

Assessing Socioeconomic Impact of 2022 Floods in Sindh

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Abstract

The 2022 floods in Sindh had a devastating impact on the people of Pakistan. Agriculture, a vital sector of the country's economy, was significantly impacted by the floods in Sindh, hindering food accessibility. The destruction of critical infrastructure including roads, bridges and irrigation systems had direct consequences for the population. These included large-scale migration, damage to homes, loss of livelihoods and exposing people to poverty. Flood-induced disruptions to local businesses and transportation systems also led to job losses and the rising unemployment rate in Sindh. Additionally, contaminated water sources, inadequate sanitation facilities and proliferation of waterborne diseases posed significant health risks to the affected population. This necessitated increased external aid for the affected communities. This research paper focuses on the socioeconomic impact of 2022 floods in Sindh, drawing upon existing literature and available data. The paper recommends an urgent need for effective flood management and mitigation strategies in Sindh.

Keywords: Sindh, Floods, Devastation, Infrastructure, Poverty, Mitigation

Introduction

Sindh, situated in the south eastern part of Pakistan, is the country's third largest province and has second largest population. It has a diverse landscape, including plains, deserts, coastal areas and proximity to the Arabian Sea in the south. The province is bordered by the Kirthar Mountains in the west and the Thar Desert in the east. It features a lush plain around the Indus River, flanked by scorching summers and frigid winters, with temperatures soaring beyond 45°C from May to August and dropping to around 2-3°C between December and January. Annual rainfall averages around 7 inches.²

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² Zarwa Farooq, "Effects of Climate Change on Sindh Province of Pakistan," 20 February 2022, <https://www.envpk.com/effects-of-climate-change-on-sindh-province-of-pakistan/>.

Agriculture is the backbone of Sindh's rural economy as 77% of Sindh's agricultural land is irrigated.³ However, the limited water resources are not used efficiently. An estimated 60-75% of water withdrawn is lost either to surface water evaporation or to seepage into saline groundwater. Sindh faces notable water scarcity issues, especially in the summer months before the monsoon.⁴

The province also grapples with climate-induced challenges. These include extreme weather conditions such as floods, cyclones, coastal erosion and droughts. These disasters cause extensive damage to the infrastructure, displacing communities and claiming lives and livelihoods.⁵ Particularly vulnerable to these disasters are the coastal communities in Sindh.

In 2022, Sindh experienced massive rainstorms followed by devastating floods, causing extensive damage to crops and livestock and thereby posing a severe threat to food security.⁶ The aftermath of 2022 floods included reduced access to clean water and increased starvation and sickness. Public health was severely impacted by the spoilage of drinking water sources and the subsequent standing water issue that bred mosquitoes. These issues resulted in hazardous health risks and diseases such as cholera, typhoid fever, malaria and yellow fever.⁷

Sindh's infrastructure bore the brunt of the devastating floods, with extensive damage to vital components of transportation networks. Roads, critical for connectivity, were blocked and the railway tracks suffered destruction, further hindering mobility and economic activities. These hurdles led to job losses in critical sectors, including agriculture.

Other socioeconomic setbacks included substantial disruption faced by the educational system with closure of schools and utilization of relatively safe school buildings as relief camps. These relief camps lacked adequate facilities even for the medical staff. The flooding not only interrupted the continuity of

³ World Bank. "Factsheet: Sindh Flood Emergency Rehabilitation Project," 19 December 2022. <https://www.worldbank.org/en/news/factsheet/2022/12/19/factsheet-sindh-flood-emergency-rehabilitation-project>.

⁴ Ibid.

⁵ Zarwa Farooq, "Effects of Climate Change on Sindh Province of Pakistan," 20 February 2022, <https://www.envpk.com/effects-of-climate-change-on-sindh-province-of-pakistan/>.

⁶ "Call for Fighting Climate Change to Preserve Sindh's Heritage." *The News International*. Accessed 22 July 2023. <https://www.thenews.com.pk/print/1070105-call-for-fighting-climate-change-to-preserve-sindh-s-heritage>.

⁷ Shaikh, Omer Ahmed, Maliha Rahim, Manisha Essarani, Soeba Nadeem, Sidhant Ochani, Md. Al Hasibuzzaman, and Kaleem Ullah. 2023. "Dreadful Infectious Disease Outbreaks Threaten Flood-Ravaged Pakistan: Short Communication." *Annals of Medicine and Surgery* 85 (6): 3237–38. <https://doi.org/10.1097/MS9.0000000000000754>

learning for students but also presented unique challenges, particularly in the context of gender dynamics.

The 2022 floods in Sindh revealed the connection between climate change, social vulnerabilities and fragile systems. It emphasized the delicate balance between changing climate patterns and the province's economic and social structures, underscoring the need for a more robust and adaptable framework for future resilience. In this context, this research delves into the multifaceted socioeconomic impact of the floods, unraveling the layers of challenges faced by the communities in Sindh. The paper also emphasizes the necessity of formulating comprehensive strategies to build resilience and ensure sustainable recovery in times of such crises.

Floods in Sindh

Sindh's geographical characteristics and climatic patterns play an important part in making this region susceptible to floods. Sindh is vulnerable to floods for a number of reasons, including the extensive river basin passing through the province, flat terrains, cyclones and tropical storms. Moreover, climate change has also brought more frequent and intense weather events, such as heavy rainfall and unpredictable monsoon patterns. These changes increase the frequency and intensity of floods and worsen the vulnerability of Sindh to such disasters.⁸

The Indus River, along with its major tributaries such as the Jhelum, Chenab, Ravi and Sutlej, traverses Sindh. This river system encompasses approximately 65% of the country's total land area. The waters in the river system often breach their banks, particularly during monsoon seasons, causing floods in the province.⁹

Monsoon also signifies a seasonal wind shift during summer, bringing moisture-laden air to South Asia, resulting in abundant rainfall. Although, this is favorable for agriculture and sustaining lives in Pakistan, as the summer monsoon contributes 65-75% of the country's annual water supply,¹⁰ these downpours can be both heavy and prolonged, leading to substantial runoff and

⁸ Shah, Shoukat Ali, and Songtao Ai. "Flood susceptibility mapping contributes to disaster risk reduction: A case study in Sindh, Pakistan." *International Journal of Disaster Risk Reduction* (2024): 104503.

⁹ Asadullah Kazi. "A review of the assessment and mitigation of floods in Sindh, Pakistan." *Natural hazards* 70 (2014): 839-864.

¹⁰ Kasha Patel. "Why Pakistan's record-breaking monsoon season is so devastating." *Washington Post*, 31 August 2022. <https://www.washingtonpost.com/climate-environment/2022/08/31/monsoon-pakistan-flooding-explainer/>.

flooding in the river systems. Moreover, the coastal areas are vulnerable to cyclones and storms, which often result in the inland flooding brought in from the coast.

Socioeconomic Impact of 2022 Floods

i. Infrastructure: In 2022, Pakistan experienced a staggering 390.7 millimeters (15.38 inches) of rainfall, with Sindh being the hardest-hit province.¹¹ The overflowing rivers entered low-lying areas, particularly impacting rural areas in Sindh. These areas already struggled with poor infrastructure, including untarred roads and worn-out bridges.¹² Approximately 1.78 million homes in Sindh were fully or partially destroyed.¹³ The 2022 floods also led to a dire humanitarian crisis in Sindh for over 5 million displaced individuals as the accumulation of water reached to a level that made their houses inhabitable.¹⁴

The widespread destruction of roads and transport infrastructure severely limited access to essential services, including health and education and hampered mobility, livelihoods, trade and commerce.¹⁵ According to Post-Disaster Needs Assessment (PDNA), led by the Government of Pakistan in October 2022, approximately 8,330 kilometers of roads were damaged due to the floods,¹⁶ which is 64% of the over 13,000 kilometers of roads damaged or destroyed countrywide.¹⁷ The railway sector, already grappling with a lack of pre-flood maintenance, suffered a significant negative impact with 3,127 kilometers of railway tracks – about 40% of all in-service railways –

¹¹ Vijdan Kawoosa, Aman Bhargava, Anand Katakam and Manas Sharma “Floods in Pakistan.” *Reuters*, 1 September 2022. <https://www.reuters.com/graphics/PAKISTAN-WEATHER/FLOODS/akpezbxgvr/>

¹² “Pakistan Floods: Sindh Province Awaits More Deluges and Devastation.” *BBC News*. 28 August 2022, <https://www.bbc.com/news/world-asia-62707436>.

¹³ “Revised Pakistan 2022 Floods Response Plan: 01 Sep 2022 - 31 May 2023” *Reliefweb.int*. 4 October 2022. <https://reliefweb.int/report/pakistan/revised-pakistan-2022-floods-response-plan-01-sep-2022-31-may-2023-04-oct-2022>.

¹⁴ Ammar Khan. “Floods 2022: Early Assessment of Infrastructure Destruction.” *Pakistan Today*. 4 September 2022. <https://profit.pakistantoday.com.pk/2022/09/04/floods-2022-early-assessment-of-infrastructure-destruction/>.

¹⁵ *World Bank*. “Factsheet: Sindh Flood Emergency Rehabilitation Project,” 19 December 2022. <https://www.worldbank.org/en/news/factsheet/2022/12/19/factsheet-sindh-flood-emergency-rehabilitation-project>.

¹⁶ “Pakistan Floods 2022: Post-Disaster Needs Assessment.” October 2022. The Government of Pakistan, Asian Development Bank, European Union, United Nations Development Programme and World Bank <https://www.pc.gov.pk/uploads/downloads/PDNA-2022.pdf>.

¹⁷ “Revised Pakistan 2022 Floods Response Plan: 01 Sep 2022 - 31 May 2023” *Reliefweb.int*. 4 October 2022. <https://reliefweb.int/report/pakistan/revised-pakistan-2022-floods-response-plan-01-sep-2022-31-may-2023-04-oct-2022>.

being damaged in the province.¹⁸ Sindh also contains 40% of the 410 bridges damaged or destroyed across the country due to 2022 floods.¹⁹ The magnitude of the disaster underscores an urgent need for effective disaster management strategies and initiatives to mitigate the impact of such calamities in the future.

ii. Economy: Sindh, with a contribution of 27% to Pakistan's GDP, plays a pivotal role in the country's economy. The livestock industry in Sindh contributes 62% to the country's agricultural GDP. The agricultural sector, employing 70% of the workforce, is also a vital source of revenue for the province. However, 37% of the rural population in Sindh lives below the poverty level, with flood-affected areas experiencing even higher poverty rates, ranging from 40-60% in some areas. The people of these areas also struggle with access to education, water, sanitation and health services.²⁰

Before the 2022 floods, Pakistan was already facing economic challenges, including a precarious balance of payments and a growing current account deficit. The aftershocks of the COVID-19 pandemic and disruptions to global supply chains further exacerbated the country's economic situation.²¹ The 2022 floods in Sindh caused loss of 4.8 million acres of crops and 428,000 animals,²² severely impacting the economy and food security.

The 2022 PDNA research had estimated the national poverty rate to increase by 3.7 to 4.0 percentage points, pushing about 9.1 million people below the poverty line.²³ Poverty measured at the lower middle-income poverty line (3.65 USD per capita per day) was projected to increase to 37.2% in FY23, pushing 3.9 million more people into poverty as compared to FY22.²⁴

¹⁸ "Pakistan Floods 2022: Post-Disaster Needs Assessment." October 2022. The Government of Pakistan, Asian Development Bank, European Union, United Nations Development Programme and World Bank <https://www.pc.gov.pk/uploads/downloads/PDNA-2022.pdf>.

¹⁹ "Revised Pakistan 2022 Floods Response Plan: 01 Sep 2022 - 31 May 2023" *Reliefweb.int*. 4 October 2022. <https://reliefweb.int/report/pakistan/revised-pakistan-2022-floods-response-plan-01-sep-2022-31-may-2023-04-oct-2022>.

²⁰ *World Bank*. "Factsheet: Sindh Flood Emergency Rehabilitation Project," 19 December 2022. <https://www.worldbank.org/en/news/factsheet/2022/12/19/factsheet-sindh-flood-emergency-rehabilitation-project>.

²¹ Shahroo Malik. "The Economic Costs of Pakistan's Floods." *South Asian Voices*. 16 September 2022. <https://southasianvoices.org/the-economic-costs-of-pakistans-floods/>.

²² "Revised Pakistan 2022 Floods Response Plan: 01 Sep 2022 - 31 May 2023" *Reliefweb.int*. 4 October 2022. <https://reliefweb.int/report/pakistan/revised-pakistan-2022-floods-response-plan-01-sep-2022-31-may-2023-04-oct-2022>.

²³ "Pakistan Floods 2022: Post-Disaster Needs Assessment." October 2022. The Government of Pakistan, Asian Development Bank, European Union, United Nations Development Programme and World Bank <https://www.pc.gov.pk/uploads/downloads/PDNA-2022.pdf>.

²⁴ "A Flood Battered Farming Sector." *The News International*. 16 April 2023. <https://www.thenews.com.pk/tns/detail/1061011-a-flood-battered-farming-sector>.

iii. Agriculture: Sindh province, a key contributor to Pakistan's agricultural output, produces 42% of the country's grains, 23% of its cotton and 31% of its sugarcane.²⁵ The 2022 floods caused USD thirteen billion of loss to the agriculture industry at the national level, with the affected communities experiencing livelihood losses exceeding USD 600 million.²⁶ The PDNA estimated that the agriculture industry in Sindh, including cattle and fisheries, suffered losses totaling approximately USD 9.2 billion (71% of the country's total damage and losses).²⁷ In districts of Badin, Mirpurkhas, Khairpur, Sukkur and Ghotki, nearly the entire cotton crop was adversely affected, along with other *Kharif* crops. In the most severely impacted districts of Badin, Mirpurkhas and Thatta, three major vegetable crops of tomato, onion and chili faced a loss of USD 374 million.

The challenges ahead for Pakistan's economic recovery are therefore immense, requiring comprehensive strategies and initiatives to rebuild the shattered agricultural sector and uplift the affected communities.

iv. Public Health: The health risks associated with 2022 flooding extended to over three million children in Pakistan. Diseases such as typhoid, diarrhea and malaria spread rapidly, with the hardest-hit province of Sindh recording over 134,000 cases of diarrhea and more than 540,000 cases of malaria from July till October 2022 – first three months of the 2022 devastating floods.²⁸ Humanitarian organizations faced a formidable task, especially in addressing the continuous malaria outbreak in 32 districts where vast reservoirs of floodwaters became breeding grounds for mosquitoes.²⁹

The challenges in the health sector were also compounded by insufficient public sector health spending. According to Pakistan Economic Survey (2021-22), public sector expenditure on health was approximately 1.2% of the GDP in 2020-21, which was less than the recommended amount by the WHO, i.e.,

²⁵ "Impact of the 2022 Floods on Agriculture in Pakistan's Sindh Province." *SERVIR*. 9 September 2022. <https://servir.icimod.org/news/impact-of-the-2022-floods-on-agriculture-in-pakistans-sindh-province/>.

²⁶ *Sindh's Strategic Policy for Floods Response 2022*. 2022 Government of Sindh. <https://rtw.sindh.gov.pk/storage/resourcePage/B43voaV33073RpPjBBNaK7ZCMipHjM4Nqj1rFi5N.pdf>

²⁷ Ibid.

²⁸ "Jolie: 'Never Seen Anything Like' Devastation of Pakistan Floods." *VOA*. 21 September 2022. <https://www.voanews.com/a/jolie-never-seen-anything-like-devastation-of-pakistan-floods-/6758039.html>.

²⁹ "Public Health Risks Increasing in Flood-Affected Pakistan, Warns WHO." *UN News*. 1 November 2022. <https://news.un.org/en/story/2022/11/1130082>.

5% of the GDP.³⁰ The global COVID-19 Pandemic had already hampered the supply of fundamental healthcare services. Floods exacerbated the situation, leaving people without adequate access to healthcare due to a shortage of medical professionals, medications and poor road conditions.³¹

Floods, in general, not only impact the environment but also inflict psychological distress on disaster victims, leading to somatization, melancholy, anxiety and post-traumatic stress disorder.³² Limited research has been published regarding the mental condition of the victims of 2022 floods. One study was conducted on 80 people living in three shelters: Jamshoro Camp, Hatri Camp and Kotri Camp. All the participants were experiencing depression, anxiety and stress. The study also found that female participants were more traumatized in the aftermath of floods as compared to male participants.³³

v. Education: The 2022 floods had a detrimental impact on the educational system in Sindh. According to the data released by the Sindh Education and Literacy Department, 29,278 out of 49,446 government school buildings were impacted by the floods, with 15,800 structures suffering partial damage and 13,478 buildings losing their entire structure.³⁴ The severity of the situation was further exacerbated by the fact that schools, which were not destroyed, were repurposed as relief camps. This dual role of schools, both as centers for education and as temporary shelters, disrupted the learning environment.³⁵ Moreover, such prolonged school closures in times of crisis increased the

³⁰ “Federal Ombudsman of Pakistan Improving Primary Health Care System in Islamabad.” Accessed 27 May 2024. https://mohtasib.gov.pk/SiteImage/Downloads/W.M.S.%20REPORT%20%20%20IMPROVING%20PRIMARY%20HEALTH%20CARE%20SYSTEM%20IN%20ISLAMABAD_compressed.pdf.

³¹ Zoraiz Azhar. “Top Health Issues in Sindh That Need Your Attention.” *Transparent Hands*. 24 May 2023. <https://www.transparenthands.org/top-health-issues-in-sindh-that-need-your-attention/>.

³² Mubeen, Syed Muhammad, Seema Nigah-e-Mumtaz, and Saqib Gul. “Prevalence of post-traumatic stress disorder and depression among flood affected individuals of Sindh, Pakistan: a cross-sectional survey in camps five months after the flood.” *Pakistan Journal of Medical Research*. Vol 52, no. 4 (2013): 111.

³³ Siddiqui, Fozia Aamir, Ms Shahana Mashooque Siddiqui, and Muniza Malik. “Psychological Impact Of Flood 2022 On Victims (A Case Study Of Sindh).” *Al Meezan Research Journal of Social Sciences* 3, no. 01 (2023).

³⁴ “Flood Devastated Government Schools Face Uncertain Future.” *The Express Tribune*. 6 October 2022. <https://tribune.com.pk/story/2380401/flood-devastated-government-schools-face-uncertain-future>.

³⁵ “Pakistan Floods: Education Snapshot - 30 September 2022” Relief Web <https://reliefweb.int/report/pakistan/pakistan-floods-education-snapshot-30-september-2022>.

probability of child labor, child marriage and other forms of exploitation and abuse against children.³⁶

vi. Gender: The aftermath of the 2022 floods unveiled deep-seated gender inequalities, exacerbated by poverty and low literacy rates, significantly worsening the conditions for women.³⁷ Around 650,000 pregnant women faced the daunting challenge of giving birth without access to essential antenatal, delivery or postnatal care in flood-affected areas. Government data revealed that a substantial 2.8 million households with infants in these areas lacked access to necessary postnatal care. The shelters provided by the government, intended to be a refuge, often lacked safety for women, further compounding the challenges they face.³⁸

The dire situation extended beyond physical safety, with numerous reports highlighting the increased risk of gender-based violence, sexual assault and harassment, leading to reluctance of female doctors to visit flood affected areas.³⁹ The absence of proper sanitation facilities, clean water and adequate food supplies in these shelters further exacerbated challenges for women.⁴⁰

Government of Pakistan's Response and Relief Efforts

The devastating floods of 2022, ranked as the ninth most disastrous climatic calamity in the past decade, overwhelmed the capacity of the government to respond.⁴¹ Resultantly, the federal government declared a national emergency on 25 August 2022. The National Disaster Management Authority (NDMA) took charge, organizing assessments and delivering humanitarian aid to flood

³⁶ "2m Children sans Education in Pakistan as Floods Destroyed 27,000 Schools: UNICEF," *DAWN.COM*. 4 November 2022. <https://www.dawn.com/news/1718774>.

³⁷ "The Disproportionate Impact of Floods on Women." *The Express Tribune*. 26 September 2022. <https://tribune.com.pk/article/97641/the-disproportionate-impact-of-floods-on-women-1>.

³⁸ "Gender Equality and the Fight against Climate Change." *The Express Tribune*. 2 April 2023. <https://tribune.com.pk/story/2409433/gender-equality-and-the-fight-against-climate-change>.

³⁹ Menaal Munshey. Review of *The Limits of Loss and Damage: A Cautionary Tale from Pakistan*. *The New Humanitarian*, 21 November 2022. <https://www.thenewhumanitarian.org/opinion/2022/11/21/loss-and-damage-Pakistan-floods-women-climate-change>.

⁴⁰ Farwa Aamer. "Pakistan Floods: Women Should Be at the Forefront of Relief Efforts and Future Climate Policies." *Stimson Center*. 1 September 2022. <https://www.stimson.org/2022/pakistan-floods-women-should-be-at-the-forefront-of-relief-efforts-and-future-climate-policies/>.

⁴¹ Amin Ahmed, "UN Dedicates USD 5.5m towards Emergency Nutrition, Food Security Interventions in Flood-Affected Areas," *DAWN.COM*. 17 April 2023, <https://www.dawn.com/news/1748151>.

victims.⁴² Relief camps were established countrywide, providing immediate assistance including food, medical care and essential supplies. Collaborating with Rescue 1122 and other provincial departments, the National Highway Authority, Pakistan Army, Pakistan Air Force and Frontier Corps personnel worked together to accelerate rescue and recovery efforts in flood-affected areas.⁴³

The government-led initiative of PDNA received the support of a Core Group of partners comprising the Asian Development Bank, the European Union, United Nations Agencies and the World Bank Group. The Core Group supported Pakistan in devising a Resilient Recovery, Rehabilitation and Reconstruction Framework (4RF). Under 4RF, it was proposed to improve effective coordination and participation arrangements among federal and provincial governments, development partners, donors, international and national non-governmental organizations and academic and the private sector.⁴⁴ The PDNA calculated the cost of floods at USD 30.1 billion – USD 14.9 billion in damages and USD 15.2 billion in losses.⁴⁵

Against the backdrop of the devastating floods, the Government of Pakistan and the United Nations co-hosted an International Conference on Climate Resilient Pakistan on 9 January 2023, in Geneva. The Conference objectives included securing international support and forging long-term partnerships for building Pakistan's climate resilience and adaptation. Pakistan was able to raise approximately USD ten billion in the form of pledges from states and international financial institutions for the implementation of 4RF.⁴⁶

Provincial Initiatives in Sindh

The Sindh government implemented various measures to help the flood-affected population, including provision of shelters, food, water, health and

⁴² “Pakistan Floods: Government Calls on WFP to Support Emergency Response” *World Food Programme*. 29 August 2022. <https://www.wfp.org/stories/pakistan-floods-government-calls-wfp-support-emergency-response>.

⁴³ “Govt Steps up Rescue, Relief Efforts as Ravages of Flood Know No Bounds.” *Pakistan Today*. 28 August 2022, <https://www.pakistantoday.com.pk/2022/08/28/govt-steps-up-rescue-relief-efforts-as-ravages-of-flood-know-on-bounds/#:~:text=August percent2022-percent2C percent2022->

⁴⁴ “Pakistan Floods 2022: Resilient Recovery, Rehabilitation, and Reconstruction Framework (4RF) | United Nations Development Programme.” *UNDP*. 2022. <https://www.undp.org/pakistan/publications/pakistan-floods-2022-resilient-recovery-rehabilitation-and-reconstruction-framework-4rf>.

⁴⁵ Ibid

⁴⁶ “Pakistan’s 10 Billion Dollar Flood Funding Question” Relief Web. 18 January 2023. <https://reliefweb.int/report/pakistan/pakistans-10-billion-dollar-flood-funding-question>.

education to the displaced population. The relief provided by Provincial Disaster Management Authority (PDMA) Sindh included 711,560 tents, 506,071 plastic tarpaulins, 2.37 million mosquito nets and 1.9 million ration bags. Life jackets, water coolers, hygiene and first-aid kits, dewatering pumps, wheelchairs and other relief items were also provided by the Sindh government.⁴⁷

The Government of Sindh also coordinated the receipt of funds from China, amounting to Rs 7,659 million, specifically designated for the renovation and construction of 646 schools. Additionally, in collaboration with the Japan International Cooperation Agency (JICA), the government proposed a comprehensive “Programme for Flood Response through Reconstruction of Education Facilities in Sindh.”⁴⁸ Other projects for supporting the people of Sindh in the flood-affected areas included USD 500 million Flood Emergency Rehabilitation Project, USD 500 million Flood Emergency Housing Reconstruction Project, USD 292 million Water and Agriculture Transformation Project and USD 200 million Strengthening Social Protection Delivery System Project as well as USD 200 million Integrated Health and Population Project.⁴⁹

International Support

In addition to the pledges committed at the Geneva Conference, the global community also extended support to flood-affected people in Pakistan. The United Nations Children’s Fund (UNICEF), World Food Programme (WFP), World Health Organization (WHO) and various NGOs played a pivotal role in providing emergency nutrition interventions. The UN Office for the Coordination of Humanitarian Affairs (OCHA) coordinated these efforts, ensuring effective fund utilization.

The WFP assisted approximately 500,000 people in severely affected areas of Sindh, having already provided aid to nearly 42,000 individuals in five districts of Sindh and Balochistan.⁵⁰ The collaboration between national and international entities underscored the collective effort to address the immediate needs and long-term recovery of the flood-affected areas.

⁴⁷ “CM Murad Unveils Rs2.2tr Sindh Budget for FY24.” *DAWN.COM*. 10 June 2023. <https://www.dawn.com/news/1759016>.

⁴⁸ Ibid.

⁴⁹ “Sindh Unveils Rs2.2tr Development-Oriented Budget.” *The Express Tribune*. 10 June, 2023. <https://tribune.com.pk/story/2421084/sindh-unveils-rs22tr-development-oriented-budget>.

⁵⁰ “Pakistan Floods: Government Calls on WFP to Support Emergency Response” *World Food Programme*. 29 August 2022. <https://www.wfp.org/stories/pakistan-floods-government-calls-wfp-support-emergency-response>.

The 2022 floods also reignited global debate on climate justice. The 27th UN Climate Change Conference (COP27) held at Sharm el-Sheikh, Egypt, in November 2022, concluded with a consensus that rich countries must compensate the vulnerable poor countries suffering from climate change disasters. Pakistan, leading the developing countries, played a key role at COP27 in forging this consensus on the Loss and Damage Fund. It was also decided at COP27 that important issues relating to the Fund operations will be deliberated upon by a Transitional Committee, comprising 24 members which would then submit its recommendations. The Committee met thrice in 2023 and navigated a series of difficult but important issues that escaped consensus. Some of the more important questions the Committee touched upon included those pertaining to the hosting entity of the Fund and its governance structure, besides questions of who will pay and who will be eligible to receive the funds.⁵¹ After much disagreements, a temporary compromise was reached, with the World Bank poised to host the Fund for the first four years.⁵²

Remarkably, the Loss and Damage Fund was operationalized at COP28, where an amount of USD 700 million was agreed for the Fund. However, it has been estimated to be less than 0.2% of the amount needed. Of the total, USD 100 million was pledged by the UAE, the US – the biggest greenhouse gas emitter – committed only USD 17.5 million, Japan USD ten million, Denmark USD fifty million and Norway USD twenty-five million.⁵³ The figures do not add up. There may be other countries but the data on their contribution is not available. It is not certain that even these meager commitments would be fulfilled. It would be recalled that USD 100 billion per year by 2020 was committed at COP15 in Copenhagen in 2009 for climate action. It never materialised and disillusioned many developing countries.⁵⁴

As far as the outcome of the Geneva Conference in monetary terms is concerned, it is unclear as to how much of the pledged USD 10 billion has been received, due to unavailability of data.

⁵¹ “What the Loss and Damage Fund at COP28 Means for Pakistan.” *DAWN.COM*. 29 November 2023. <https://www.dawn.com/news/1793540>.

⁵² Ibid.

⁵³ “COP28: Climate Finance Needs.” *The Express Tribune*. 25 December 2023. <https://tribune.com.pk/story/2451055/cop28-climate-finance-needs>.

⁵⁴ “What the Loss and Damage Fund at COP28 Means for Pakistan.” *DAWN.COM*. 29 November 2023. <https://www.dawn.com/news/1793540>.

Recommendations

Policies for flood management and regulation are crucial for maintaining the ecosystem, reducing the dangers of economic slowdown and protecting human life. To effectively tackle the multifaceted challenges posed by flooding, a range of strategic interventions can be employed to control and mitigate the aftermath of such events.

i. Early Warning Systems: It has become critically important in recent years to build multi-hazard early warning systems that reduce economic and personal losses by notifying the public of impending disasters. While there are flood warning and detection systems in Pakistan, the forecasting capacity remains constrained by network limitations. The current flood forecasting system in Pakistan relies on empirical regression,⁵⁵ highlighting the necessity of adopting an ensemble hydrological forecasting system to address uncertainties in the forecast and early warning mechanisms. Many nations utilize ensemble forecasting for timely flood warnings.⁵⁶ Ensemble flood prediction based on weather forecasts and data assimilation can assist the decision-makers in providing an actionable early warning.⁵⁷ The effectiveness of these systems hinges on the accuracy of rainfall forecast.⁵⁸

To ensure the efficacy of these warnings, timely dissemination is important, reaching all relevant organizations and vulnerable districts of Sindh. Digital and social media should be used to disseminate early warnings about the consequences of flood catastrophes and flood predictions. These mediums enable effective evacuation, mitigating substantial damage before it occurs. Furthermore, upgrading early warning systems is essential to prevent infectious disease outbreaks.

ii. Responses During and After the Flood Event: In times of crises, it is crucial for government and non-governmental organizations to provide the

⁵⁵ Adams III, Thomas E. "Water Resources Forecasting within the Indus River Basin: a call for comprehensive modeling." In *Indus River Basin*, pp. 267-308. Elsevier, 2019.

⁵⁶ Troin, Magali, Richard Arsenault, Andrew W. Wood, François Brissette, and Jean-Luc Martel. "Generating ensemble streamflow forecasts: A review of methods and approaches over the past 40 years." (2021): e2020WR028392.

⁵⁷ Wu, Wenyan, Rebecca Emerton, Qingyun Duan, Andrew W. Wood, Fredrik Wetterhall, and David E. Robertson. "Ensemble flood forecasting: Current status and future opportunities." *Wiley Interdisciplinary Reviews: Water* 7, no. 3 (2020): e1432.

⁵⁸ Emerton, Rebecca E., Elisabeth M. Stephens, Florian Pappenberger, Thomas C. Pagano, Albrecht H. Weerts, Andy W. Wood, Peter Salamon et al. "Continental and global scale flood forecasting systems." *Wiley Interdisciplinary Reviews: Water* 3, no. 3 (2016): 391-418.

affected population shelters, dietary supplements and nutrition guidance on an immediate basis. The focus should also be on improving access to clean water and sanitation to mitigate waterborne infections contributing to malnutrition.

The government must prioritize enhancing maternal and child healthcare services, implementing maternal health education programs and emphasizing illness prevention through timely management, vaccination campaigns and public health education.

For long-term resilience, a shift to climate-smart agriculture is vital for food security. While immediate availability of fertilizers and seeds is necessary, climate-smart agriculture will improve efficiency and sustainable practices. Encouraging small farmers and micro-entrepreneurs to expand operations will also foster economic growth and job opportunities for the underprivileged.

iii. Drainage System: Apart from heavy rainfall, floods result from disruptions in the natural drainage system. Key contributors to these disruptions include impediments like bridges and farmland in the primary Indus River floodplains, causing a notable distortion. Additionally, waterlogging on agricultural land hinders efficient runoff absorption, intensifying the issue. In Sindh, incomplete drainage systems such as the Right Bank Outfall Drain (RBOD) and Left Bank Outfall Drain (LBOD) inconsistently redirect stormwater.⁵⁹ An equally significant impact is the alteration of drainage patterns due to infrastructure development like highways, housing, railways and irrigation canals.

iv. Collaborative Governance: Decision-making should prioritize the affected communities by providing them technical and financial support. The local, social, cultural, economic and environmental sensitivities should be respected in all policies, guidelines, standards and implementation procedures. Accountability in policy development and implementation plans is also important. Addressing these challenges necessitates collaborative efforts of the Sindh and federal governments to engage with experts, including those from the World Bank, to overhaul the outdated systems. This is imperative for ensuring resilience against future climate-induced disasters.

Conclusion

The 2022 floods in Sindh inflicted pervasive losses, adversely impacting every aspect of life. The challenges faced by the population, including

⁵⁹ Long Hoang. "Flood-Proofing the Road Network (2): Roads for Controlled Drainage in Pakistan." *The Water Channel*. 21 November 2022. <https://thewaterchannel.tv/thewaterblog/flood-proofing-the-road-network-2-roads-for-controlled-drainage-inpakistan/>.

infrastructure, economy, public health, education and gender dynamics, reflect the interconnectedness of these issues and call for the formulation of policies that are both responsive and proactive. Early warning systems, with a focus on ensemble hydrological forecasting, are essential tools for minimizing economic and other losses. Moreover, timely dissemination of warnings through digital and social media channels is effective for preventing and controlling damage. During and after floods, immediate responses, including the provision of dietary supplements, nutrition guidance and enhanced healthcare services, are critical for survival. However, a shift to climate-smart agriculture is important for long-term resilience. The documented magnitude of destruction caused by the 2022 floods should serve as a warning for improving the development approach in the public sector. The emphasis should be on climate-resilient planning and sustainable development.