



The Climate Change Governance in Pakistan

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Abstract. Climate change governance presents unique challenges for existing systems and requires urgent adaptation to address the deepening climate crisis. The interdependence of basic human needs—water, food, and energy—necessitates a holistic view to better understand the complexity of the dynamics of climate changes. This approach will aid in developing a long-term optimal policy. This paper delves into the challenge of climate change governance in Pakistan. It emphasizes the significance of the interconnection between water, food and energy and examines the steps taken to confront the associated challenges. The scarcity of resources essential for an effective mitigation and adaptation program to tackle climate change challenges is also discussed.

Keywords: Climate Change adaptation, Water-Food-Energy Nexus, Climate justice, Environmental Governance.

1 Climate Crisis

Our planet is warming fast. Studies prove that current warming rates are order of magnitude faster compared to the average rate of warming since the last glacial period [1]. Anthropogenic activities are considered the main reason for this unprecedented global warming. An unchecked increase in global warming poses severe threats to communities around the world. The highly likely risks of climate change include a change in rainfall patterns causing extreme weather, frequent and severe droughts, floods, wildfires, and a rise in sea levels. These changes will lead to loss of life, people losing shelter, pandemics, scarcity of fresh water and food, and consequently, an increased risk of food security. The impacts will be more severe for vulnerable populations who have limited resources to respond to the brunt of the climate crisis.

We have already started witnessing the irrefutable evidences of climate change. The 2022 flood in Pakistan is an example. The flooding has been attributed to unusual heavy rains and melting glaciers that followed a severe heat wave [2]. The flooding was estimated to be one of the costliest natural disasters in world history [3]. In the wake of the 2022 flood, nearly 2000 lost their lives, more than 2 million people were left homeless, and nearly 33 million were affected. The country's education system was severely affected. Flood damaged the infrastructure and educational institutions, resulting in the loss of learning time.

2 Water-Food-Energy Nexus

The interactions between water, food, and energy define the Water-Food-Energy Nexus (WFEN). Agriculture consumes ~70% of the world's freshwater resources, and water is also a key element in most energy production systems. Water and energy remain the major inputs for the production of food. Similarly, water serves as either a direct or an indirect input for energy production, and conversely, energy is needed for water usage. The complex interdependence and interactions among these three basic necessities of human life highlight the importance of considering them together during analysis and planning. An in-depth analysis of interactions between these basic resource sectors provides a basis for water-energy-food nexus assessments.

In the reference to climate change adaptation, the 'water-food-energy nexus' approach provides a guideline for optimizing the allocation and utilization of resources by illustrating the opportunities and constraints in a given scenario [4, 5]. The WFEN is emerging as a promising approach to overcoming governance failures in dealing with complex scenarios. This makes the utilization of WFEN a prerequisite for any planning effort aimed at mitigating or adapting to climate change.

3 Levels of Developments & Current Scenario in Pakistan

3.1 Water

Climate change impacts life on the planet in general and human livelihoods and well-being in particular through water. A variation in the availability, accessibility, and quality of water therefore has a direct and deep impact on both food and energy systems. An increase in mean global temperatures affects the availability of water resources through changes in rainfall patterns, soil moisture content, increased melting of glaciers and ice sheets, and groundwater flows. These factors further influence the availability and quality of water, consequently affecting agriculture and the food chain. The management and control of water resources and supply thereby impacts the socio-economic fabric of human society.

The present population growth rate (1.98%) of Pakistan demands an increase in food production. This, combined with changes in lifestyle, is adding to water stress, consequently posing a threat to food security, human health, and climate variability. Water is life. However, the centrality, gravity, and urgency of the water crisis in food security and the growing energy crisis have not yet been fully recognized by the people who matter most and are thereby not reflected in national planning. Long-term resilient water management and infrastructure require awareness of the scarcity of water resources, the acquisition of improved water management technologies, and well-functioning ecosystems. It is concerning that while rival African countries are resolving their water-related disputes, conflicts over the use of water resources remain unresolved both on a national and international level. There has been little to no planning on issues like glacial lake outburst flooding (GLOF) and the growing shortage of water for agriculture and the urban population. The quality of drinking water and falling water tables in big cities has also been overlooked.

3.2 Food

Global warming is changing the world climate, posing a serious threat to existing water resources. We are witnessing an increase in extreme events i.e. unusually severe weather such as heat-waves, heavy downpours, tornados, and floods. Reduced water availability results in decreased crop yields, leading to a decrease in the profit margin for producers and an increase in spending on food for consumers. Additionally, it affects the nutritive value of food. Developing countries are likely to be more vulnerable to food security challenges compared to developed nations. Climate change is feared to amplify the gradient between developed and developing countries.

There is a variation in average rise in temperature across the globe. The average annual increase in temperature over Pakistan over the past fifty years (1952–2009) is around 0.36 °C per decade. The past decade (2001-2010) was the warmest in the recorded history. In agriculture-based economies, the loss in crop yield can a substantially curtail the GDP. Based on present trends, it is anticipated that in the time to come the climate crisis will adversely affect~23% of the land and 50% of the population in Pakistan [6]. The agricultural sector is most sensitive to changes in temperature, and even a small increase in mean ambient temperature or extreme events is reported to affect crop yield [7]. According to a study, if the present trends continue, by 2050, the yield of rain-fed maize can decline by 12%, and irrigated maize will lessen by 14% [8].

Even the present food security situation of Pakistan is bleak. Pakistan ranks 102nd out of the 125 countries in the 2023 Global Hunger Index. The score of 26.6 in the Global Hunger Index places Pakistan at a level categorized as serious, despite a 7.6% decrease in the hunger index since 2015 [9]. Combined with an all-time high food inflation of 48.65 percent in May 2023, it is feared to exacerbate vulnerability to malnutrition and hunger [10].

With reference to the EWFN approach, the main factors reported in the literature to stress food security are [11]:

- a. “Urbanization
- b. Climate change
- c. Population growth
- d. Globalization (with “hidden” externalities)
- e. Political uncertainty
- f. Increasing living standard”

In the case of Pakistan, all factors (except the last one) contribute to its highest point. Unfortunately, the gravity and seriousness of the grim picture of food security in Pakistan have failed to permeate through the group of policymakers. This speaks for itself, indicating the need for policy shifts and urgent measures.

3.3 Energy

Electric power generation is a major contributor to global greenhouse gas emissions. Shifting to renewable energy sources not only reduces emissions but also conserves natural resources. Pakistan's total installed power generation capacity, according to a recent is 43,775 MW. Of this capacity, 59% is comes from fossil fuels, 25% from hydro, 7% from renewable sources (wind, solar, and biomass), and 9% from nuclear [12]. Given the country's reliance on foreign oil and gas, the 59% share of thermal energy in national power generation is alarming.

Fortunately, there are positive developments. The current installed capacity of hydroelectric power is 10,635 MW. If under-constructed projects are completed as scheduled, an additional 4,250 MW will be added to the national grid by 2025 and 8,500 MW by 2026. Upon completion in 2029, the Diamer-Bhasha Dam will further increase the hydropower share by 4,500 MW. The hydroelectric power projects with a total capacity of 30,237 MW are in in the different stages of planning. The major under-construction hydroelectric power projects are presented in Table-1.

For Pakistan, the exploitable potential of wind energy through wind turbines is 50,000 MW electric. Presently, 36 private wind power generating units are operational with an output of ~1,845 MW. The under-construction Ghara Wind Farm, upon completion, will add an additional 100 MW to wind energy [13].

Table 1. Major under-construction power projects [12]

Hydropower Project	Capacity	Expected completion date
Kohala	1124	2025
Azad Pattan	700	2025
Shingo Kas	102	2024
Mohmand Dam	800	2025
Dasu Dam	4320	2026
Tarbela Ext-V	1530	2025
Diamer-Bhasha Dam	4500	2029
Total	14600 +	

The present national installed capacity of nuclear energy is 3,262 MW. Another unit of 1,100 MW is in the planning phase. The project has experienced delays due to funding issues [14]. The present share of nuclear in the total electricity generation is about 10%. To date, electricity generation from solar energy is limited to 530 MW. The rising cost of electricity has prompted increased interest in domestic rooftop photovoltaic panels. The government of Punjab has initiated a program aiming at providing free solar panels to low-income households. The removal of the 17% general sales tax on solar panels is also attracting people to the solar option [15].

4 Resource Scarcity

The climate change crisis demands an urgent and comprehensive strategy that encompasses mitigation, adaptation, and disaster management. Scarcity of resources is arguably a major factor contributing to a lackadaisical response. Pakistan's economy has faced a series of domestic and external economic shocks, barely surviving bankruptcy in the last couple of years. The catastrophic flooding of 2022 further added to the economic collapse. According to the World Bank report, during fiscal year 2023, Pakistan's economy is estimated to have shrunk, with GDP declining by 0.6 percent [16]. The severe balance of payments crisis still plagues Pakistan, making it highly unlikely, if not unthinkable, to initiate or ramp up capital-intensive civil engineering projects to mitigate climate change threats.

In addition to the scarcity of financial resources, the declining human resource capital is alarming. Unfortunately, at the national level, we have overlooked the deteriorating quality of education. Universities are mass-producing graduates of questionable capability. The highly educated, capable, and competent few either leave the country or become demoralized. This leaves us with a very small number of motivated professionals to face a monumental and multidimensional challenge. The scarcity of resources can, in part, be met and addressed by institutional innovations, national will, and international collaboration.

However, the response from developed countries to create a fund to help at-risk locales adapt to climate change remains disappointing. International aid tends to be reactive, focusing on disaster management, and hardly proactive in supporting mitigation or adaptation measures in developing countries. Global relief funds often fall short of what is needed. For example, in the case of Pakistan, even after more than a year since the 2022 flood, the country received only 68.2% of the \$816 million requested from donors.

5 Mass Mobilization

National climate change adaptation necessitates the transformation of various systems, including energy, transportation, production, and agriculture, to varying degrees. The exacerbating climate change crisis demands urgent and rigorous actions. A national climate change action should encompass public awareness of the threats posed by climate change, fostering a consensus on the necessary strategies, enacting essential legislation, establishing time-phased targets, and implementing 'adaptation tracking' to measure progress. This entails adopting a new paradigm that actively involves people rather than relying on isolated planning by a cluster of experts. Adaptation and mitigation efforts without active engagement from the public are rendered pointless. However, as of now, no visible development involving the masses in these efforts has been observed [17].

6 Climate Justice: Home and Abroad

Both the share in the global warming and the repercussions of climate crisis are unevenly distributed worldwide. Developing countries, such as Pakistan, which have contributed the least to the climate crisis, are facing severe consequences. Within nations, underprivileged populations and marginalized ethnic communities are more susceptible to climate-induced loss and damage. Globally, the richest 10% of households contribute 34–45% of total global household carbon emissions, while the bottom 50% contributes 13–15%. Climate justice recognizes the disparity in low-income people and places least responsible for the problem.

It is ironic that governments advocating climate justice at the international level are oblivious to it at home. Like many other countries, sparsely populated remote rural areas in Pakistan have historically been overlooked. These underdeveloped areas receive limited investments in social services and infrastructure but bear the brunt of climate change. In the face of natural disasters and calamities, unequal relief support remains the reality of the day. The simple truth of equality and equity has yet to dawn on the people who matter [18].

Conclusions

1. Global warming is on the rise, and climate conditions are expected to deteriorate.
2. Appropriate adaptation measures can increase the resilience of management systems.
3. Embracing emerging technologies of climate change such as weather and climate information services can help communities effectively mitigate and adapt to the climate variability and cope-up with the climate crisis [19].
4. Meaningful collaboration among government, NGOs, businesses, researchers, and people can catalyze adaptation efforts.
5. Climate change mitigation and adaptation programs, being capital-intensive, require international funding from countries that are major contributors to global warming.

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