, analyses, institutions, or experts; what it has lacked is a national will, a shared vision, and commitment to translate plans into action through effective coordination among key stakeholders.

4. INSTITUTIONAL LANDSCAPE

Pakistan's water is governed through a complex and multi-layered, confused and in some cases conflicting institutional architecture. Pakistan's water governance lacks clarity on federal versus provincial authority. 'The Constitution assigns water to the provinces, yet none have authorized federal legislation, even amid warnings of severe scarcity. This raises serious questions about the democratic mandate for integrated water management.' More than a dozen federal agencies, four provincial governments with their respective departments, hundreds of local bodies, and an array of NGOs, research institutes, and development partners all play a role. While this diversity offers opportunities, overlaps, blind spot, fragmentation, and weak coordination often undermine systemic resilience. Water moves in a naturally coordinated system and so shall be its institutional landscape to manage it in a cyclic way. Below is an overview of the key institutions shaping water governance in Pakistan, their mandates and gaps.

4.1. Federal Institutions: Without a Unified Direction

Ministry of Water Resources (MoWR): The apex federal body' mission is to develop the country's water and hydropower resources and is responsible for national water policy, planning, and coordination with provinces. It plans, construct and sometime operate large-scale projects (dams, barrages, canals and drains), oversees transboundary water such as Indus Water Treaty (1960) through the office Pakistan Commissioner for Indus Waters (PIWC), provincial water allocation under the Water Apportionment Accord (1991) through Indus River System Authority (IRSA) and flood control through Federal Flood Commission (FFC). Its core challenge is balancing provincial tensions, climate-driven variability, and outdated supply-side structural (brick and mortar-based) planning against the need for integrated, basin-wide watershed management, including nature-based solutions. Theoretically and logically, the MoWR should run the whole discourse on national water security by providing leadership, guidance and resources for an integrated water management across the country. In practice, its role has been restricted to preparing policy documents, mostly through donors that seldom see the day light, building of concrete structures, and operation of dams. Currently, it seems like the MOWR is acting as post office for processing of Plan (annual, short, medium and long term) and PC-Is clearance through Departmental Development Working Party (DDWP), Central Development Working Party (CDWP), Executive Committee of the National Economic Council (ECNEC). The problem seems to be the lack of professional capacity of the ministry to take up the gigantic task of national level water planning and implementation coordination, such as implementation of the National Water Policy 2018. There are five agencies working under the MoWR, which are briefly discussed below (See Table 4 for detailed institutional mandates, overlaps and gaps).

Water and Power Development Authority (WAPDA): Created under the WAPDA Act (1958), it remains the most powerful water management agency, developing and managing dams, barrages, link canals, hydropower, and drainage. Back in the 60's and 70's WAPDA has delivered landmark projects like Mangla and Tarbela dams and 8 link canals (640 km) but continues to prioritize mega-infrastructure over river basin management, watershed management, economic productivity and ecological sustainability. In today's climate-stressed reality, WAPDA must pivot toward basin level, multi-purpose, climate resilient and productive water management.

Federal Flood Commission (FFC): Established in 1977, the FFC was tasked with preparing National Flood Protection Plans (NFPPs), coordinating provincial flood schemes, and overseeing flood forecasting. Although it has produced four NFPPs (1978–2025), its overall impact has been limited by chronic underfunding, weak enforcement, and an embankment-centric approach. In reality, floods are not isolated disasters but manifestations of excess

water, and broader water management already falls under the mandate of WAPDA. Most of the FFC's reported achievements, as listed on its official website, relate only to the preparation of flood protection plans, work that arguably should fall within WAPDA's scope**.** The FFC Annual Report 2024 further highlights institutional fragility, noting that 15 of its 30 sanctioned positions, including that of the Chairman, remain vacant. The report also states that since 1978, some 5,613 projects[3] have been completed, but it provides little evidence of their impacts beyond procurement of forecasting equipment, installation of early warning systems, and technical studies, suggesting that these investments were made without clear indicators to measure outcomes. For the period 2011–2022, against a requirement of PKR 83 billion, the government released only PKR 6 billion (7%), reflecting the low priority of flood management in public policy. The National Flood Protection Plan IV, first envisaged in 2007 at a cost of PKR 26 billion, was delayed for a decade and revised in 2017 to PKR 332 billion, then again in 2024 to PKR 825 billion, yet it remains unimplemented. In Phase I, the PC-1 (FPSP-III) approved in 2024, carries a cost of PKR 195 billion, with 82% allocated to physical structures[4] and only 18% to non-structural interventions, underscoring a persistent bias toward brick-and-mortar solutions rather than integrated resilience planning. Following the catastrophic floods of 2010, 2022, and 2025, there is now an urgent need to move away from narrow flood-defence measures toward comprehensive floodplain management and resilience-building.

Pakistan Indus Water Commissioner (PIWC): The office of the Indus Water Commissioner was created under the Indus Waters Treaty (1960) to safeguard Pakistan's rights over the western rivers (Indus, Jhelum, Chenab) and to monitor India's compliance on the eastern rivers. Its core responsibilities include reviewing Indian hydropower and storage projects, ensuring adherence to treaty provisions, and raising disputes through the Permanent Indus Commission or international arbitration when required. However, the PIWC faces serious capacity constraints, with limited technical staff, outdated monitoring systems, and inadequate funding to engage effectively with India's rapidly expanding upstream projects. This weakness has become more pronounced in recent years as India has intermittently held the Treaty in abeyance, disrupting regular meetings and restricting data sharing on river flows. The absence of timely hydrological data has had direct implications for Pakistan during recent floods on the Ravi, Sutlej, and Chenab, where sudden upstream releases from India intensified flood risks downstream without prior warning. This situation underscores both the institutional fragility of PIWC and the urgent need for stronger technical, legal, and diplomatic capacity to protect Pakistan's water security in an era of heightened climate and geopolitical stress.

Indus River System Authority (IRSA): Formed in 1992 under the Water Apportionment Accord, IRSA regulates water distribution among provinces, particularly the flows of the Indus and its tributaries. Its decisions directly shape irrigation availability, drought management, and flood releases. However, IRSA's technical role frequently overlaps with WAPDA's operational responsibilities and provincial irrigation departments, creating tensions during

[3] Since 1978, Pakistan has spent PKR 34.862 billion on three flood protection plans, an amount that, when adjusted to today's value, would run into billions of dollars.

[4] **Structural Interventions** (Construction of small to medium dams, flood diversion/ dispersal structures, construction/strengthening/ remodelling of flood embankments & improving drainage) small/medium dams, works etc.) **Non-Structural Interventions** (Installation of new AWS, Establishment of Regional FFW Centres, Installation of Flood Telemetry stations and strengthening other Gauging Networks of WAPDA, besides, green interventions through Recharge

both flood and drought years. In flood management, IRSA's focus is mainly on water allocation and reservoir operation, rather than broader resilience planning.

Pakistan Council of Research in Water Resources (PCRWR): PCRWR is mandated to conduct applied research on water availability, quality, conservation, and efficient use. In relation to floods, it contributes data on groundwater recharge, rainwater harvesting, and safe drinking water for affected populations. Despite its technical strengths, PCRWR often works in isolation, with limited integration into the planning processes of FFC, WAPDA, or IRSA. As a result, valuable research outputs—such as groundwater assessments or drought monitoring—are underutilized in national flood and water management strategies.

National Disaster Management Authority (NDMA): Formed under the NDMA Act (2010), it leads disaster preparedness, response, and recovery. Despite strong relief efforts, it remains largely reactive, with limited capacity in risk reduction and community preparedness. To meet climate-era challenges, NDMA must evolve into a proactive, prevention-focused body with stronger integration into urban planning and climate adaptation at all levels (national, provincial and local).

Ministry of Climate Change (MoCC): Responsible for climate policy, adaptation, and international negotiations, including access to climate finance (e.g., Loss and Damage Fund, GCF). Despite its growing importance, MoCC's influence is limited by weak authority over water, agriculture, and planning ministries. With climate acting as a threat multiplier, empowering MoCC to enforce adaptation standards is vital.

Pakistan Meteorological Department (PMD): Provides weather forecasts, hydrological data, and early warnings. While modernization has begun, forecasting accuracy and dissemination lag behind new risks such as cloudbursts and GLOFs. Investment in satellite, AI-driven forecasting, and community outreach is essential.

Ministry of National Food Security and Research (MNFSR): Oversees agricultural policy and food security, both heavily dependent on water. Despite agriculture consuming over 90% of available water, productivity remains low, and water-efficient farming has yet to be mainstreamed. MNFSR must lead a shift toward diversified, water-smart agriculture.

Pakistan Council of Research in Water Resources (PCRWR): The lead water research body on groundwater, water quality, and irrigation technologies. While its studies are authoritative, limited resources and weak policy uptake restrict its influence. Strengthening PCRWR as a bridge between knowledge and governance is critical.

Ministry of Planning, Development and Reform (MoPDR): The Ministry integrates water priorities into the Public Sector Development Program (PSDP) and Vision 2025. However, planning often remains politically driven, top-down, and project-heavy, with limited attention to governance, scientific evidence, efficiency, sustainability, and climate risks. In the past, the Pakistan Institute of Development Economics (PIDE) served as a key think tank supporting the Planning Commission, but no such institutional arrangement exists today. The Ministry now needs to move beyond project listing and begin evidence-based planning grounded in scientific research, data, and climate risk analysis. To strengthen resilience, all water-related PSDP projects should undergo climate-risk screening and be aligned with the National Water Policy. For this to happen, it will need to restructure its workforce and reform internal processes to ensure that expertise, transparency, and long-term resilience guide decision-making.

4.2. Provincial Institutions: Lost in the Middle

Provincial Irrigation Departments (PIDs): Traditionally, PIDs have managed barrages, canals, distribution systems, flood protection, and land reclamation. However, entrenched supply-side practices, inequitable distribution, an overly engineering-focused approach, and political interference continue to undermine efficiency and sustainability.

To address today's complex water challenges, provinces require a modern water resource department rather than a narrowly defined irrigation department. Such a department should integrate the currently fragmented functions of public health engineering (PHED), on-farm water management, drainage, flood control, watershed management, and groundwater regulation. This consolidation would ensure a unified, basin-wide approach to water management. At the same time, PIDs must evolve their capacity beyond traditional engineering. They need to build multidisciplinary teams that include hydrologists, groundwater specialists, resource economists, digital and GIS experts, and climate scientists. Such skill sets are critical for digitizing operations, regulating groundwater extraction, improving equity in distribution, enhancing flood resilience, and planning for long-term sustainability. India has already transitioned from irrigation departments to Water Resources Departments in several states, integrating groundwater and watershed management under one roof. South Africa's Catchment Management Agencies (CMAs) provide another model, emphasizing basin-wide planning and stakeholder participation. Adopting similar reforms would allow Pakistan's provinces to move toward integrated water resources management, better aligned with climate resilience and national water security.

Public Health Engineering Departments (PHEDs): Responsible for rural water supply and sanitation. With over 70% of drinking water unsafe and sewage contaminating aquifers, PHEDs face chronic underfunding and weak monitoring and capacity issues. Reform into modern utilities with climate resilient planning and investments, financial sustainability, metering, wastewater treatment and reuse, and accountability is necessary.

Provincial Planning & Development Departments (P&Ds): P&Ds manage provincial ADPs and donor coordination but remain focused on short-term, politically visible projects, undermining systemic resilience. To serve as genuine planning and investment forums, they must adopt evidence-based and climate-smart approaches, supported by multidisciplinary teams of hydrologists, resource economists, climate scientists, groundwater and digital experts. All water-related ADP projects should undergo climate-risk screening and align with national and provincial water policies. International models, such as India's State Planning Boards and Bangladesh's climate-screened planning, show how provinces can shift from fragmented projects to transformative, climate-resilient investments.

4.3. Local Governments: The Missing Link

Local governments should be the frontline providers of water supply, sanitation, drainage, stormwater management, and early warning systems. Yet weak devolution, political instability, and chronic resource and capacity constraints render them ineffective. Policy discourse and program design rarely trickle down to the local government level, making their exclusion the critical break between planning and implementation. The consequences are evident in unsafe drinking water, inadequate preparedness, and recurrent urban flooding in cities like Karachi, Lahore, and Peshawar. Empowering local governments with financial, technical, and institutional capacity is essential to closing this gap.

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4.4. Other Institutions

NGOs and Civil Society: Play vital roles in community mobilization, awareness, and local adaptation pilots (e.g., water user groups, women's participation). Yet scale and sustainability remain challenges. Formalizing their role in local planning could bridge state capacity gaps.

Development Partners: Multilaterals (World Bank, ADB, UN agencies) and bilateral (USAID, GIZ, FCDO, JICA, China), and research and development agencies (IWMI, IFPRI) remain deeply involved in Pakistan's water sector, funding infrastructure, research, and governance reforms. While they provide critical financing and technical expertise, Pakistan has gradually outsourced much of its strategic thinking to donors. From flagship reports to seminars and project design, external actors often define the policy agenda, with limited ownership by host governments or communities. As a result, recommendations remain donor-driven rather than locally embedded, and projects often end when funding cycles close. This reinforces a cycle of dependency, fragmented pilots, and weak sustainability. Real transformation requires reclaiming domestic policy leadership, ensuring that donor support strengthens, not substitutes local priorities, capacity and accountability.

In summary, Pakistan's water and flood management is hindered by a fragmented and overlapping institutional structure, where federal agencies such as MoWR, WAPDA, IRSA, PIWC, FFC, PCRWR, NDMA, and MoCC operate in silos with conflicting mandates and limited coordination. While WAPDA continues to prioritize large infrastructure, IRSA focuses on allocations, and PIWC struggles with transboundary challenges, the FFC remains underfunded and ineffective, and research bodies like PCRWR and PMD produce valuable data that rarely informs policy. At the same time, Provincial Irrigation Departments (PIDs) remain narrowly engineering-driven, with entrenched practices, political interference, and limited capacity for integrated water resources management; P&Ds pursue politically visible but short-term projects; and local governments remain weak in managing urban flooding and basic services. NGOs and donors fill some gaps but often through fragmented, donor-driven initiatives with limited sustainability.

This institutional fragmentation leaves Pakistan poorly prepared for climate-driven extremes such as floods and droughts, underscoring the urgent need for integrated, basin-wide, climate-resilient water governance that empowers provinces and local governments while ensuring national leadership and ownership of policy direction.

This institutional fragmentation leaves Pakistan poorly prepared for climate-driven extremes such as floods and droughts, underscoring the urgent need for integrated, basin-wide, climate-resilient water governance that empowers provinces and local governments while ensuring national leadership and ownership of policy direction. Critically, there is no single agency tasked with tracking a national water mission, aligning targets, and weaving together the fragmented efforts into one coherent story for resilience and security.

5. MISSED OPPORTUNITIES

Pakistan's recurring water and flood crises are not the inevitable acts of nature they are often portrayed to be, but the product of deep-rooted weaknesses in governance, institutions, and investment priorities. A reactive mindset dominates, treating floods as unavoidable calamities to endure rather than risks to manage. This has locked the country into a cycle of rescue, relief, and rehabilitation, a cycle that is neither sustainable nor effective. Global experience shows that even wealthy nations struggle once floods are unleashed, as Hurricane Katrina in the United States demonstrated. The lesson for Pakistan is clear: prevention and systemic risk reduction must take precedence.

At the heart of this challenge is a prevailing mental model that sees floods as a curse—natural punishments that bring only destruction. This belief system is reinforced by a culture that values emergency relief over long-term planning, and by governance choices that view floods as acts of nature rather than the result of poor management and planning failures. This mindset fosters helplessness, narrows imagination, and blocks investments in storage, groundwater recharge, and resilience-building. Reframing floods as an opportunity—for water security, ecological restoration, and climate adaptation—is essential to breaking this cycle.

Instead of systemic thinking, Pakistan's water crises—scarcity, floods, and pollution—are treated in isolation. Scarcity is blamed on storage gaps rather than weak allocation and inequity. Floods are blamed on embankments rather than encroached floodplains and poor drainage. Pollution is seen as a lack of treatment plants rather than a failure of utilities and regulation. Each crisis is met with symptomatic fixes—new canals, raised bunds, emergency filters—reinforcing a crisis-driven culture while leaving structural causes unaddressed.

Institutional overlaps deepen the problem. Federal agencies such as MoWR, IRSA, WAPDA, NDMA, and the FFC often compete for authority, while provincial and local tiers remain weak. Climate policy through MoCC has little enforcement power, and communities—despite their proven solidarity during the 2022 and 2025 floods—are sidelined from planning. Donor dependency has further eroded ownership, with externally designed strategies rarely embedded in local contexts. In practice, Pakistan's institutional architecture is crowded at the top but hollow at the grassroots, leaving megacities and rural areas alike unprepared for recurring shocks.

Investment priorities mirror these weaknesses. Urban drainage projects like Karachi's S-III remain stalled, O&M budgets for irrigation are neglected, and agricultural spending continues to ignore efficiency despite canal losses of 40–50%. Floodplain zoning and enforcement remain absent, allowing disasters like 2022 to displace 33 million people at a cost of over USD 30 billion. Meanwhile, groundwater depletion in Punjab, salinity in Sindh, and aquifer decline in Baluchistan advance largely unchecked.

Underlying all this is an unhealthy dependence on external actors. While donor-led research and projects provide useful insights and funding, they rarely lead to systemic reform because they lack local ownership and continuity. Instead, every major flood sparks another cycle of assessments and project pipelines that fade with funding cycles, leaving little structural change.

Finally, governance at the local level remains hollow. Weak, underfunded, and unstable local governments struggle to deliver water supply, sanitation, drainage, and flood management. The result is recurring urban flooding in Karachi, Lahore, and Peshawar, unsafe drinking water in rural areas, and continued vulnerability at the community level. These missed opportunities, failing to prevent risks rather than just endure them, focusing on symptoms instead of root causes, neglecting groundwater regulation, outsourcing policy thinking, and leaving local governments powerless—have together kept

Pakistan trapped in a cycle of fragility and reaction. Unless these structural weaknesses are addressed, floods will continue to be seen as curses rather than opportunities for resilience and renewal.

6. GLOBAL BEST PRACTICES

Floods are a universal challenge, but countries around the world have shown that effective management is possible when infrastructure, planning, and community engagement work together. The Dutch experience offers one of the most compelling examples. Guided by the principle of "Keeping the Dutch Feet Dry," the Netherlands combines hard infrastructure, ecological solutions, and adaptive planning through initiatives like the Delta Plan and the Room for the River program. By allowing rivers to safely expand during high flows, enhancing floodplains, and integrating nature-based defences, the Dutch have turned recurring flood risks into opportunities for sustainable development, protecting both communities and ecosystems.

Other countries demonstrate complementary approaches. In the United States, cities such as Houston and regions in California use detention and retention basins to slow, store, and channel stormwater. Many retention basins are multifunctional, serving as parks, wetlands, and groundwater recharge zones, improving urban liveability while mitigating floods. Seoul in South Korea transforms underground spaces, parks, and stadiums into temporary reservoirs to absorb cloudburst rains, while Indian cities like Chennai and Bangalore are reviving traditional water tanks and lakes to buffer monsoon surges. China's Sponge Cities initiative and Singapore's Marina Barrage and ABC Waters program show how urban landscapes can be designed to absorb, store, and safely release excess water, blending engineering with green and public spaces.

Pakistan can adapt lessons from the 2004 Australia's National Water Initiative (NWI) to address its recurring flood challenges within a similar federal and basin-wide context. The NWI emphasizes coordinated water planning across states, transparent water rights, and sustainable allocation in stressed systems, all of which are directly relevant to the Indus Basin. By reorienting these principles toward floods, Pakistan could institute basin-level flood management plans, strengthen data sharing and water accounting across provinces, introduce transparent rules for storage and release from reservoirs, and improve urban water demand management to reduce stormwater risks. Just as the NWI provided investment confidence and environmental safeguards in Australia, a comparable framework in Pakistan could enhance flood resilience, balance federal–provincial roles, and protect both rural and urban communities from the increasing impacts of climate-driven disasters.

Even within Pakistan, innovative approaches exist. The National Command and Operation Centre (NCOC), established during COVID-19, demonstrated the power of a unified command platform integrating civil, military, and technical expertise to coordinate resources, communicate transparently, and respond rapidly. Translating this model to flood management could strengthen preparedness, response, and recovery nationwide. Collectively, these global and domestic examples make clear that floods are not invincible forces but challenges that can be anticipated, managed, and harnessed. They offer Pakistan a roadmap: with integrated planning, adaptive infrastructure, and community-cantered strategies, floods can shift from disasters to opportunities for resilience, ecological restoration, and water security.

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7. THE WAY FORWARD

There is no single silver bullet or "imported fix" for Pakistan's floods and water management challenges. Water management in the Indus Basin is a complex challenge shaped by diverse geographies, competing interests, and fragmented institutional structures. While global solutions may offer lessons, they cannot succeed if transplanted without adaptation to local realities. Pakistan has long outsourced strategic thinking to donors, which has weakened ownership and sustainability. What is now needed is a homegrown, system-based approach that integrates policy, institutions, and technologies under a long-term social contract for water management. Despite institutional fragmentation and underperformance, Pakistan has sufficient knowledge, institutions, experts and resources to address the twin threats of floods and water scarcity. Floods in Pakistan are too often seen only as destruction and loss. Yet with the right policies, institutions, and investments, they can be harnessed as engines of economic renewal. The next section lays out a framework to make this shift possible.

7.1. Framework to Transform Floods into Economic Opportunities

Rather than creating new policies or institutions, the proposed framework calls for leveraging existing policies, institutions, knowledge and resources to transform floods into economic opportunities. It emphasizes the mindset, pragmatism, inclusivity, and accountability, with guiding principles to reset Pakistan's water policy and investment model.

7.1.1. Principles for Policy and Investment Reset

Following are the principles to build a conducive environment for the implementation of the national water action plan.

- **Teamwork approach:** The Indus Basin is a single system, yet in Pakistan it is managed across fragmented and sometimes conflicting federal and provincial jurisdictions, cutting across diverse geographies, climates, and cultures. Effective water governance, much like teamwork in football, requires trust, communication, shared goals, and coordinated roles. Institutions must work as one unit, that is, federal, provincial, and local actors clearly aware of their responsibilities, supporting each other, and adapting to changing challenges like floods and droughts.
- **Reframe the mindset:** Shift the prevailing narrative from "floods as a curse" to "floods as a catalyst" turning devastation into an opportunity to build surface water storages, recharge aquifers, restore ecosystems, and redesign systems for resilience. Once this belief takes root, flood management can move from a reactionary response to a proactive economic strategy that harnesses floods for long-term societal benefits.
- **Shift from project to system approach:** Move beyond isolated, one-off projects toward a system-change approach that simultaneously addresses the underlying mental models (beliefs, values, norms), institutional structures (both formal and informal), physical structures (dams, levees, dykes), recurring patterns, and events that shape flood management. For example, treat the Indus Basin as a single interconnected system (from mountains to plains and coastal area) and devise a comprehensive plan that integrates governance, investments, infrastructure, ecosystems, and communities to produce system-level results and outcomes.
- **Outcome-based budgeting:** Allocate funds based on quantifiable output such as quantity of water stored, recharged, diverted, or damages prevented and outcomes such as economic, social and environmental benefit accrued from flood management interventions at basin scale.

- **Harness social capital:** Strengthen ownership and sustainability by complementing scientific and technical expertise with community knowledge, experience, trust, leadership, and local resources while avoiding expert-capture syndrome.
- **Adopt pragmatism:** Focus on better, not perfect solutions and encourage incremental progress but under a well-defined national plan.
- **Shift the development model:** move from *Borrow–Build–Neglect–Reborrow–Rebuild* to *Invest-Build–Sustain*.

7.1.2. National Action Plan

To operationalize these principles, Pakistan should adopt a National Water Action Plan anchored in strong national coordination:

- **National Coordination:** Rejuvenate the National Water Council (NWC) under the 2018 National Water Policy and activate its mandatory Steering Committee (SC) to drive implementation with the same urgency and discipline as the NCOC during COVID-19. The SC should initially meet daily to review and reassess policy (direction), prioritize investments, and craft a National Water Action Plan, then shift to fortnightly reviews to track progress. The NWC would provide biannual political oversight, while PCRWR consolidates research and WAPDA leads implementation under a unified donor framework. A "Digital Water Room" at MoWR should link agencies in real time through maps and dashboards to strengthen efficiency and accountability. Provinces must be at the core of the SC to build trust and ownership, ensuring their development plans align with a national, basin-wide strategy that addresses recurring floods and droughts, much like Australia's National Water Initiative, for the benefit of both upstream and downstream communities.

- **Infrastructure and Storage (water storage/regulation targets in parenthesis):**
    - **Detention and Retention Ponds (5 MAF):** Construct one million low-cost ponds in depressions, parks, playgrounds, stadiums, green belts, and community lands for flood storage, groundwater recharge, fishing, and recreation.
    - **Watershed Management (2 MAF):** Engage local communities and the private sector in slope stabilization, check dams, diversion structures, and plantations using low-cost local materials to slow floods and recharge aquifers.
    - **Hill Torrent Management (1 MAF):** Develop flood control systems in the Sulaiman and Kirthar ranges to manage destructive hill torrents.
    - **Wetland and Waterway Restoration (1 MAF):** Rehabilitate wetlands, ponds, and natural waterways to store water, support biodiversity, and reduce flood risks.
    - **Wastewater Treatment (1 MAF):** Install treatment plants to reduce pollution, increase urban water storage, and promote reuse.
    - **Drainage Rehabilitation (1 MAF):** Redesign and rehabilitate drainage systems, integrate solid waste management, and expand flood carrying capacity.
    - **Forestation and Watershed Protection (1 MAF):** Enforce bans on deforestation and implement large-scale reforestation in watersheds and rangelands to enhance recharge and reduce erosion.
    - **Inundation Canals (5 MAF):** Build canals to divert floodwaters into wastelands and deserts, doubling as long-term reservoirs.
    - **Irrigation Canal Regulation (1 MAF):** Use existing irrigation canals as temporary flood reservoirs through controlled gate operations.
    - **Dam Operations Optimization (1 MAF):** Rationalize operations of existing dams to maximize flood storage and ensure safe releases.
    - **Flood Zoning and River Management (3 MAF):** Enforce zoning laws, allow rivers space to meander, and plan settlements for at-risk communities.

    - **Priority Water Storage Projects (7 MAF):** Fast-track completion of all under-construction and planned water storage projects.
    - **Rainwater Harvesting (1 MAF):** Mandate harvesting systems in public offices, housing societies, and private residences to recharge groundwater.

- **Disaster Preparedness:** NDMA to establish national, provincial, and district-level coordination committees for early warning systems, local adaptation and resilience plans, and daily coordination during floods integrating public, private, community, academia, and donor efforts.

7.1.3. Anticipated Outcomes

Enhanced upstream water storage and coordinated basin-wide management will significantly reduce downstream flood damages, currently costing Pakistan an average of USD 2–3 billion annually, while simultaneously boosting water availability for agriculture, industry, services, and the environment. Achieving the proposed storage target of 30 MAF through retention and detention ponds, wetlands, reforestation, dams, and canal regulation can:

- Reduce flood damages by 50% within a decade, saving nearly USD 15 - 20 billion over 10 years.
- Increase crop yields by 20 - 25%**,** adding an estimated USD 5–7 billion annually to agricultural GDP and strengthening food security.
- Expand hydropower and industrial water use to support export-oriented growth in a water-scarce regional market.
- Replenish groundwater by 5 - 7 MAF annually, improving urban and rural drinking water security.
- Restore delta flows (minimum 10 MAF annually) to sustain ecosystems, fisheries, and coastal livelihoods.

In sum, Pakistan can transform its recurring flood losses into a triple dividend: reduced disaster damages, enhanced water security, and accelerated economic growth.

7.1.4. Financing Options

Transforming floods into opportunities requires restructured financing mechanisms: Following are some of the proposed options to finance the national water action plan.

- Reallocate federal government's Public Sector Development Plan (PSDP) and provincial government's Annual Development Plan (ADP) from other sectors (roads, electricity, street pavements, buildings) for the five years to fund the national water action plan.
- Implement performance-based development financing under the PSDP for provincial water management projects, linking funds to measurable outcomes such as increased water storage, groundwater recharge, and reduced flood damages. Provinces should adopt the same approach by linking ADPs with measurable outcomes when allocating funds to local governments.
- Strategically channel donor support to governance, capacity, and infrastructure.
- Introduce water pollution taxes on industries and businesses.
- Leverage local resources: Encourage private sector and local communities to participate financially or through labor, knowledge, or other resources in water management projects.
    - Private sector investment: Attract businesses or investors to fund projects, seeing a potential return or social impact.

    - Leasing public parks: Temporarily allow private entities to use public land (e.g., parks) for projects like water retention and detention, renewable energy, or sustainable infrastructure, generating revenue or improving water management.
    - Issuing impact bonds tied to groundwater recharge and flood control outcomes: Create financial instruments (like social or environmental impact bonds) where investors provide upfront capital for projects that recharge groundwater, and are paid back (often with a return) only if measurable results are achieved.

- Access climate finance instruments including GCF, GEF, Adaptation Fund, CIFs, Loss and Damage Fund, NDC Partnership platforms, multilateral development banks, and bilateral climate funds.

7.2. Final Thought

Floods in Pakistan are too often seen solely as curses, yet they also carry the potential to become catalysts for resilience and prosperity. While disasters inevitably bring suffering, they also create opportunities to reset governance, strengthen institutions, and realign investments toward long-term solutions. Seizing this opportunity requires moving beyond a project-driven, donor-dependent model toward a system-based, nationally owned, and climate-informed strategy. The choice is stark: continue the cycle of damage, relief, and loss, or embrace resilience, integration, and sustainability. By acting now, expanding water storage, restoring ecosystems, and empowering institutions, Pakistan can transform floods from destructive forces into unifying agents that reduce economic losses, secure water supplies, strengthen food security, and safeguard ecosystems. This shift will not only ensure sustainable water management but also advance national development and elevate Pakistan's role.

The choice is stark: continue the cycle of damage, relief, and loss, or embrace resilience, integration, and sustainability

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ANNEXURE

Table 1: Historical Flood Damages in Pakistan (1950 -2025)

Table 4: Historical Flood Damages in Pakistan	Direct Losses (USD million) – Using relevant conversion rates	Lost Lives (number)	Affected Villages (number)	Flooded Area (km^2)
1950	488	2,190	10,000	17,920
1955	378	679	6,945	20,480
1956	319	160	11,609	74,406
1957	301	83	4,498	16,003
1959	234	88	3,902	10,424
1973	5,134	474	9,719	41,472
1975	684	126	8,628	34,931
1976	3,845	425	18,390	81,920
1977	338	848	2,185	4,657
1978	2,227	393	9,199	30,597
1981	299	82	2,071	4,191
1983	135	39	643	1,882
1984	75	42	251	1,093
1988	858	508	100	6,144
1992	3,010	1,008	13,208	38,758
1994	843	431	1,622	5,568
1995	376	591	6,852	16,686
2010	10,000	1,985	17,553	38,600
2011	3,730	516	38,700	27,581
2012	2,640	571	14,159	4,746
2013	2,000	333	8,297	4,483
2014	500	367	4065	9779
2015	170	238	4,634	2,877
2016	-	271		
2022	15,000	1,700	15,540 Est	94,000
2023	-	159	-	-
2024	-	100	-	-
2025 (As of Sep 12, 2025)	Yet to determined	1,050	4,100	12,645
Total	53,584	15,457	212,236	720,366

Source: Flood Protection Plan - IV (2015-25) by the Federal Flood Commission of Pakistan
Note: Data for 2022, 2023, 2024 and 2025 has been added by the author.

Table 2: British-Era Water Institutions in Present-Day Pakistan

Year	Institution / Law	Location/Region	Significance
1860s–70s	Irrigation Departments	Punjab, Sindh, NWFP	Foundations of today's provincial irrigation departments.
1873	Northern India Canal & Drainage Act	Punjab, NWFP	Legal basis of irrigation management; still in force in Pakistan.
1879	Bombay Irrigation Act	Sindh	Influenced irrigation governance in Sindh.
1882	Punjab University (Engineering & Agriculture Faculties later linked)	Lahore	Provided technical education for water/agriculture.
1900	Punjab Land Alienation Act	Punjab	Protected peasant settlers in canal colonies; linked land with irrigation rights.
1901	NWFP Province created (with irrigation offices)	Frontier Region	Frontier canal management formalized.
1920s	Punjab Irrigation Research Institute	Lahore	Introduced scientific water management & hydraulic research.
1925	Hydraulic Research Institute established	Punjab	Hydraulic Research Institute established at Malikpur on Upper Bari Doab Canal.
1945	Sindh Irrigation Act	Sindh	Consolidated Sindh's irrigation rules before partition.

Table 3: British-Era Water Infrastructure in Present-Day Pakistan

Year	Project	Type	Location/Region	Significance
1859	Bari Doab Canal	Canal	Punjab (Ravi)	First major perennial canal; model for future works.
1872	Sirhand Canal	Canal	Punjab (Sutlej)	From the Sutlej
1886	Sidhnai Canal	Canal	Punjab (Ravi)	Extended irrigation to central Punjab.
1892	Chenab Canal & Chenab Colony	Canal + Settlement	Punjab (Chenab)	Transformed Faisalabad region; cornerstone of canal colonies.
1895	Lower Swat Canal	Headworks/Canal	KP (River Swat)	Construction of Lower Swat Canal with design discharge of 830 cusec.
1908	Paharpur Irrigation Canal system	Canal	KP (Indus River)	Irrigation Canal system was constructed with a total length of 50 miles.
1913	Upper Jhelum Canal	Canal	Punjab	Linked Jhelum to Chenab; part of Triple Canals Project.
1914	Lower Bari Doab Canal	Canal	Punjab (Ravi)	Expanded central Punjab irrigation.
1914	Upper Swat Canal	Headworks/Canal	KP (Swat River)	Brought 2,200 cusec from Swat River waters to Peshawar Valley.
1915	Balloki Headworks	Headworks	Punjab (Ravi)	Controlled water for Lower Bari Doab Canal.
1915	Upper Chenab Canal	Canal	Punjab	Irrigated Lyallpur & Sheikhupura areas.
1926	Sulemanki Headworks	Headworks	Punjab (Sutlej)	Supplied Sutlej colonies.
1932	Sukkur Barrage	Barrage	Sindh (Indus)	Irrigated ~7 million acres; largest colonial irrigation project.
1939	Trimmu Headworks	Headworks	Punjab (Chenab-Jhelum)	Controlled floods & supplied irrigation.
1939	Kalabagh Headworks	Headworks	Punjab (Indus)	Major Indus control point for irrigation.

Table 4: Institutional Landscape of Flood and Water Management in Pakistan

Agency	Core Mandate	Role in Floods & Water Management	Overlaps	Gaps / Capacity Issues
Pakistan Indus Water Commissioner (PIWC)	Implement the Indus Waters Treaty (1960); safeguard Pakistan's rights on western rivers; review Indian projects.	Relevant during floods when India releases water into Ravi, Sutlej, and Chenab; manages data sharing and treaty compliance.	Overlaps with IRSA (allocation) and WAPDA (technical monitoring).	Weak technical and legal capacity; limited staff; inadequate equipment; India's suspension of treaty meetings/data sharing undermines early warning.
Indus River System Authority (IRSA)	Distribute Indus waters among provinces under the 1991 Water Apportionment Accord.	Manages reservoir releases, canal operations; critical for balancing flood control with irrigation supply.	Overlaps with WAPDA (reservoir operations) and provincial irrigation departments.	Narrow focus on allocation, not resilience; prone to provincial disputes; lacks floodplain planning role.
Federal Flood Commission (FFC)	Prepare National Flood Protection Plans (NFPPs); coordinate provincial schemes; oversee flood forecasting.	Developed four NFPPs (1978–2025); installs flood forecasting instruments.	Overlaps with WAPDA (planning), NDMA/PDMA (disaster response).	Chronic underfunding, weak enforcement, vacant key posts, embankment-centric; poor monitoring of impacts.
Pakistan Council of Research in Water Resources (PCRWR)	Applied research on water quality, availability, conservation, and groundwater.	Provides data on groundwater recharge, drought monitoring, and safe water supply post-floods.	Overlaps with FFC (flood forecasting) and IRSA/WAPDA (resource monitoring).	Valuable research underutilized; weak integration into national planning; limited outreach to provinces.
Water and Power Development Authority (WAPDA)	Develop and manage dams, barrages, and hydropower projects; integrated water and power planning.	Operates major reservoirs (Mangla, Tarbela, etc.), essential for both flood control and irrigation.	Overlaps with IRSA (allocations), FFC (planning), and PIWC (technical monitoring).	Strong engineering focus but little emphasis on ecosystem resilience or social dimensions; lacks floodplain management role.

ABOUT THE AUTHOR

Muhammad Nawaz is an accomplished development leader with 30 years of experience in water resources management, agriculture, climate resilience, and economic growth. He served USAID Mission Pakistan from 2011 to 2025 as Senior Water Advisor, managing the water sector investment portfolio, and performed as Mission Environment Officer and Climate Integration Lead from 2023-25. Earlier, he worked as a senior public policy analyst (water) at the Planning Commission of Pakistan for five years and as a water management officer with the Government of Khyber Pakhtunkhwa for 12 years. His work has benefited hundreds of thousands of farmers, built climate-resilient water systems across fragile regions, and influenced national water and climate policies. Mr. Nawaz holds a Master of Engineering Science in Water Resources Management from the University of Melbourne, Australia, and a Bachelor's in Agricultural Engineering from UET Peshawar, complemented by 40+ specialized international trainings and 16 performance awards. In 2022, UET Peshawar recognized his professional contributions by placing his name on its Wall of Fame.

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