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Urban Climate Resilience and Development in Pakistan

National Policy Paper

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Executive Summary

This report delves into the intricate relationship between urbanization, climate change, and resilience-building in Pakistan, against the backdrop of South Asia's burgeoning urban population. With Pakistan's rapid urban growth and the increasing frequency of climate-related disasters, it is imperative to comprehend the complex interplay of these factors. The report outlines the significant urbanization surge in South Asia, particularly in Pakistan, where the urbanization rate is the highest. This urban shift contributes substantially to the country's GDP and tax revenue. However, concerns loom large over the sustainability and environmental repercussions of unplanned urban expansion and its alignment with climate action. The study's focus encompasses the assessment of prevailing urban development policies and interventions, identifying gaps in mitigation and adaptation strategies, and exploring viable financing mechanisms for fostering sustainable growth. Anchored in the resilience perspective, the study emphasizes equitable development that integrates climate action, ensuring fairness and justice for all stakeholders.

The chapter on, "Status Quo of Pakistan," presents detailed profiles on the country's climate, geographical location, economy, and population dynamics. Against the backdrop of Pakistan's current economic status, growth trajectory, and demographic dynamics, this chapter highlights the considerable challenges posed by factors such as political instability, inflation, and trade deficits. It also underlines the vulnerability of the informal sector, which constitutes a significant portion of the workforce, particularly in agriculture and transportation, and how climate-induced events can exacerbate urban migration. The chapter also highlights key actions, policies, and projects related to urban development and climate change, with a comprehensive analysis of the spring heatwaves and floods in 2022, including loss and damage assessment.

In the "Urbanization" chapter, a thorough analysis is provided regarding the various elements of urban growth, housing and infrastructure, sanitation and health, water and urban heat island effects, urban mobility, gender mainstreaming, waste management, and social protection policies. The chapter integrates case studies of sectoral projects implemented in urban areas, such as rainwater harvesting, the metro bus project, health coverage, and the Benazir Income Support Programme (BISP). Furthermore, it delves into the current situation of katchi abadis (slums) and analyzes the master plan of Islamabad as another case study. It is noted that massive rural-to-urban migration leads to urbanization on the outskirts of large cities, which is not included in official statistics and creates a "hidden" portion of the equation.

The chapter on "Disaster Resilience and Management" includes an analysis of the institutional framework and the targeted approach adopted by both the public and private sectors in urban areas. The policy landscape at national, urban, and sectoral levels provides valuable insights into the efforts made and further actions required to enhance urban resilience in the context of climate change by the public sector.

Finally, after conducting stakeholder consultations and seminars, the report proposes a set of recommendations to effectively manage urban resilience and strengthen climate action in Pakistan.

The report serves as a comprehensive reference for understanding the status of urban development and resilience in Pakistan considering climate change, offering valuable insights and practical recommendations for policymakers, stakeholders, and concerned citizens alike.

Methodology

Current Status of Urbanization in Pakistan:

The status of urbanization in the country has been reviewed and analyzed based on population dynamics, demographics, socio-economic trends in relation to climate profile of the country.

Mapping Pakistan's Climate Commitments:

Pakistan has made certain commitments under the Nationally Determined contributions (NDC's) for reducing emissions and improving climate adaptation and mitigation response. The report has assessed the alignment of NDC's with current urbanization trends and how climate crisis can be addressed by aligning sector specific urban trends with the NDC's.

Challenges and Barriers:

Identification of challenges in urban policies related to urban housing, mobility, infrastructure, and the barriers to socio-economic growth including those which can be supportive of urban slums and climate adaptation measures in urban sector have been discussed.

Action Plans:

The report includes certain case studies on the existing policies, program and action plans which support urban climate resilience in Pakistan.

Stakeholder Consultations:

Through stakeholder engagements, data was collected from credible sources and consultations were conducted with both the public and private sectors, allowing for a broad representation of stakeholders. By adopting these measures, the credibility and accuracy of the information gathered were enhanced, and a comprehensive understanding of climate change issues in the urban sector was fostered.

1. Background and introduction

South Asia has been witnessing an accelerating growth in urban population, which is expected to increase by 250 million by 2030. Among countries of the South Asian region, Pakistan has the highest rate of urbanization. As per estimates, 36.4% of the population lives in urban areas (2017 census), and more than half of the country's population will be living in urban cities by 2025 (The UN Population Division). Cities in Pakistan generate 55% of the GDP, and 95% of its federal tax revenue comes from ten major cities. Poverty in cities – i.e., urban multi-dimensional poverty – is one-sixth of that of rural areas of Pakistan, hence considered to be closely related to economic growth of the country and more employment opportunities.

While recognizing the need for urbanization to reduce extreme poverty in the region, it is increasingly recognized that cities and urban areas must be planned with adequate infrastructure and services without compromising on building resilience and sustainability in the discourse of actions and measures being taken. The country leaders and regions' city leaders are becoming cognizant to the fact that the unplanned and unsustainable expansion of megacities and secondary cities in South Asia are expected to see an increased economic activity at the cost of increased emissions to contribute to climate change. Moreover, seasonal shifts due to climate change trigger the rural to urban migration patterns. For instance, a report by the International Institute for Sustainable Development (IISD) notes that climate change-induced extreme weather events, such as floods and droughts, have led to reduced crop yields, increased production costs, and income losses for farmers in Pakistan. Therefore, these impacts have pushed many farmers towards urban areas in search of alternative livelihood opportunities, leading to increased pressure on urban resources and systems (IISD, 2019)[1]. Similarly, a report by the World Bank highlights the impact of climate change on agriculture in Pakistan and the resulting rural to urban migration. The report notes that climate change is expected to reduce crop yields and increase production costs for farmers in Pakistan, leading to reduced incomes and a push towards urban areas. The report also notes that the resulting urbanization trend can put pressure on urban resources and systems and exacerbate social and environmental challenges[2].The region's leaders are planning for bold climate-smart urban development plans through policy and initiatives, one example is the planned city of Hulhumale being developed as the first smart city in the Maldives; Surat in India has developed the country's first comprehensive Urban Resilience Strategy; Pakistan has planned for a harmonized action plan on 'Climate Resilient Safe & Sustainable Cities"[3]. This nexus between urban growth and climate change is prevalent in the major economic sectors such as energy use, transport, infrastructure and buildings, water use and industries. Furthermore, it is also

1 International Institute for Sustainable Development. (2019). Climate impacts and migration in Pakistan. https://www.iisd.org/system/files/publications/climate-impacts-migration-pakistan.pdf

2 World Bank. (2018). Pakistan's changing climate: Impacts and adaptation strategies. http://documents.worldbank.org/curated/en/297961536308824688/pdf/Pakistan-s-Changing-Climate-Impacts-and-Adaptation-Strategies.pdf

3 Climate Resilient Urban Policy Framework is being formulated by Government of Pakistan which will take into account opportunities and challenges in achieving green and resilient urban development, Minister Climate Change Ms. Sherry Rehman

prevalent in non-economic sectors as unplanned urban growth and climate change can significantly impact public health by increasing the risk of air pollution, water-borne diseases, and heat-related illnesses. Climate change can exacerbate existing health risks in urban areas, such as increased rates of asthma, allergies, and other respiratory illnesses, due to factors like air pollution and extreme heat. South Asia being the most vulnerable region of the world, is experiencing the worst climate catastrophes including floods, glacier melts, earthquakes, heat waves, cyclones, and direct and indirect impacts on natural resources, human lives, livelihoods, and the economies. These impacts are witnessed in the recent climate events in South Asian countries and it is estimated that cities in South Asia would require more than $215 billion annually by 2030 for flood protection[4].

Recent studies indicate that unplanned and unmanaged urbanization is a significant challenge amongst others faced by developing countries like Pakistan that has resulted into urban slums, environmental degradation, poverty, and inequality. Climate change is the main culprit, and the development choices made and being made exacerbate the problem. It is important to note, however, that while urbanization plays a significant role, it is not the sole challenge. Given the most recent climate catastrophe in Pakistan in the form of Super Floods 2022, an estimated cost of more than 16.3 billion USD is required for rehabilitation and reconstruction in a resilient way[5]. With the country already facing a financial crunch and economic meltdown, this climatic catastrophe has brought an inevitable devastation in a form of loss of human lives, infrastructure, **loss of livelihoods and dragging millions into extreme poverty. With the rise in population of the country, there is a huge housing deficit of nearly 10 million units and growing, resulting in the growth of slums, overexploitation of natural resources and risk to human health and lives.**

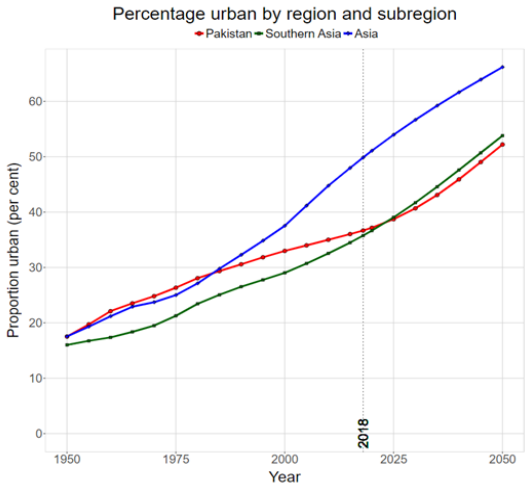


Figure 1: Proportion of urban population in Pakistan as compared South Asia and Asia
(Source: United Nations, Department of Economic and Social Affairs, Population Division (2018). World Urbanization Prospects: The 2018 Revision)

4 World Bank. (2017, September 6). Cross-border action on climate disasters is urgent in South Asia. [Blog post]. End Poverty in South Asia. https://blogs.worldbank.org/endpovertyinsouthasia/cross-border-action-climate-disasters-urgent-south-asia

5 World Bank. (2022, October 28). Pakistan flood damages and economic losses over USD 30 billion and reconstruction needs over USD 16 billion: New assessment. [Press release]. https://www.worldbank.org/en/news/press-release/2022/10/28/pakistan-flood-damages-and-economic-losses-over-usd-30-billion-and-reconstruction-needs-over-usd-16-billion-new-assessme

Given the expected increase in the region's urban population, coupled with these climatic events, embedding climate change into the development plans is becoming a most essential component of urbanization and developing the cities around the region. It becomes crucial to recognize the ways and solutions to build back better through improved governance system in the country, enhanced adaptation measures, and through adequate financing through different sources and mechanisms, as well as in the form of "climate reparations" – where even though countries of the Global North are responsible for 92% of global carbon emissions yet countries in the Global South are having to bear the extreme consequences of climate change. These core concerns have been brought to the forefront to demand for 'loss and damage' - a fairly precise technical term used in international climate negotiations which refers to climate impacts that exceed the adaptive capacity of countries, communities and ecosystems and cannot be reversed or restored (a measure of post-adaptation and post-mitigation scenarios).

Scope and objectives of the study

Aim and objectives

While migration has been a historic phenomenon, recent trends indicate that the exponential growth of our cities is not solely driven by pull factors such as education, jobs and better living standards; a major part is driven by marginalized communities who are forced to travel either temporarily or permanently to cities from rural areas, especially due to loss of agriculture-based livelihood income options. They have forced semi-skilled, unskilled and landless families to migrate to urban peripheries. This national report is based on case studies, examples and stakeholders' consultations and hopes to unravel how – despite the triple challenges of increasing population pressure, dwelling economic opportunities and finally climate onslaught – some meaningful solutions can be found, that ensure justice, equity and opportunity ensuring decent living standards for all inhabitants keeping climate action in mind **(adaptive action and resilience-building for the poor, and mitigative action for the middle and high income groups).** The report attempts to shed light on the prospects of urbanization in Pakistan, in terms of challenges and opportunities, through the resilience lens: mitigation, adaptation measures, loss and damage, and the need for climate finance. It particularly aims to assess the urban sector of Pakistan by:

- assessing the policies and interventions related to urban development and urban resilience in Pakistan, in compliance with the national and international climate change objectives.
- identifying critical gaps and challenges in urban development vis-a-vis mitigation, adaptation, and resilience in Pakistan.
- identifying financing resources to meet the needs of urban development in the country, with respect to sectors, growth and policies that can supplement resource regeneration and maintain ecological integrity of the cities in Pakistan.

Conceptual framework

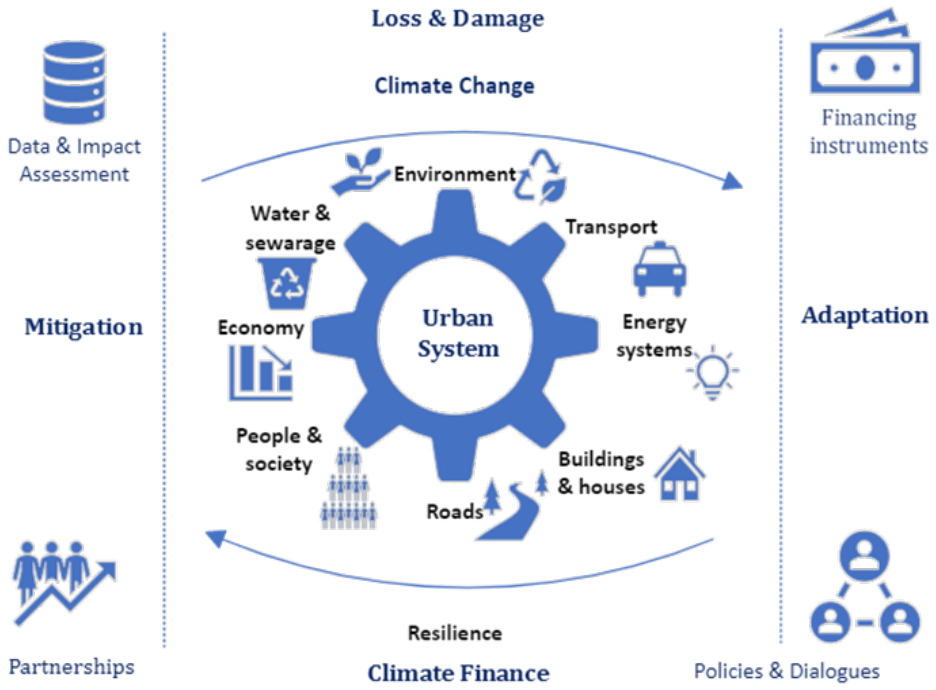


Figure 2: Conceptual framework of the report on Urban Resilience in Pakistan[6]

2. Status quo of Pakistan

State of economy, growth, and development

The economic outlook is crippled with the ongoing political instability, high international fuel and commodity prices, and burgeoning trade deficit, exerted immense pressure on foreign exchange reserves resulting in significant depreciation of PKR against USD which in turn contributed to the high inflation. A recent World Bank's report (Table 1) identified the country's GDP growth at 6.0% in 2022 and forecasted it to be low at 3.2% in 2023.

- An increase in the agriculture sector's growth from 3.5 percent in FY21 to 4.4 percent in FY22, with livestock constituting 60% of the total output in the sector.
- Industrial sector growth reached 7.2 percent in FY22, lower than last year's growth of 7.8 percent, supported by higher production in sectors like water, electricity, gas and manufacturing sectors. Industries like cement and textile showed a weak trend.

6 CSO level consultations were organized to understand their perspectives and expectations for a sustainable urban development that is climate compatible, and the inputs are provided in the analysis.

Table 1: Economic outlook of Pakistan

Economic indicators	2019	2020	2021	2022 (estimated)	2023 (forecasted(f))	2023 (f)
Real GDP growth, at constant factor prices	3.1	-0.9	5.7	6	2	3.2
Current Account Balance (% of GDP)	-4.2	-1.5	-0.8	-4.6	-4.3	-3.3
Fiscal Balance (% of GDP), excluding grants	-7.9	-7.1	-6.1	-7.9	-6.9	-6.2
Public Debt, including govt. guaranteed debt (% of GDP)	78	81.1	75.6	78	71.7	71.9

(Source: World Bank, 2022)

The existing economic challenges of Pakistan have been significantly exacerbated by the recent floods, with a major impact on the main economic sectors of Pakistan. In the agriculture sector, mainly crops, land and livestock, an estimated 9.4 million acres of crops are affected with significant losses to cotton, date, wheat, and rice crops, with an expected spillover onto the industrial sector mainly textile's industry. The lower agricultural and industrial activities would eventually have an impact on the transportation sector, which accounts for 50 percent of service sector output. According to studies on the informal sector in Pakistan, approximately 72% of the workforce is employed in the informal economy, which includes agriculture, agri-based industries, and transport sectors[7]. These sectors are particularly vulnerable to the impacts of climate change, including floods, droughts, and extreme weather events. Such losses can have a significant impact on the livelihoods of individuals working in the informal sector, leading to increased migration to urban areas in search of work. This, in turn, can exacerbate existing challenges faced by cities, such as inadequate housing, water, and sanitation infrastructure, and increased demand for social services[8] . Therefore, addressing the impacts of climate change on the agricultural and allied industries is critical to reducing the burden on urban areas and the resources available to them[9] These coupled challenges related to transportation arise from the loss of infrastructure, such as roads and bridges, disrupting supply chain, contributing to the existing inflationary pressures and production challenges in Pakistan. As a direct consequence, several million people could fall into poverty, the national poverty rate can increase by 2.5 to 4.0 percentage points, pushing between 5.8 and 9.0 million people into poverty, with huge socio-economic losses, reflected by long-standing structural weaknesses and exacerbated by floods. The report identifies the real GDP growth to be expected to slow to 2.0 percent in FY23, but recover to 3.2 percent by FY24, supported by a rebound in agricultural production, reconstruction efforts, and projected lower global inflationary pressures[10]

7 Haq, R., & Rafique, M. Z. (2017). Labor force participation in informal sector of Pakistan. Journal of Poverty, Investment and Development, 31, 73-83.

8 Ali, A., & Anwar, M. (2020). Climate change, urbanization and migration: A review of literature. Journal of Cleaner Production, 252, 119791.

9 Khan, F. (2013). The impact of climate change on the agricultural sector: A review of the vulnerability, impacts and adaptation

10 Pakistan Development Report 2022, The World Bank Group

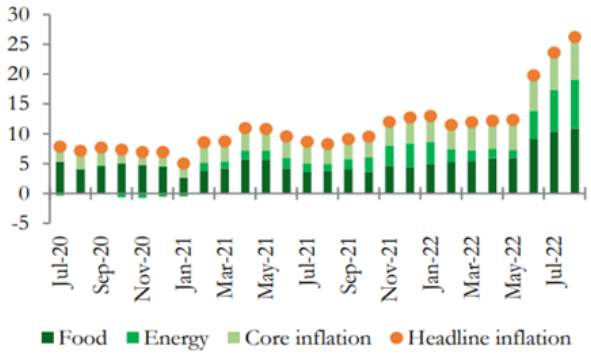


Figure 3: Headline inflation in urban parts of Pakistan
(Source: Pakistan Bureau of statistics, World Bank 2022)

Geo-ecological landscape and demographics

Geographically, with a physical area of 795,000 km2, Pakistan is situated in the northern hemisphere in South Asia (SA) between latitudes 23°-38° N and longitudes 61°-78° E. The country is home to the Himalayan belt and other mountain ranges (some above 1000 m high) in the north and a coastal belt along the Arabian Sea in the south.[11]

Administratively, the urban centres of Pakistan, apart from the federal capital of Islamabad, have been divided into three tiers under the provincial governments of four provinces, namely, Punjab, Sindh, Khyber Pakhtunkhwa and Balochistan. Additionally, two disputed territories of Gilgit Baltistan and Pakistan Administered Kashmir (PAK) have also been divided into three tiers which include division, district and tehsil.[12]

Pakistan's climate profile

Pakistan's climate is primarily arid, with an intense summer followed by monsoon (June to August) and a frigid winter (December to February). There are two seasons between winter and summer: autumn, which is characterized by a warm fall (September to November), and spring, which is usually dry (March to May)[13]. Generally, the country has a wide range of temperatures, from -15°C in the northern Himalayas to above 35°C in the southern regions. Furthermore, the annual precipitation varies from less than 125 mm in the southwest to around 1000 mm in the north. Due to its arid climate, the country experiences a total annual rainfall of less than 500 mm for the great bulk of its geographical area, and only a small portion of it exceeds 1000 mm[14]. However, due to climate change, the trend of seasons and weather patterns has also changed.

11 Spate, O.H.K. and Learmonth, A.T.A., 2017. India and Pakistan: A general and regional geography. Routledge.

12 Soherwordi, S.H.S. and Khattak, S.A., 2014. The Creation of New Provinces in Pakistan and its Implications for an Integrated Country. Journal of the Research Society of Pakistan, 51(1).

13 Aslam, A., Rana, I.A. and Bhatti, S.S., 2022. Local climate zones and its potential for building urban resilience: a case study of Lahore, Pakistan. International Journal of Disaster Resilience in the Built Environment.

14 Khan, S., 2019. Climate classification of Pakistan. International Journal of Economic and Environmental Geology, 10(2), pp.60-71.

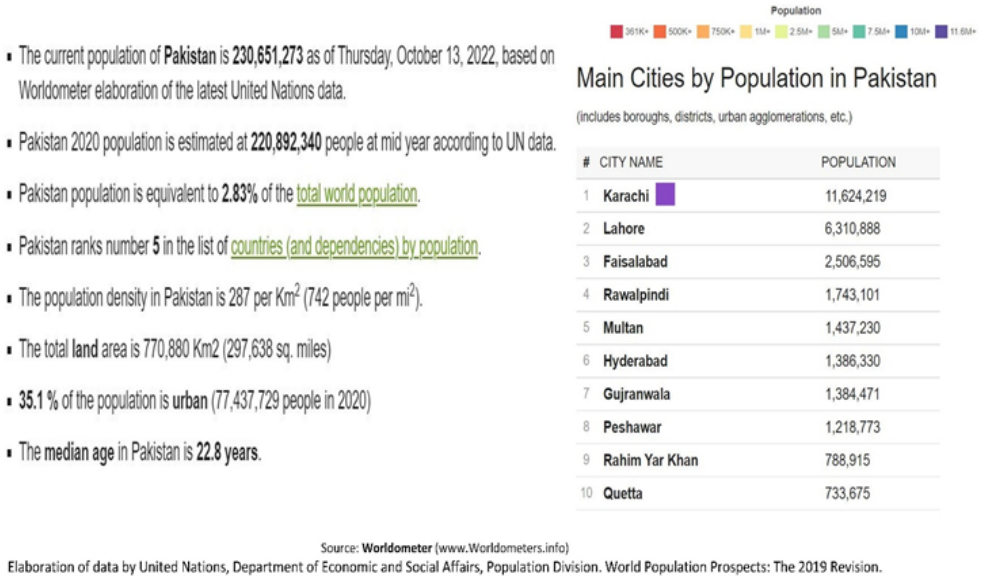


Figure 4: Pakistan's demographics, cities, and agro-climatic zones

Policies, plans and commitments

While climate change has moved from an abstract notion to having a real impact, recent governments have started making progress in terms of strengthening the institutionalization of climate change policymaking and policy commitments to tackle the impacts. For tackling such impacts, the government has proposed actions in key economic sectors such as energy and power systems, industry, agriculture and transport. Recognizant of the technical and financial adaptive capacity and constraints, Pakistan has been actively ratifying multiple international climate agreements and developing climate-resilient policies at the national level to tackle the negative impacts of climate change.

Pakistan has actively engaged in efforts at the national and international level against climate change. Nationally, various governments have passed new policies and acts to strengthen the climate change efforts while internationally, the country has enthusiastically participated in several conventions and ratified its climate change agenda. As a G77 member at the UNFCCC, Pakistan has endorsed the Warsaw International Mechanism on Loss and Damage (2013), the subsequent Paris Agreement (2015) (UNFCCC 2016) and the recent COP26 at Glasgow. In the last decade, the country has accelerated policymaking on climate change by developing the National Climate Change Policy 2012 and the National Disaster Risk Reduction Policy (NDRRP) (NDMA 2013)toxic chemical products formed as secondary metabolites by a few fungal species that readily colonise crops and contaminate them with toxins in the field or after harvest. Ochratoxins and Aflatoxins are mycotoxins of major significance and hence there has been significant research on broad range of analytical and detection techniques that could be useful and practical. Due to the variety of structures of these toxins, it is impossible to use one standard technique for analysis and/or detection. Practical requirements for high-sensitivity analysis and the need for a specialist laboratory setting create challenges for routine analysis. Several

existing analytical techniques, which offer flexible and broad-based methods of analysis and in some cases detection, have been discussed in this manuscript. There are a number of methods used, of which many are lab-based, but to our knowledge there seems to be no single technique that stands out above the rest, although analytical liquid chromatography, commonly linked with mass spectroscopy is likely to be popular. This review manuscript discusses (a, enacting the National Climate Change Act (2017) (National Assembly 2017), and establishing the National Water Policy (2018) (National Assembly 2017). In 2021, the Climate Change Policy has been reshaped as per the changing global climate agenda.

Figure 5: Key climate actions by Pakistan

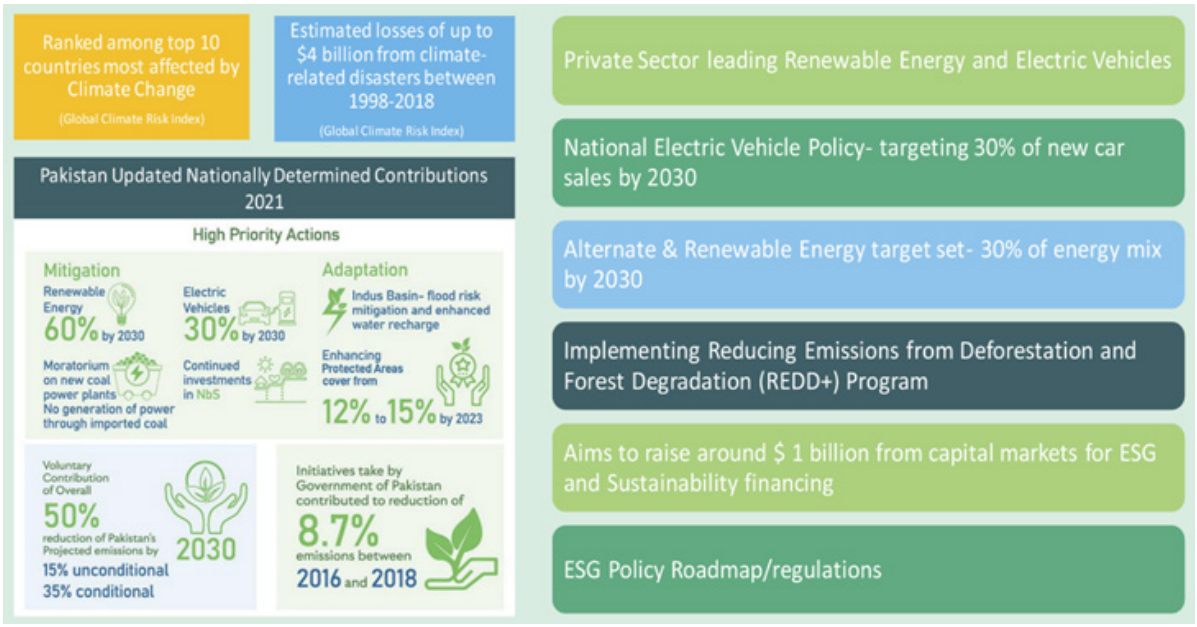


Figure 6: Pakistan's Nationally Determined Contributions (NDCs) 2021

3. Climate change in Pakistan: recent catastrophes, vulnerability and impacts

Pakistan is ranked eighth among the world's most climate-vulnerable nations in the Global Climate Risk Index report from 2021. Despite contributing just a negligible amount of greenhouse gases (less than 1%), climate change has had a substantial negative socioeconomic impact on Pakistan, particularly during the past two decades. Annually, climate change-related impacts cost Pakistan a loss of USD 38 billion. According to the UNDP HDI report 2020-2021, Pakistan's position in the Human Development Index (HDI) has decreased seven places, placing it at 161 out of 192 countries[15]. By 2030, it is anticipated that Pakistan's sensitivity to climate change would further increase due to the country's rapid urbanization, increase in transportation, rise in energy consumption, and increase in waste production[16]. The Himalayan range glaciers are melting at a rate faster than ever before documented in history. Other extreme weather events that are occurring in Pakistan at a high rate and severity include hurricanes, storms, intense heat waves, abrupt rainfall, unpredictable flooding, and droughts[17].

Analysis of climate data for the major cities reveals a significant increasing tendency of annual mean temperature between 1961 and 2018. **The highest increase is seen in the southern cities of Quetta (in Balochistan), at +0.50°C per decade, followed by Karachi (in Sindh),where the annual mean temperature has risen by +0.32°C per decade.** The northernmost cities, Muzaffarabad and Gilgit (in Gilgit Baltistan), have experienced the least increase at +0.02°C per decade and+ 0.10°C per decade, respectively (Figure). On the other hand, the tendency of rainfall is somewhat mixed. Annual total rainfall has increased the most in Peshawar (+39 mm/decade), followed by Islamabad (+37 mm/decade) and Lahore (+26 mm/decade), while it has declined in Muzaffarabad (–19 mm/decade) and Karachi (–17 mm/decade)[18].

Spring heat waves in Pakistan 2022

Earlier this year, Pakistan was engulfed by intense heat wave episodes during the time when the country usually experiences spring season. There was a sudden shift from winters to summer and the spring season was skipped completely. The temperature exceeded above 40oC in many parts of the country. The highest temperature was recorded in Jacobabad city of Balochistan, which was above 47oC. It was the highest temperature recorded in the northern hemisphere. The heatwaves were prolonged and recurring which continued till the mid-June. A drought-like situation was created due to

15 2022. Uncertain Times, Unsettled Lives: Shaping our future in a transforming world. [online] UNDP. Available at: https://report.hdr.undp.org

16 Khan, I., Lei, H., Shah, A.A., Khan, I. and Muhammad, I., 2021. Climate change impact assessment, flood management, and mitigation strategies in Pakistan for sustainable future. Environmental Science and Pollution Research, 28(23), pp.29720-29731.

17 Usman, M., Ndehedehe, C.E., Manzanas, R., Ahmad, B. and Adeyeri, O.E., 2021. Impacts of climate change on the hydrometeorological characteristics of the soan river basin, Pakistan. Atmosphere, 12(6), p.792.

18 Sathar Z.A. and K. Khan (eds). 2019. Climate, Population, and Vulnerability in Pakistan: Exploring Evidence of Linkages for Adaptation. Islamabad: Population Council.

the constant dry spell and these heat waves affected the wheat and mango production which declined by 20%[19]. Moreover, the heat waves caused GLOF (glacial lake outburst flood) in the Gilgit Baltistan region when Shisper glacier melted. This GLOF completely damaged the Hussaini bridge which was an important connecting bridge for Gilgit Baltistan. The figure represents the heat wave map of April 2022[20].

The Ministry of Climate Change in collaboration with the National Disaster Management Authority, National Food Security ministry, Pakistan Meteorological Department, and other relevant departments, launched the Heat Wave Action Plan in May 2022. The purpose was to create awareness among masses regarding coping strategies, understand the scope through heat index measurement, assess the damage and vulnerabilities and propose mitigation and adaptation strategies in the affected areas. The plan is comprehensive; however, its implementation has not been effectively and strategically performed[21].

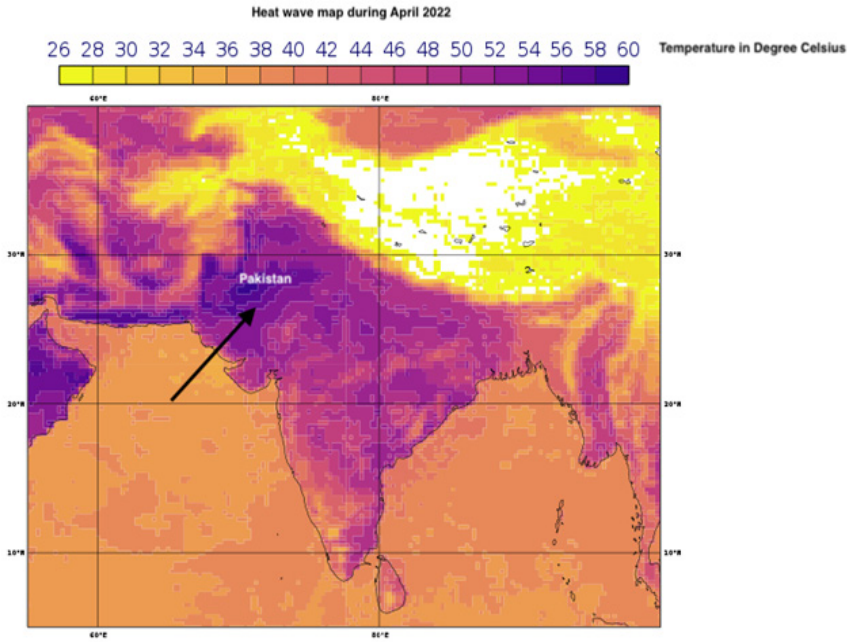


Figure 7: Heat wave during the spring season in April 2022 covering entire country of Pakistan along with the neighboring India.

This map is not to scale. It is for reference purposes only. It is not a legal document.

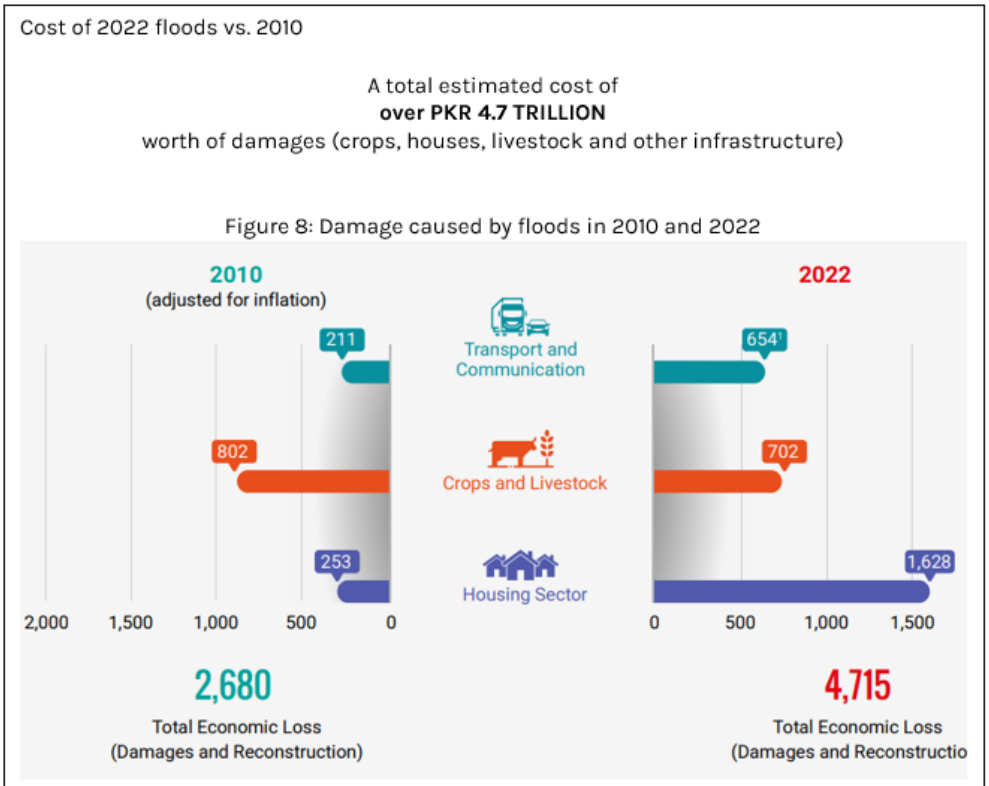
19 World Economic Forum. 2022. Deadly heat wave in India and Pakistan was 30x more likely due to climate change, scientists say. [online] Available at: https://www.weforum.org/agenda/2022/06/deadly-heat-wave-in-india-and-pakistan-was-30x-more-likely-due-to-climate-change-scientists-say/

20 Thenews.com.pk. 2022. Hunza, Gilgit disconnected after glacial lake flooding. [online] Available at: https://www.thenews.com.pk/print/956134-hunza-gilgit-disconnected-after-glacial-lake-flooding

21 Heat Wave Action Plan 2022. [online] Available at: https://www.pdma.gov.pk/sub/uploads/PDMA%20Heat%20Waves%20Plan%202022

Floods 2022

With the recent extreme climatic events in Pakistan, evident in the form of heatwaves and floods of 2020 (Figure 8 and 8a), the economic loss is estimated to be over PKR 4.7 trillion worth of damages (Box 1). The Government of Pakistan has released the Floods Response Plan which urgently seeks USD 816 million to provide prioritized multi-sectoral aid and protection to 9.5 million people in affected areas of Balochistan, Sindh, Khyber Pakhtunkhwa and Punjab until 31 May 2023[22] (Details of financing required in different sectors are provided in Figure 6.)



Total Economic loss (PKR Billion)	Sindh	Khyber Pakhtunkhwa	Balochistan	Punjab	Other regions
2010	1,124	385	150	583	438
2022	2444	141	541	122	14

Figure 8: Damage caused by floods in 2010 and 2022

22 Sources: Government of Pakistan, NDMA, PDMA, UNOSAT, Humanitarian partners, Post Floods Assessment 2022

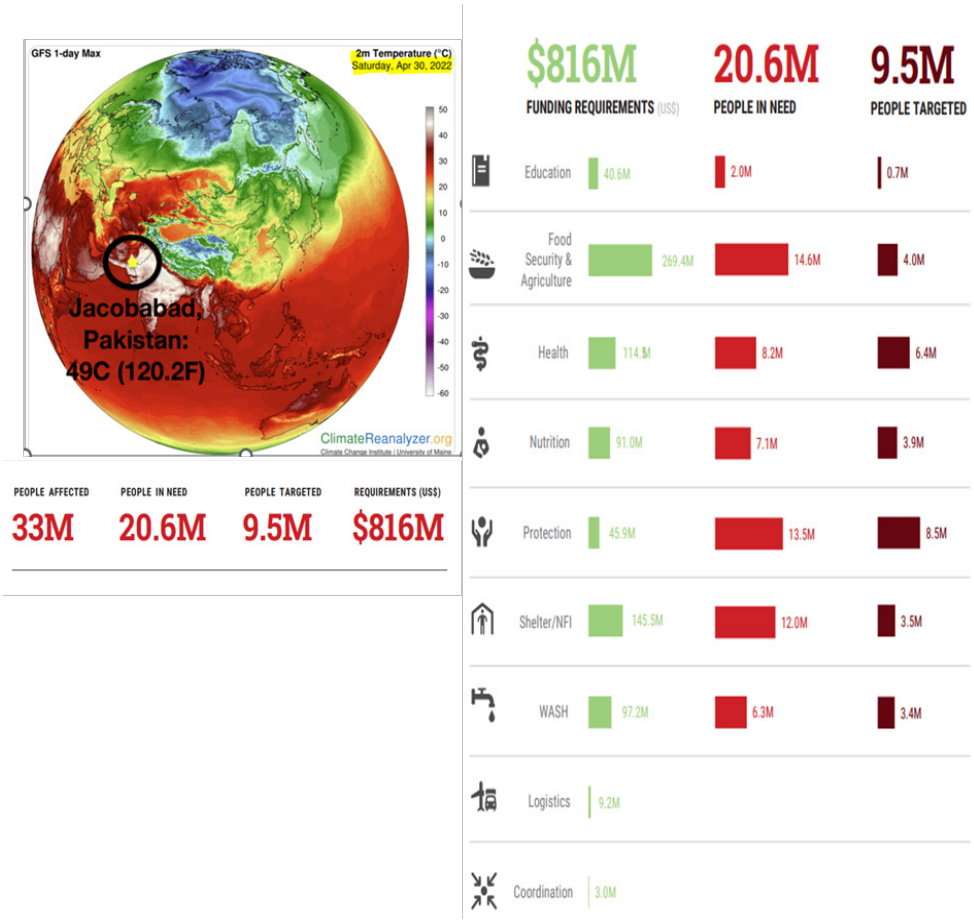


Figure 8a: Recent climatic events in Pakistan and financing needs (heatwaves, floods 2022)

(Source: Government of Pakistan, NDMA, PDMA, UNOSAT, humanitarian partners)

4. Urbanization in Pakistan: Urban landscape, trend, challenges, and opportunities

Growth and trend of urbanization in Pakistan

Since the last three decades, Pakistan's urban population has been growing rapidly, posing serious challenges to the country's citizens. In terms of population, Pakistan is the sixth-largest nation in the world after China, India, the United States, Indonesia, and Brazil. Since 1998, the country's population has risen by more than 60%, from 132.4 million to an estimated 220 million people now. As per a statistic of 2020, 34.9% of the population of Pakistan is urban (75,510,639 people in 2019). The 2019 population density in Pakistan is 281 people per Km2 (728 people per mi2), calculated on a total land area of 770,880 km2 (297,638 sq. miles).

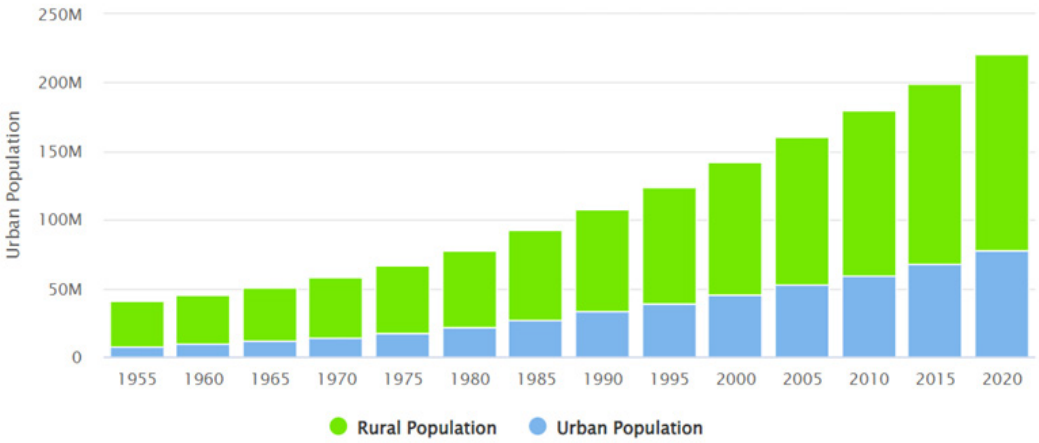


Figure 9: Pakistan's rural and urban population (1955-2020)
(Source: World Bank data)

The population distribution within the nation is unusual; the province with the biggest area, Balochistan, has the fewest inhabitants, while Punjab, the second-largest province, has the highest population of all the provinces. As per the 2017 census report, Punjab province accounts for 40.38 million of all urban residents. With 24.91 million urban residents, Sindh is regarded as having the second-highest urban population share. With 5.29 million people residing in urban areas, Khyber Pakhtunkhwa is the third largest province. Following closely behind with urban populations of 3.4, 1.01, and 0.14 million each were Balochistan, Islamabad, and the Federally Administrative Tribal Areas (FATA) (Figure 10)[23].

The country's urbanization continues to be primarily fueled by migration, instability, and economic necessity. The rapid population growth is attributed to rural-to-urban migration in the country, where the internal migrants make about 12% of the population, with around one-third of them moving within the last ten years[24]. With large populations migrating towards the urban centres, more land is being converted to developed infrastructure (residential, commercial, roads, railway networks, airports, and others) (Figure9). As a result, **many of the peri-urban areas are currently becoming dense urban districts and the urban sprawl is increasing.**

A report by the International Organization for Migration (IOM) highlights that climate change is a significant driver of internal and cross-border migration in Pakistan. It states that people who are exposed to environmental stressors such as floods, landslides, and droughts are more likely to migrate, either temporarily or permanently, to urban areas[25]. Additionally, the report states that climate change-induced migration could increase poverty and

23 Wazir, M.A. and Goujon, A., 2019. Assessing the 2017 census of Pakistan using demographic analysis: A sub-national perspective (No. 06/2019). Vienna Institute of Demography Working Papers.

24 Nisar, A., Akram, A. and Hussain, H., 2013. Determinants of internal migration in Pakistan. The Journal of Commerce, 5(3), p.32.

25 Brücker, P., Glasser, J., Pakistan, B. and Haiti, R. (n.d.). The State of Environmental Migration 2010 STudY, deCeMber 2011 | CliMate. [online] Available at https://pakistan.iom.int/sites/g/files/tmzbdl1121/files/documents/the-state-of-environmental-migration-2010.pdf

inequality in the affected regions, leading to further economic instability and social tensions. Interestingly, the proportion of the population living in poverty decreased over the past 20 years, dropping from 61.6% in 1998–1999 to 21.5% in 2018–19. It dropped from 47.4% to 10.7% in cities as well in 2018-2019[26]. However, due to the COVID pandemic, poverty increased globally and in Pakistan as well. According to the World Bank (WB), Pakistan's poverty rate has risen and now stands at 39.3%, with over two million people living in poverty[27].

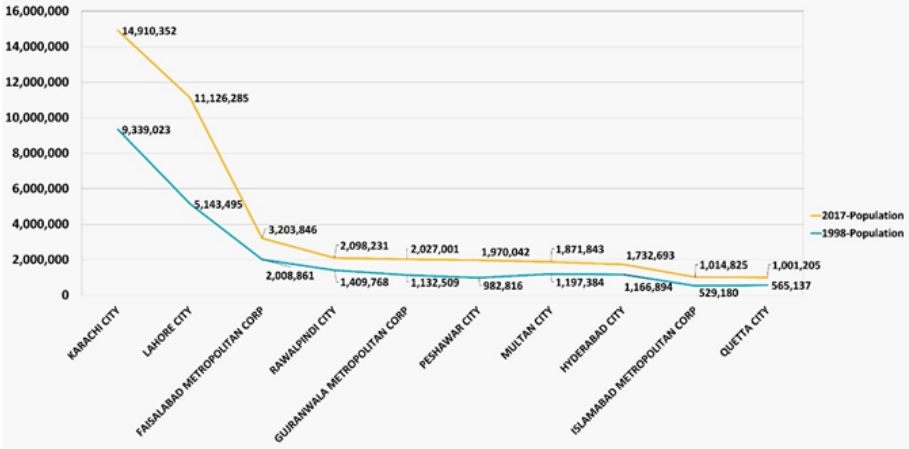


Figure 10: Comparison of population between 1998 census and 2017 census.

Challenges and issues pertaining to urbanization

Urban areas in Pakistan are becoming hotspots for recurring extreme weather events and disasters due to growing urbanization, inadequate land use planning, and vulnerabilities. Urbanization causes land use/land cover change, which raises air temperature, lowers precipitation, increases relative humidity, and raises energy consumption, eventually affecting a region's meteorological parameters.

According to the 2013 World Bank Development Report, 10.7% of the global population subsists on less than the World Bank's established poverty line of USD 1.90 a day[28]. In Pakistan, 3.7% of the employed population was living below USD 1.90 of purchasing power parity per day in 2021. For this reason, rural–urban migration is prevalent in the country, giving rise to the rapid rate of urbanization. Furthermore, many of the people who fall below the poverty line are forced to reside in informal settlements rather than in developed housing societies. **The major reason is that the housing is not affordable in many of these societies and a poor person cannot afford to pay for the amenities which are being provided by these societies.** Massive rural to urban migration causes urbanization on the

26 Javed, N., Hasan, R. and Qureshi, N.N., 2020. Developing a national urban policy: a case study of Pakistan. In Developing National Urban Policies (pp. 121-146). Springer, Singapore.

27 Azam, T., Mohsin, M., Naseem, S., Nilofar, M., Zia-UR-Rehman, M., Nelofer, S., Khan, S. and SongJiang, W., 2020. Economic growth vulnerability amid the COVID-19 epidemic: a systematic review of different sectors of Pakistan. Revista Argentina de Clínica Psicológica, 29(4), p.705.

28 2018. Poverty & Equity Brief. [online] World Bank. Available at: https://databankfiles.worldbank.org/data/download/poverty/33EF03BB-9722-4AE2-ABC7-AA2972D68AFE/Global_POVEQ_PAK.pdf

outskirts of large cities, which is not included in official statistics and creates the "hidden" portion of the equation. **As a result, slums and informal settlements, also known as "katchi abadi," have grown, contributing to urban poverty and inequality**[29]. The expansion is horizontal via urban sprawls, and is mostly unregulated by the authorities and hence, the urbanization goes unchecked[30].

Currently, the country has a housing backlog of around 9 million units, and the housing conditions that are currently in place are marked by crowding, bad sewage systems, pollution, and shoddy building construction that provides neither security of tenancy nor protection from extreme weather. Pakistan does have a National Housing Policy (2001) and Ministry of Housing and Works is responsible for its implementation[31]. Although owner-occupied housing still makes up most urban households, this percentage is slowly declining. 72% of urban households in 2018–19 is owner-occupied, compared to 21% who are renters, 5% who are rent-free, and only 2% who are renters receive subsidies[32]. Though, overall housing conditions across the nation have improved, there is still a big supply-and-demand disparity. According to estimates, Pakistan needs 350,000 new urban housing units per year. Furthermore, inequitable housing layouts exist. According to the latest Demographic and Health Survey's study, just 29.5% of housing in large cities are adequate, compared to 10.6% in small cities[33].

The building industry accounts for roughly 30% of all energy consumption, and yearly growth in this sector is 2.5% for commercial structures and 4.7% for residential buildings[34]. In Pakistan, where the average annual energy usage per person is roughly 475 KWh, heating, and cooling of houses accounts for 60-80% of the country's overall energy costs. In many buildings in Pakistan's northern regions, 60–70% of the energy used for operation is lost via the walls and roof [35]. A thorough analysis of Pakistan's building stock would show that most of the **country's structures were not created with the local climate in mind. Buildings frequently utilize glass and concrete, yet they lack the necessary thermal comfort.** Many of the structures frequently use cooling equipment. Most of the actions required to make cities more climate-change resilient fall under the purview of their governments. However, danger and susceptibility are frequently disproportionately concentrated in these **informal settlements, many of which are on floodplains next to rivers or on steep slopes,** in cities with infrastructure deficiencies and a sizeable portion of their people living there. These are areas where local governments have not provided resilient infrastructure and services aimed at decreasing risk

Urban Policies, development plans and social protection

29 Arshad, S., Ahmad, S.R., Abbas, S., Asharf, A., Siddiqui, N.A. and ul Islam, Z., 2022. Quantifying the contribution of diminishing green spaces and urban sprawl to urban heat island effect in a rapidly urbanizing metropolitan city of Pakistan. Land Use Policy, 113, p.105874.

30 Mustafa, M., 2019. The informal settlements of lahore: Understanding the role of informal katchi abadi in the context of affordable housing. Department of Architecture & Planning, NED University of Engineering & Technology, City Campus Maulana Din Muhammad Wafai Road, Karachi, p.38.

31 Munir, F., Ahmad, S., Ullah, S. and Wang, Y.P., 2022. Understanding housing inequalities in urban Pakistan: An intersectionality perspective of ethnicity, income and education. Journal of Race, Ethnicity and the City, 3(1), pp.1-22.

32 Hasan, A. and Arif, H., 2018. Pakistan: the causes and repercussions of the housing crisis.

33 Mielke, K. and Cermeño, H., 2021. Mitigating pro-poor housing failures: Access theory and the politics of urban governance.

34 Ansari, S., Memon, R.A. and Memonb, A.G., 2020. Comparison of Cooling Energy for Different Insulation Materials of an Office Building in Hyderabad Pakistan. International Journal of Electrical Engineering & Emerging Technology, 3(1).

35 Rizwan, M., Determination of Optimum Insulation Thickness for Different Cities of Pakistan. World, 16, p.10.

Box 1 Migration-As-Adaptation in Pakistan

Considering the changes in climate currently underway and the poverty situation, rural populations of Pakistan, particularly small farmers, and landless households, need to diversify their sources of income to reduce their vulnerability. Internal migration, which consists of permanent, semi-permanent, and temporary/seasonal migration flows, is overall more important in South Asia including Pakistan. Migration is being adopted as an adaptation strategy of households to diversify their sources of income to reduce both environmental and nonenvironmental risks including the severity of climate change impacts.

A report identifies that about two thirds (61%) of internal economic migrants moved from rural areas to urban centres in 2018, more pronounced around across agroecological zones in Wet Mountains, Western Dry Mountains, and the Southern and KP Northern Irrigated Plains than in other zones. While the migration is mainly attributed to diversify household sources of income, enhance livelihood security, and reduce risks at the place of origin, but also majorly caused due to the risks related to climate change with the occurrence of floods or drought.

Although on the surface urban areas appear to be better off and are still attracting migration from rural areas, they too are affected by climate patterns and additional risks because of their locations; for example, Karachi, on the coast of the Arabian Sea, faces an increasing risk of sea level rise and cyclones, while Gilgit is in a region at risk of flooding from the melting of glaciers. These risks add to existing challenges associated with the greater inequalities in urban living, ranging from the high-end to the squatter settlements and slums in many of the large cities across the world, including Pakistan. These findings also underscore how urbanization throughout the country, though waning in some areas, continues to be rapid in some of the more climatically and economically fragile zones. This reflects a strong base for assessing vulnerabilities to climate patterns across different agroecological zones and the urban cities, pointing stark economic inequalities.

Hence, a disaggregated approach both by agroclimatic zones and urban and rural divisions for the Disaster Management Authorities is required and to be included in the National Climate Change Policies. These policies and programmemes must also adopt differentiated and tailored approaches for the populations when planning infrastructural changes and warning systems to address the major associations between climate change, urban growth and population, and economic challenges.

Source: Sathar Z.A. and K. Khan (eds). 2019. Climate, Population, and Vulnerability in Pakistan: Exploring Evidence of Linkages for Adaptation. Islamabad: Population Council.

For climate resilience urban planning, different plans and policies have been proposed, such as a Resettlement Policy Framework has been designed under "Karachi Neighborhood Improvement" project in 2017. This policy framework also covers the Environmental and Social Management Framework (ESMF) for achieving environmental sustainability in urban planning and development[36] In 2019, Asian Development Bank and Asian Infrastructure Investment Bank (AIIB) funded and launched Khyber Pakhtunkhwa Cities Improvement Project (KPCIP) worth $585 million in various cities of KPK Province including Peshawar as well. Major infrastructure projects including green spaces, solid waste management and water supply and sanitation in the KPK region are covered in this project. Improvement of water supply system, provision of Integrated Solid Waste Management System (ISWM), better sewerage systems with the installation of STPs and creation of urban green areas are the major components of this KPCIP project (Asian Development Bank, 2019). Despite these various schemes, urban poor are still not being integrated and catered.

In the housing and construction sector, the national Energy Conservation Center (ENERCON), now known as National Energy Efficiency and Conservation Authority (NEECA), developed the Building Energy Code of Pakistan in 1990. The code establishes minimum performance requirements for structures' lighting, heating, ventilation, and air-conditioning systems, windows, and other openings (HVAC). The ASHRAE standard 90.1 was incorporated as part of this code[37]. Specific standards and guidelines for passive design are defined for each climatic zone of Pakistan, including solar coefficient, thermal conductance, and others. The Building Code of Pakistan (BCP) was updated in 2008 by the Pakistan Engineering Council (PEC) which is the implementation unit for the code, although it did not contain any guidelines for multifamily buildings with three storeys or fewer above ground. The BCP focusses on commercial buildings and does not follow the guidelines of ASHRAE standard 90.2. The Building Code of Pakistan (Energy Provisions) was created in 2011. These energy-related clauses were officially adopted into Pakistan's building code in 2013 [38]. Recently, the BCP has been updated again and revised by the PEC which has been approved formally by the Government of Pakistan in February 2022. Interestingly, building performance and disaster resilience has been considered in the BCP this time.

No matter where in the country the building is located, the internal design temperatures specified in the Building Energy Code of Pakistan (BECP) are 21°C in the summer and 26°C in the winter. These restrictions are not less than 25°C in the summer and not more than 22°C in the winter for a building with HVAC system, according to Pakistan's Building Code (Energy Provisions-2011). Pakistan Green Building Council (PGBC), an organization that actively promotes green building development, was founded with the goals of enhancing environmental performance, increasing advantages to human

36 2017. Resettlement Policy Framework Karachi. [online] Karachi: Planning and Development Government of Sindh. Available at: https://urbandirectorate.gos.pk/wp-content/uploads/2021/03/7-Resettlement-Policy-Framework-English.pdf

37 Mahar, W.A., Anwar, N.U.R. and Attia, S., 2019, July. Building energy efficiency policies and practices in Pakistan: A literature review. In AIP Conference Proceedings (Vol. 2119, No. 1, p. 020005). AIP Publishing LLC.

38 Waseem, M., Lai, C.G. and Spacone, E., 2018. Seismic hazard assessment of northern Pakistan. Natural Hazards, 90(2), pp.563-600.

health, and developing building infrastructure to enable sustainability at all levels[39]. However, it lacks capacity and support in terms of finance to integrate green building infrastructure countrywide. Furthermore, most of the housing for urban poor lack basic building code requirements. The cost of the house is lower in areas lacking basic facilities and most of the urban poor reside in such areas. Hence, housing in these areas lack basic insulation systems and even the building material used is of very poor quality. These societies for urban poor are mostly not even regularized.

Despite these measures and policies, compliance to the building codes still lacks in urban infrastructure of the country. There are so many unregulated and illegal buildings which have been developed by encroaching on public land. Moreover, high-rise buildings are being constructed along the seismic zones without any disaster risk strategy. Also, many buildings and structures lack emergency exit and fire safety plans. There is lack of enforcement mechanism regarding the urban infrastructure development in the country.

The case of katchi abadi in Islamabad

In 2013, it was revealed that nearly 80,000 people live in squalor in the 20 unauthorized slums of the federal capital. Residents of these slums struggle with health challenges in addition to water and electricity problems. In the early 80s, the Capital Development Authority (CDA) decided to convert these slum areas into model villages to provide them with basic facilities which are being provided to the residents living in the urban developed centres, however only one or two areas were converted due to vested interests of people.

Almost 38% of homes are made of non-concrete material in these slums. 73% of slums and underserved communities lack access to government water supplies, according to an assessment of water and sanitation conditions. According to the research, 75% of the regions don't have any drains, have unclean or clogged drains, or both. Government waste pickup services are not available in 75% of the slums and underdeveloped areas. Slums and other underserved regions make up 32% of the population. CSOs (civil society organizations) are absent from 71% of slums and neglected regions[1]. In 2015, the CDA removed 10% of the slums from Islamabad. Initially, the slum dwellers were asked to vacate by the CDA and were also offered plots which were allocated to the dwellers by the CDA. However, since they have been living there for decades, they resisted. Later petitions were filed with the Islamabad High Court who ordered and provided a stay order on the demolition of the slum areas.

1 Samuel, P. and Nisar, S.M., 2021. Stuck in Slums: A Case Study of Slums in Islamabad, Pakistan. Eur. Sci. J. ESJ, 17, p.56.

In Pakistan's urban slums, women face significant challenges related to health, hygiene, education, and social security. According to a study by UN Women, women in these areas have

39 Azeem, S., Naeem, M.A. and Waheed, A., 2020. Adoption of green building practices in Pakistan: barriers and measures. In Green Building in Developing Countries (pp. 199-215). Springer, Cham.

limited access to basic health services and are often unable to afford the cost of healthcare . Poor hygiene practices in these areas can further impact women's health, increasing the risk of infectious diseases. Access to education is also limited for women and children in urban slums. A study by UNICEF found that girls in urban slums were more likely to be out of school compared to boys, highlighting the gender inequalities that persist in these areas . Limited access to education can have long-term consequences for women's economic empowerment and their ability to support their families. Social security is another critical issue for women in urban slums of Pakistan. According to a report by the International Labour Organization, women in Pakistan are less likely to have access to social protection programes, leaving them vulnerable to economic shocks and other crises . The lack of social security programes in these areas can perpetuate poverty and further exacerbate gender inequalities.

In conclusion, the challenges faced by women in Pakistan's urban slums related to health, hygiene, education, and social security, highlight the need for targeted interventions to address gender disparities and improve the quality of life for women and their families in these areas.

Institutional and governance capacity challenges:

In Pakistan's urban slums, women face significant challenges related to health, hygiene, education, and social security. According to a study by UN Women, women in these areas have limited access to basic health services and are often unable to afford the cost of healthcare. Poor hygiene practices in these areas can further impact women's health, increasing the risk of infectious diseases. Access to education is also limited for women and children in urban slums. A study by UNICEF found that girls in urban slums were more likely to be out of school compared to boys, highlighting the gender inequalities that persist in these areas[40]. Limited access to education can have long-term consequences for women's economic empowerment and their ability to support their families. Social security is another critical issue for women in urban slums of Pakistan. According to a report by the International Labour Organization, women in Pakistan are less likely to have access to social protection programes, leaving them vulnerable to economic shocks and other crises[41]. The lack of social security programes in these areas can perpetuate poverty and further exacerbate gender inequalities.

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40 UN Women. (2018). Gender and urban poverty in Pakistan: A study of women's experiences of poverty in urban slums of Karachi. Retrieved from https://asiapacific.unwomen.org/en/digital-library/publications/2018/03/gender-and-urban-poverty-in-pakistan-a-study-of-womens-experiences-of-poverty-in-urban-slums-of-karachi

41 ILO. (2018). Social Protection for Women Workers in Pakistan. Retrieved from https://www.ilo.org/wcmsp5/groups/public/---asia/---ro-bangkok/---ilo-islamabad/documents/publication/wcms_644746.pdf

Institutional and governance capacity challenges:

None of these issues, neither institutional structures nor statutory or regulatory protections, are considered while managing cities in Pakistan. While the national and regional level issues receive zero attention, a variety of entities with overlapping roles manage local development. Only local level plans were created even though the second five-year plan (1960–1965) called for a process of planned development at the national, regional, and local levels that would create a system of hierarchical growth in the nation[42]. Moreover, in Pakistan, city master planning is almost non-existent. In fact, Islamabad and Gwadar are the only cities in Pakistan with an updated master plan. Though the previous government planned on introducing the master plans for eight major cities with a focus on vertical expansion and improving green cover, due to many factors including the economic and political instabilities, it could not be materialized. There exists no uniform urban planning policy in the country at the national level, though a few rules and acts have been established. Local planning organizations in Pakistan struggle with unplanned urbanization. Beginning in the early 1960s, development plans were created for Pakistan's largest cities, but they were unsuccessful in integrating the resilience perspective in urban planning. Urban development and housing policies are coordinated at the federal level by the Federal Ministry of Housing and Works' division of environment and urban affairs. Town planning and housing have been created as ministerial roles in all the four provinces' governmental frameworks, but with distinct names. There are just local level institutions, but they are not in coordination with one another. The current urban infrastructure in Pakistan cannot keep up with the rising needs of urbanization.

The Case of Islamabad Master Plan

Urban growth in Islamabad has been unsustainable in many respects because it has not been connected to building resilience, to natural and human-induced disasters, a green and clean transportation system, planned expansion of industrial and economic expansions, and other factors. The city has a population of roughly 1.7 million people and occupies an area of 906 km2, according to the 2017 census. The population density is 1876 people per km as a result. Between 1979 and 2019, the built-up area significantly grew, rising from 97.2 km2 (10%) to 474.8 km2 (52.4%), demonstrating a trend that is very unsustainable due to new housing societies and unlawful settlements.

When the capital of Pakistan was shifted from Karachi in the early 60s, the then government decided to develop a new model capital in Islamabad. The master planning task was assigned to a Greek architectural firm, Doxiadis Associates. At that time, the total population of Islamabad was only 45,400 person[43].

The Islamabad Metropolitan Area was designed in a grid-iron pattern, divided into sectors, and

42 Hameed, R. and Nadeem, O., 2008. Challenges of implementing urban master plans: The Lahore experience. International Journal of Humanities and Social Sciences, 2(12), pp.1297-1304.

43 Kreutzmann, H., 2013. Islamabad-Living with the plan. Südasien-Chronik-South Asia Chronicle, 3, p.136.

Box 2 Urbanization and social protection programs

Pakistan's urban development policy prioritizes social protection program, which aim to help struggling households meet basic needs and improve their quality of life. Social protection program includes social safety nets and social security program and help vulnerable populations by protecting them from income shocks and supporting essential expenses. These kinds of program also increase citizen empowerment and participation in decision-making and income-generating activities. Social security systems are typically for formal economy workers and include social assistance and insurance policies. As a result, it is a part of social protection, whereas safety nets are often temporary emergency measures that are put in place to prevent individuals from slipping below a certain level of living. The social protection program can be categorized as per the following basis:

- Social Security/ Social Insurance
- Social Assistance
- Labour Market Program
- Microfinance/ Microinsurance

The government has launched the following social protection program to support the underprivileged in the country which are the greatest social security and safety net program ever introduced in the country's history.

Benazir Income Support Program

The Benazir Income Assistance Program (BISP) launched in July 2008 is an unconditional federal poverty alleviation program in Pakistan and is the single largest social security program in the country. In 2016, $90 billion (USD 900 million) was distributed to 5.4 million beneficiaries. The UK Department for International Development is the largest foreign supporter of the program, contributing $244 million (or 27%) of total funding in 2016 to Pakistan, with the rest provided by the provinces. Eligible families initially received a quarterly cash payment of PKR 4834 . This amount increased the purchasing power of a family with a monthly income of approximately PKR 5,000 by 20% later.

Ehsaas Program

The BISP program was renamed as Ehsaas by the government of Pakistan in 2018 with the aim to empower the underclass, reduce inequality, invest in the masses and empower the underdeveloped parts of the country. A separate ministry was set up under the Poverty Alleviation and Social Security Department to support the program. In 2021, Ehsaas program had two main pillars, namely, Ehsaas Emergency Cash (introduced during the COVID-19 pandemic) and the Ehsaas Kafalat. The latter program expanded the population coverage from 7 to 10 million in 2021. In 2022, the program has again been named as BISP.

Source: Benazir Income Support Program, Available at: https://bisp.gov.pk

Urban cities resilience in Pakistan: Development and challenges

Urban heat island effect: Heat resilient cities

Due to global warming, urban centres are already under heat temperature stress in Pakistan. Rapid urbanization has drastically reduced the urban green cover in Pakistan[45]. The phenomenon of Urban Heat Island (UHI) is prevalent in many cities of the country. The federal capital Islamabad is the most recent example where temperature used to be low in comparison to other low-lying areas, including Rawalpindi. However, now the temperature difference is hardly observed because the city experiences UHI due to rapid urbanization. The government is trying to improve the green spaces and control deforestation and urban sprawl. While global warming has exacerbated the UHI effect in the country, surface energy may vary when one land use type is converted to another, such as when green space is converted to impermeable surface or when bare land is converted to a built-up area. A local climate that is subjected to such fast shifts is significantly altered, with effects on air and land temperatures. Urban heat island is one of the main themes in urban climate research and is regarded as the phenomena that has been most thoroughly studied in terms of climate change. Due to UHI, the temperature of urban areas rises in comparison to its surroundings. Also, transportation, industrial emissions and loss of green cover are contributing factors for the UHI[46].

However, the unsustainable growth patterns of urbanization and clearing of green cover to develop housing societies have also led to the UHI in many cities including Islamabad, Karachi, Lahore, etc (Figure 11). For the last few years, each year is designated as the hottest year and Pakistan has been experiencing heat waves in different cities. These heat waves have induced migration from rural to urban areas because of water scarcity and food insecurity[47]. The urban centres are not being developed based on the climate resilience perspective. Because of the heat waves, more insulation is required for the infrastructure. However, since the building envelope lacks required insulation, heating, and cooling systems such as AC and inverters are being widely used in urban areas. These require intensive energy consumption and increase the energy cost for the residents.

Previous governments did develop and promote green spaces through the parks and horticultural authorities. However, if the urban poor are considered, their living conditions vary – they do not have insulation or access to climate-smart housing. Also, as most of the urban poor population is concentrated within the slums where regulated services do not exist, hence they lack access to these basic facilities. In the slums of Karachi, people do not have access to even drinking water and sanitation.

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45 Jabbar, M. and Yusoff, M.M., 2022. Assessing The Spatiotemporal Urban Green Cover Changes and Their Impact on Land Surface Temperature and Urban Heat Island in Lahore (Pakistan). GEOGRAPHY, ENVIRONMENT, SUSTAINABILITY, 15(1), pp.130-140.

46 Sadiq Khan, M., Ullah, S., Sun, T., Rehman, A.U. and Chen, L., 2020. Land-use/land-cover changes and its contribution to urban heat Island: A case study of Islamabad, Pakistan. Sustainability, 12(9), p.3861.

47 Arshad, S., Ahmad, S.R., Abbas, S., Asharf, A., Siddiqui, N.A. and ul Islam, Z., 2022. Quantifying the contribution of diminishing green spaces and urban sprawl to urban heat island effect in a rapidly urbanizing metropolitan city of Pakistan. Land Use Policy, 113, p.105874.

The Parks and Horticultural Authorities (PHA)

The Punjab government has established the Parks and Horticultural Authorities in different cities of Punjab with the aim to improve the green cover in the urban areas. These authorities are regulated by the city administrations. The PHA Rawalpindi has established vertical plantation along the Metro Bus station pillars in the city. While the PHA Lahore has established a Miyawaki forest in the urban centre of Lahore[48]. Also, the PHA Lahore is carrying out a project to convert the railway lands along the tracks into beautiful garden and green spaces.

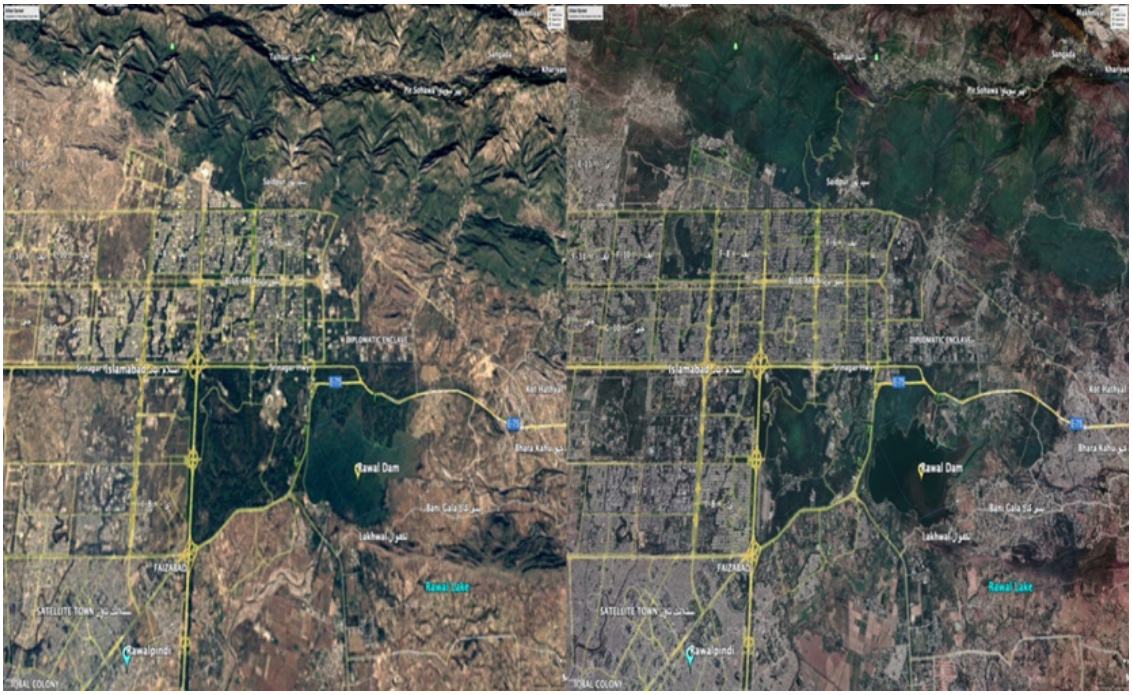

Figure 11: Urbanization trend of Islamabad.

This map is not to scale. It is for reference purposes only. It is not a legal document.

First satellite image (on the left) represents the development in 1985. Barren land was available and built infrastructure was low. Green cover was also less. The second image represents urbanization trend in 2022. Though green cover has increased along the national park due to the plantation campaigns. However, urbanization has spread vertically. The barren land has been covered with grey infrastructure.

Water scarcity

Due to rising temperatures and specifically the urban heat island effects, water scarcity has become a major prevalent issue in many metropolitan areas of the country. Access to safe and clean drinking water has become almost non-existent. On the list of top ten countries without access to clean drinking water, Pakistan stands at number nine. In Pakistan, out of population of 220 million, 21 million people lacked access to clean water, as per the report by Water Aid in 2018[49].

48 Shoaib, A., Nadeem, K., Islam, H.S. and Saleemi, A., 2021. Assessing spatial distribution and residents satisfaction for urban green spaces in Lahore city, Pakistan. GeoJournal, pp.1-16.

49 Akram, N., 2020. Consumption of safe drinking water in Pakistan: its dimensions and determinants. Drinking Water Engineering and Science, 13(2), pp.43-50.

Almost 20 to 30% of hospital cases and almost 60% of infant fatalities are caused by water-borne diseases. According to estimates, 230,000 children in Pakistan die from water-borne illnesses each year[50]. Although clean water is available in many urban areas of Pakistan, public health authorities frequently ignore peri-urban areas, where water supply and quality are unknown[51]. Pakistan was declared a water stressed country in 2000 and it is projected to become a water scarce country by 2025. It has also been estimated that by 2025, the country's water consumption, which is anticipated to rise by 10% yearly, will reach 338 billion cubic metres[52]. The recent analysis by the Pakistan Council of Research on Water Resources (PCRWR) shows that safe water quality is improving slowly, by just 7% between 2015 and 2020. As a result, Pakistan appears to have significant difficulty in providing 100% of the people with access to clean drinking water by 2030[53]. In the federal capital, the municipal administration of Islamabad extensively subsidies the city's water supply, and residents are only required to pay USD 2.25 to 5.5 per household per month, depending on the size of their home. For the city's middle class and working-class population, these subsidized water rates significantly reduce the cost of water. However, the water table in Islamabad has declined from 12 m in 1986 to 35 m in 2015, and further 11 m decline is predicted by 2025. Groundwater recharging is hampered when impermeable built-up regions replace vegetation and arid terrain due to extraordinary urban growth.

Health and sanitation

Lack of access to clean drinking water and adequate sanitation in Pakistan appears to be a barrier to the development of the public health sector, as well as to economic growth and the preservation of ecosystem health. Pakistan is recognized as one of the most disease-affected countries in the world. Every year new diseases arise, and no measures are taken. Urban areas are more polluted, generally less impactful on the environment, and many diseases are transmitted on an almost daily basis. There are health facilities in such areas, but few in rural areas, but the disease is occurring in both areas. Urban areas consist of many health institutions such as private hospitals and government hospitals. The delivery of healthcare, its administration throughout the nation, and the execution of national policy are primarily the provinces' responsibilities. Pakistan's primary healthcare system is split between the public and private sectors. Primary, secondary, and tertiary level outreach health facilities are offered by the public sector. Initially, basic health units (BHU) are responsible for providing primary healthcare services in urban areas[54]. The rest of the population is served by tertiary healthcare institutions that are associated with teaching hospitals in metropolitan areas, while district and tehsil headquarters provide secondary healthcare services.

50 Rehman, S.U. and Baig, S., 2017. Water Consumption Patterns and Waterborne Diseases in Slums of Karachi. Academic Journal of Interdisciplinary Studies, 6(1), p.37.

51 Zafar, R., Ali, A., Hassan, S. and Mushtaq, K., 2020. Household Perceptions about Drinking Water Quality and Human Health: A Comparative Analysis of Urban and Rural Areas in Pakistan. NICE Research Journal, 13(4), pp.108-126.

52 Mustafa, D., Akhter, M. and Nasrallah, N., 2013. Understanding Pakistan's water-security nexus. Washington, DC: United States Institute of Peace.

53 2022. [online] Available at: <https://pcrwr.gov.pk/wp-content/uploads/2021/10/Drinking-Water-Quality-in-Pakistan-2021.pdf> [Accessed 18 September 2022].

54 Akber, S. and Hamid, S., 2020. Public health and health system reforms in Pakistan; a view through ethical lens. Journal of Ayub Medical College Abbottabad, 32(1), pp.147-151.

It is mostly in the slum areas that - due to financially deplorable conditions - high death rates, increasing crime rates, health hazards and mental illness, increase in alcohol and drug addiction and increase in pollution, are reported more often. The condition of prenatal and postnatal care delivery is also quite dismal in slums in Sindh and Balochistan. Majority of the women in slums are illiterate and or have very low levels of education and are not engaged in any livelihood activities.

However, it is up to the federal government to plan and create national policy, conduct research, provide training, and look for foreign assistance. While the private sector only accounts for 25% of total healthcare spending, the public sector accounts for around 75% of it overall (Figure 12). There are a few reasons for an increasing rate of health issues in urban areas of Pakistan[55]:

1. The first reason for this trend is the pollution in cities that spread due to industrial waste, the garbage that is thrown on streets and the contaminated water.
2. Lack of awareness regarding disease management and prevention.
3. Unhygienic conditions of public health institutions where many patients instead of getting treated contract many other diseases.
4. Poverty, because private hospitals, where proper treatment is available, are very expensive, and hence inaccessible to the poor, who make up majority of the population in the country.
5. Corrupt practices by administrative authorities in public sector hospitals.

According to the 2018–19 Economic Survey, there are 1279 hospitals overall in the nation, with a doctor–patient ratio of 1:1300, above the WHO–recommended level of 1:1000[56]. Only 0.4% of the GDP is spent on health financing. Nearly 78% of the general population, however, pays for their own medical care[57]. Curative programes, which are those offered at the secondary and tertiary levels of treatment, account for 80% of healthcare expenditure[58]. Although the healthcare systems in urban areas are noticeably better due to higher literacy rates and greater health awareness among the urban populations, this improvement is primarily attributable to the availability of private healthcare, which provides three-quarters of services at a significant out-of-pocket cost to the public and is therefore out of the reach of the majority of Pakistani citizens.

55 Yousaf, A., Khan, F.M.A., Hasan, M.M., Ullah, I. and Bardhan, M., 2021. Dengue, measles, and COVID-19: a threefold challenge to public health security in Pakistan. Ethics, Medicine, and Public Health, 19, p.100704.

56 Ministry of Finance. Government of Pakistan, (n.d.). http://www.finance.gov.pk/survey_1819.html

57 Khan, S.A., 2019. Situation analysis of healthcare system of Pakistan: post 18 amendments. Healthcare Current Reviews, 7(3), p.244.

58 Hussain, W., 2019. Healthcare Quality Management System in Pakistan. The International Journal of Frontier Sciences, 3(2), pp.74-77.

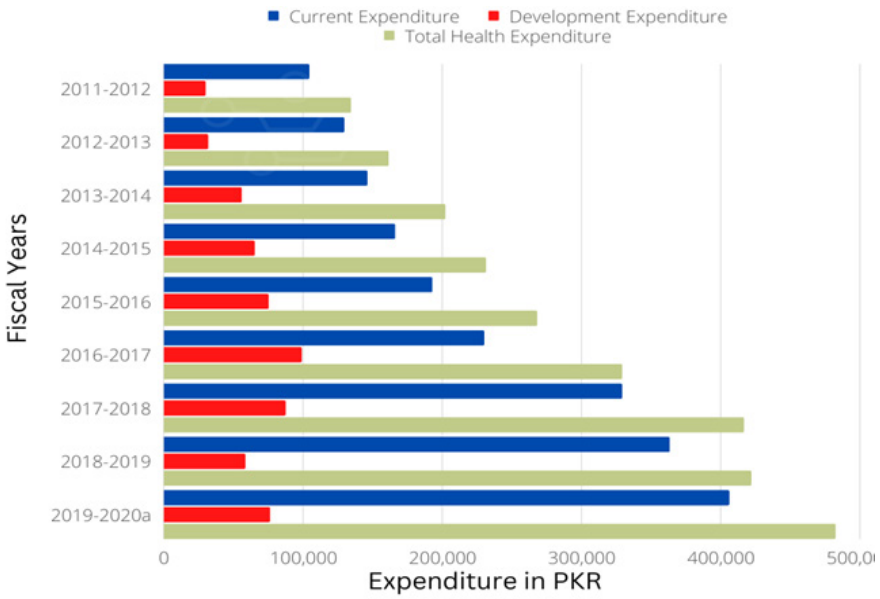

Figure 12: Health Expenditure by the Government of Pakistan over the years.

Air quality

Air pollution in urban areas of Pakistan is a serious health concern, with outdoor air pollution causing a significant increase in premature mortality and morbidity. According to the World Health Organization (WHO), in 2016, outdoor air pollution caused 163,432 disability-adjusted life years (DALYs) and 22,000 premature adult deaths in Pakistan. Southern Punjab and northern Sindh are the most polluted regions of the country, where residents could live longer by more than five years if particulate pollution were permanently reduced to meet WHO recommendations[59].

The primary source of carbon dioxide in cities is the combustion of fossil fuels in vehicles, ships, construction equipment, diesel trucks, heating furnaces, and power plants (stationary sources)[60]. While cooking fires still play a part in many developing nations, a range of industrial processes including steel mills and cement kilns can also considerably contribute to air pollution. Due to variations in geography, climate, and emission sources, this mixture's precise composition varies depending on the area [61].

As determined by the Pakistan Environmental Protection Agency (Pak-EPA), this figure exceeds both the WHO Interim Target-1 (mean annual PM2.5 35 µg/m3) and Pakistan's National Environmental Quality Standards (Pak-NEQS, i.e., 15 µg/m3 annual mean) for ambient air[62].

59 Sarfraz, Z., 2020. The social and economic burden of smog in Pakistan. Pakistan Journal of Surgery and Medicine, 1(1), pp.5-7.

60 Anjum, M.S., Ali, S.M., Subhani, M.A., Anwar, M.N., Nizami, A.S., Ashraf, U. and Khokhar, M.F., 2021. An emerged challenge of air pollution and ever-increasing particulate matter in Pakistan; a critical review. Journal of Hazardous Materials, 402, p.123943.

61 Khwaja, M.A. and Khan, S.R., 2005. Air pollution: key environmental issues in Pakistan. Sustainable Development Policy Institute.

62 Anwar, M.N., Shabbir, M., Tahir, E., Iftikhar, M., Saif, H., Tahir, A., Murtaza, M.A., Khokhar, M.F., Rehan, M., Aghbashlo, M. and Tabatabaei, M., 2021. Emerging challenges of air pollution and particulate matter in China, India, and Pakistan and mitigating solutions. Journal of Hazardous Materials, 416, p.125851.

Box 3 Smog Policy 2017

In 2017, due to the worsening conditions of public health in Lahore, the Lahore High Court ordered the Punjab Government to develop a smog policy. Following the order, in 2018, a smog commission was formulated to investigate the causes of smog in the province. As per the policy, Air Quality Monitoring Stations were installed in the affected cities. The Environment Protection Department was made responsible for implementing the policy in the province. Moreover, under the policy, brick kilns were identified as one of the primary contributors to the air pollution and smog. Hence, conventional brick kilns were banned and instead zig zag technology was introduced to reduce the emission. The district administration in Punjab regulated the transition to zig zag technology. Furthermore, apart from the federal and provincial ministry and departments, the private sector has also initiated air quality monitoring programes. Pakistan Air Quality Initiative (PAQI) and the US embassy have also installed their monitors in different areas to provide real time air quality data including the PM2.5.

The increase in particulate pollution has led to several health issues, particularly in those with cardiovascular and respiratory conditions. To address this issue, the Pakistani government has implemented various measures, such as the National Clean Air Programme (NCAP), to improve air quality in urban areas[63]. However, despite these efforts, air quality in urban areas of Pakistan remains a significant challenge due to a lack of political will, inadequate resources, and a lack of public awareness. The mean annual value of PM2.5 concentrations in Pakistan from 2003 to 2020 was 54.7 µg/m3, well above the WHO's recommended limit[64]. Therefore, there is a need for the government to prioritize air pollution as a public health issue and take immediate action to improve air quality in urban areas.

The urban poor, despite their negligible contribution to air pollution, suffer more from its impacts. The reason in particular is, because they reside mostly in hotspots of air pollution, have low resistance due to bad nutrition, and lack access to healthcare facilities too. Furthermore, due to poor housing infrastructure, their vulnerabilities are enhanced.

In terms of public health, poor quality is one of the major factors which contributes to health deterioration in the country. The typical Pakistani's life expectancy is reduced by 4.3 years due to air pollution compared to what it would have been if the World Health Organization (WHO) recommendation had been followed. The average life expectancy in Pakistan is substantially lower than in some regions, where the worst air pollution reduces it by over 7 years.[65]

63 National Clear Air Programme (2020). National Clear Air Programme. Retrieved from https://ncap.gov.pk/

64 World Health Organization (2016). Ambient Air Pollution: A Global Assessment of Exposure and Burden of Disease. Retrieved from https://www.who.int/publications/i/item/9789241511353

65 Raza, W., Saeed, S., Saulat, H., Gul, H., Sarfraz, M., Sonne, C., Sohn, Z.H., Brown, R.J. and Kim, K.H., 2021. A review on the deteriorating situation of smog and its preventive measures in Pakistan. Journal of Cleaner Production, 279, p.123676.

The most serious effects of air pollution are typically an increase in premature mortality and morbidity. For those who already have cardiovascular and respiratory conditions, short-term exposure to air pollution can potentially be lethal. According to the WHO, outdoor air pollution caused 163,432 DALYs (disability-adjusted life years) and 22,000 premature adult deaths in Pakistan[66]. The amount of particulate pollution has risen over time. Southern Punjab and northern Sindh are the most polluted regions of the country, where residents would live longer by more than 5 years if particulate pollution were permanently reduced as per the WHO recommendation[67]. In Karachi, the biggest metropolis in Pakistan, people would live longer by 3.6 years. Residents of Lahore, Pakistan's second-largest metropolis, would advance by five years. The population of Islamabad's capital would gain four years. For several years, the entire population of Pakistan has been subjected to high PM2.5 concentrations, with a mean annual value of 54.7 µg/m3 over the country as a whole from 2003 to 2020 (Figure 13).

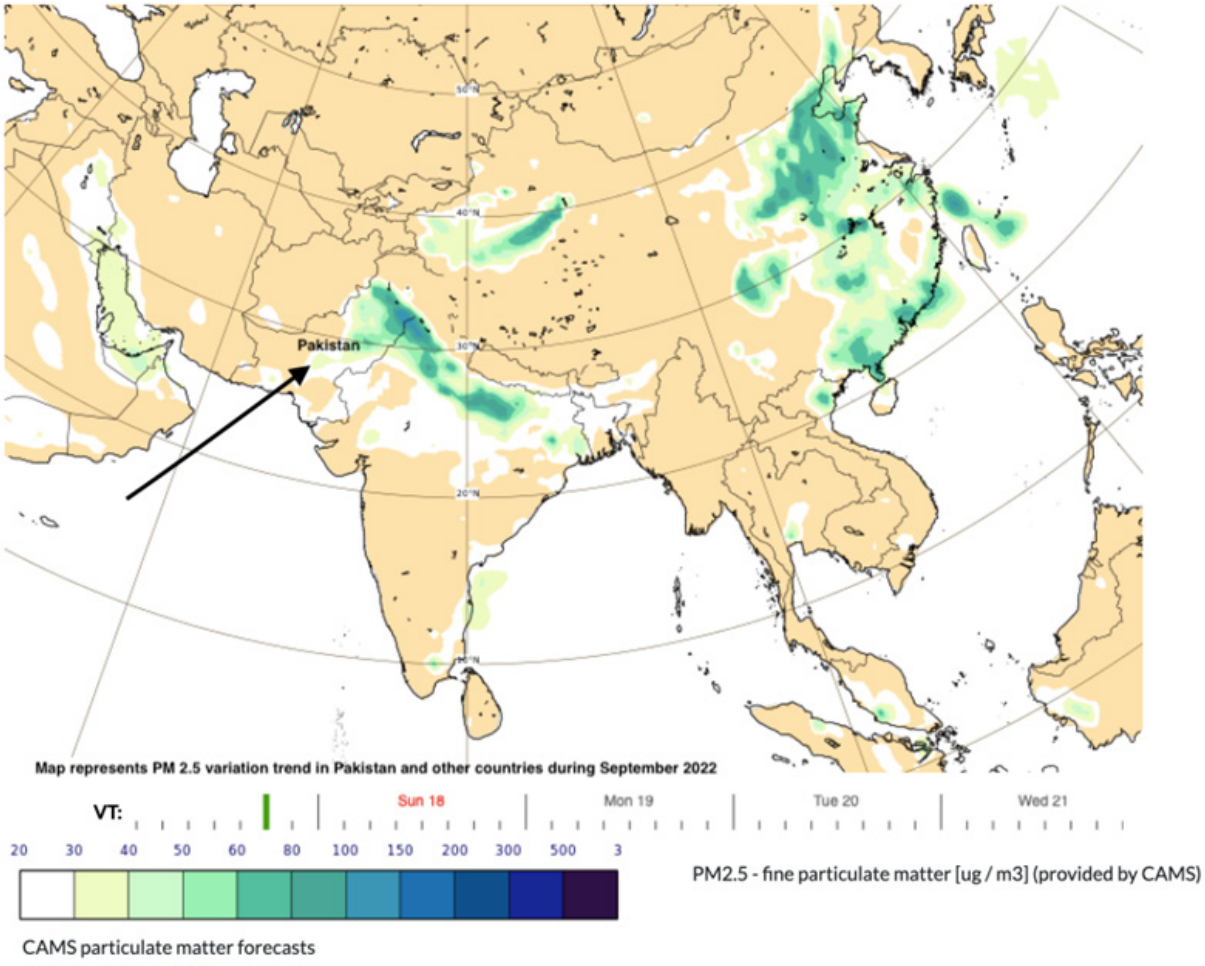

Figure 13: Map represents PM 2.5 variation trend in Pakistan during the month of September 2022 (source: Authors own derivation, retrieved from Earth Observatory by NASA). This map is not to scale. It is for reference purposes only. It is not a legal document.

66 Ashraf, M.F., Ahmad, R.U. and Tareen, H.K., 2022. Worsening situation of smog in Pakistan: A tale of three cities. Annals of Medicine and Surgery, p.103947.

67 Udaipurwala, I.H., 2022. Air Pollution and Health Hazards: A Menacing Situation in Pakistan. Journal of Bahria University Medical and Dental College, 12(02), pp.66-67.

Waste management

Pakistan generates approximately 49.6 million tonnes of solid waste annually, increasing at a rate of more than 2.4% each year[68]. Like other developing countries, Pakistan lacks solid waste management infrastructure, causing serious environmental problems. Most municipal waste is incinerated, buried in landfills, or buried in vacant lots, threatening the health and well-being of the general population. The Government of Pakistan estimates that it generates 87,000 tonnes of solid waste a week, mostly in metropolitan areas. Hospital waste in Pakistan produces around 250,000 tons of waste each year (Figure 14). Hospital waste has been inadequately dealt with and overseen by the medical clinic staff and organization individually. All major cities face major challenges in municipal solid waste management - lack of urban planning, inadequate waste disposal facilities, and low public awareness all contribute to the problem. In most major cities in Pakistan, municipalities are responsible for waste collection. About 60-70% of municipal solid waste is collected. Garbage trucks usually consist of a wheelbarrow and a donkey pull-carts for primary collection. Then open trucks, tractor/wagon systems and arm roll containers/trucks for secondary collection and transportation. Some municipalities employ street sweepers and sanitation workers to supplement other collection methods. Solid waste is collected from small piles and bins using wheelbarrows and brooms and stored in formal and informal warehouses.

Waste disposal and recycling work is generally carried out by people on the margins of society (by virtue of caste, race, ethnicity or migrant status). The technology and management of garbage disposal hardly ever considered the welfare and safety of workers, and that remains till today. The availability of skilled low-paid individuals who are willing to perform disagreeable and hazardous labour without protection is taken for granted.

The National Electric Power Regulatory Authority (NEPRA) has announced a competitive upfront rate of USD 0.10007/kWh for waste-to-energy projects with a total capacity limit of 250 MW and based on 25 years of operation[69].

68 Siddiqi, M.M., Naseer, M.N., Abdul Wahab, Y., Hamizi, N.A., Badruddin, I.A., Chowdhury, Z.Z., Akbarzadeh, O., Johan, M.R., Khan, T.Y. and Kamangar, S., 2019. Evaluation of municipal solid wastes based energy potential in urban Pakistan. Processes, 7(11), p.848.

69 Longsheng, C., Shah, S.A.A., Solangi, Y.A., Ahmad, M. and Ali, S., 2022. An integrated SWOT-multi-criteria analysis of implementing sustainable waste-to-energy in Pakistan. Renewable Energy, 195, pp.1438-1453.

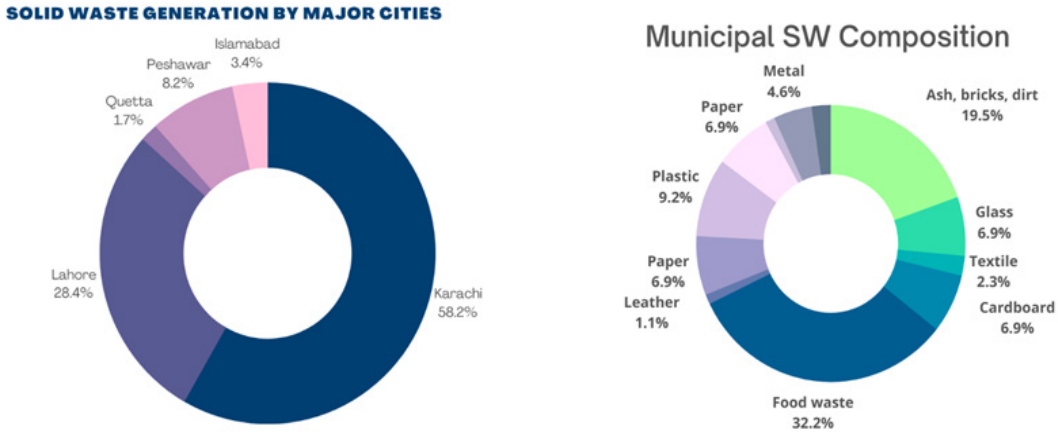

Figure 14: Solid waste generation by different cities of Pakistan, b) Municipal solid waste composition in Pakistan.

Box 4 Hazardous Waste Management Policy of Pakistan 2022

The Pakistan Hazardous Waste Management Policy 2022 was recently introduced by the Ministry of Climate Change. In order to improve the definition and application of hazardous waste management (HWM) for better environmental management, clarify institutional responsibilities related to HWM, and strengthen the management of hazardous and other wastes, this policy is intended to facilitate the implementation of international treaties and conventions on a national level. Furthermore, it will help Pakistan in improving its GSP+ status . The policy primarily has placed emphasis on the principle of 3R's (reduce, re-use and recycle). Moreover, it will ensure that SOPs are developed to monitor the import of waste in the country. Also, eco-labeling will be introduced. Since it has been recently launched, hence, its implementation status is yet to be determined.

Urban mobility

In Pakistan, roads account for more than 90% of all traffic, making them the primary means of transportation. Most Pakistan's urban transportation issues are resolved by expanding and improving the nation's highways; however, this is not the only option. Road construction must be part of a comprehensive transportation strategy that addresses issues like traffic control, expanding and improving transit, and public transportation. Road, rail, air, and sea transportation are all included in the Transport Logistics and Communications (TLC) industry.

In 2016–2017, the transport sector contributed about 13% of the country's GDP, with road transportation accounting for more than 62% of that contribution. Traffic congestion has increased dramatically over the last few years in the urban areas due to increasing urbanization. There are more vehicles on roads now. In December 2021, 6,628,063 vehicles were estimated to be registered in Pakistan. From the prior figure of 6,398,249 vehicles for December 2020, this is an increase. Traffic

congestion, travel insecurity and delays, traffic accidents, increased energy (oil/gas) consumption, increased vehicle costs, urban air pollution, and financial losses due to health issues and associated lost wages are just a few of the issues brought on by the rapid growth in motorization and vehicle dependence. Approximately 15% of Pakistan's national motor vehicle fleet is concentrated in four large cities, including Karachi, the provincial capital of Sindh. However, Karachi alone represents almost 6% of the country's automobiles. Increasing numbers of automobile owners have led to major problems of traffic congestion. To address urban transport, provincial governments have launched bus rapid transit systems.

In addition, the Pakistani government has constructed in Lahore, the Orange Line Metro Train (OLMT), the nation's first metro train-based public transportation system. The track of Orange Line spreads over a total of 27.1km (16.8mi) with 25.4km (15.8mi) elevated and 1.72km (1.1mi) underground. Moreover, the Green Line Bus Service has also been launched in Karachi to address urban transportation.

Pakistan has implemented various initiatives to improve urban transportation. These include the Metro Bus Rapid Transit System, car ride-sharing services such as Careem and Uber, and the recent National Electric Vehicle Policy. The Metro Bus system has been successful in Punjab and other major cities, while carpooling services have been initiated by the private sector. However, traffic congestion remains an issue, and cycling lanes are limited. The National Electric Vehicle Policy aims to increase industrial production, create jobs, and lessen the negative impact of pollution. Despite the infrastructure being in place, the economic situation in Pakistan has impacted the purchasing power of citizens, resulting in slow adoption of electric vehicles.

However, for now, due to rising inflation and economic meltdown in the country, the purchasing power of urban dwellers has been affected and has declined. Hence, people are not buying electric vehicles despite the set-up of required infrastructure. But in the long run, if the economic situation improves, this policy will be very fruitful for the country's transportation system.

Energy usage: Sources, supply and consumption

According to the Energy Information Administration (EIA), Pakistan's main sources of energy are biomass, gas, oil, coal, hydro, nuclear, wind, and solar (EIA, 2021). Biomass is the largest source of energy consumption, accounting for 33% of the total, followed by gas and oil at 28% and 22%, respectively. Coal and lignite contribute 12% to the energy mix, while primary electricity from hydro, nuclear, wind, and solar sources constitutes 5% of the overall energy consumption in Pakistan[70]. The electricity generated in Pakistan is primarily produced from thermal power plants, which currently account for 75% of the nation's fuel oil use. Most of these plants are set up for dual fuel operation, making the transition from fuel oil to gas quick and inexpensive. The power sector distributes electricity to residential, commercial, industrial, and agricultural sectors. The industrial sector also utilizes a significant amount of energy, with 35% of the total energy used in the textile, fertilizer, food

70 Energy Information Administration. (2021). Pakistan: Country analysis brief. Retrieved from https://www.eia.gov/international/content/analysis/countries_long/Pakistan/pakistan.pdf

processing, and other industries used in boilers. Transportation uses the third-highest amount of energy in Pakistan, and there are efforts to improve energy efficiency in this sector by maintaining engines better and adopting better engine design. Finally, households in Pakistan also consume a significant amount of energy, and there is potential for energy savings with high-efficiency appliances and building design improvements.

Background of Energy Consumption in Pakistan

In Pakistan, energy sector directly affects per capita income and GDP growth. However, it is also one of the main sources of GHG emissions[71]. As Pakistan seeks to satisfy its rising electrical demand, power generation capacity from all energy sources has expanded dramatically in recent years to fulfil the needs of the nation. The average per-person consumption of energy in the country has been increasing at a rate of 6-8% annually and is expected to rise to 9% by 2030. The overall annual electric energy consumption of 103.49 trillion kWh is the most significant factor in Pakistan's energy balance. This equates to 439 kWh on average per person[72]. Since 2014, the total consumption of the country has grown effectively (4%/year). Between 2008 and 2013, the growth was relatively gradual (1.5%/year). [73] Almost 33% of overall energy consumption comes from biomass. Gas and oil make up 28% and 22% respectively, while coal and lignite account for 12%. Primary electricity (hydro, nuclear, wind, and solar) make up 5% [74]. In the slum areas, the source of supply is usually not regulated, rather people tend to steal the electricity to save themselves from the regulation or licensing fee. Furthermore, some families also utilize biogas as a source of fuel even in slum areas. In Karachi, slum areas usually lack access to any kind of electricity, however, the situation is better in the slums of Islamabad.

Challenges and Solutions

As Pakistan seeks to address the energy demand and its environmental impact, renewable energy emerges as a promising solution for building resilient urban centers. The country's vast solar and wind potential presents an opportunity for sustainable development. The target of generating 30% of electricity from renewable sources by 2030 indicates a commitment to reducing carbon emissions and enhancing resilience. Initiatives like the net metering policy and feed-in-tariffs have encouraged private investment and contributed to the installation of over 2,000 MW of renewable energy capacity. These renewable energy projects enhance the reliability and affordability of energy supply in urban areas, thereby bolstering their resilience to disruptions and climate-related challenges. However, the transition to renewable energy is not without challenges. Developing renewable energy infrastructure

71 Mir, K.A., Park, C., Purohit, P. and Kim, S., 2020. Comparative analysis of greenhouse gas emission inventory for Pakistan: Part I energy and industrial processes and product use. *Advances in Climate Change Research*, *11*(1), pp.40-51.

72 Abbasi, K.R., Abbas, J. and Tufail, M., 2021. Revisiting electricity consumption, price, and real GDP: A modified sectoral level analysis from Pakistan. *Energy Policy*, *149*, p.112087.

73 Lin, B. and Raza, M.Y., 2021. Analysis of electricity consumption in Pakistan using index decomposition and decoupling approach. *Energy*, *214*, p.118888.

74 Wang, J., Hassan, M.S., Alharthi, M., Arshed, N., Hanif, I. and Saeed, M.I., 2022. Inspecting non-linear behavior of aggregated and disaggregated renewable and non-renewable energy consumption on GDP per capita in Pakistan. *Energy Strategy Reviews*, *39*, p.100772.

requires substantial investments and supportive policies to attract private sector participation. Additionally, issues related to grid integration, intermittency of renewable energy sources, and technical capacity need to be addressed for effective implementation. Ensuring proper enforcement of energy efficiency policies, particularly in rural areas, is crucial to achieving sustainability and resilience goals. Moreover, raising awareness and promoting energy conservation among the public is essential for the successful adoption of renewable energy and efficient energy practices. By tackling these challenges head-on, Pakistan can build a resilient and sustainable energy future for its urban centers. The strategic plan of NEECA for 2020-2023, encompassing building codes of efficiency, minimum energy performance standards (MEPS), and effective regulations for various appliances, is a step in the right direction to overcome these challenges and foster sustainable urban resilience.

5. Disaster resilience and management in Pakistan

Institutional structure and management

The disaster risk management cycle is a well-known tool for controlling catastrophe occurrences and their effects. Pakistan is located over a tectonically active zone and is also vulnerable to climate-related disasters. The disaster management (DM) system in Pakistan currently has a broad, interconnected institutional arrangement, but it lacks an effective and quick response strategy. The reason for this is that there is no efficient resource allocation (RA) method to handle a crisis situation in line with the most recent technical advancements[75]. As a result, the government response to disaster gets affected. Therefore, there would be significant loss and damage reported every time a disaster-related emergency occurred in the country[76].

The October 2005, 7.6-magnitude earthquake in Northern Pakistan proved to be a turning point in disaster management policy and planning in the country, placing the focus on a wide spectrum of both natural and human-induced threats. The creation of a National Disaster Management Authority (NDMA) and affiliated provincial administrations in 2007 was a significant milestone. The top policy- and decision-making body for disaster risk management is the National Disaster Management Commission.[77] Additionally, it regulates how disaster risk management concerns are included into sectoral development plans and how this policy is put into practice through the National Disaster Management Authority (NDMA), which is led by the Prime Minister. The NDMA was founded to serve as a focal point and coordinating organization to help expedite the execution of disaster-related mitigation methods because disaster risk is a multi-sectoral activity that requires prompt action. All parties involved, including ministries, departments, and other organizations that are likely to take part in disaster risk management, are directly communicated with. There are Provincial Disaster Management

75 Rana, I.A., Asim, M., Aslam, A.B. and Jamshed, A., 2021. Disaster management cycle and its application for flood risk reduction in urban areas of Pakistan. *Urban Climate*, *38*, p.100893.

76 Cheema, A.R., Mehmood, A. and Imran, M., 2016. Learning from the past: Analysis of disaster management structures, policies and institutions in Pakistan. *Disaster Prevention and Management*, *25*(4), pp.449-463.

77 Maqbool, A., Usmani, Z.U.A., Afzal, F. and Razia, A., 2020. Disaster mitigation in Urban Pakistan using agent based modeling with GIS. ISPRS International Journal of Geo-Information, 9(4), p.203

Authorities (PDMAs) and District Disaster Management Authorities (DDMAs). The NDMA has developed national disaster risk strategy for managing floods in the country based on the Sendai Framework for Disaster Risk Reduction (SFDRR) (2015-2030). Furthermore, heat wave action plans, flood response plans have also been developed. The NDMA has initiated many projects to build the capacity of the institution to manage disasters in the country.

Also, along with NDMA, there are line agencies that are also providing support to the main authority in terms of DRR such as the Flood Commission, Pakistan Meteorological Department, Water, and Power Development Authority, etc. Pakistan is also one of the countries in South Asia to endorse and adopt the global frameworks for DRR at the second and third World Conferences in Kobe and Sendai Japan including the Hyogo and Sendai frameworks. In 2012, Pakistan developed its National Disaster Management Plan (NDMP) based on the protocols of the Hyogo Framework of Action (HFA). However, the plan has not been updated formally as per the priority actions defined under the SFDRR which is the disaster risk agenda from 2015 to 2030[78]. Other policies and plans which support the DRR in Pakistan, including the climate change policy, have been formulated as per the guiding principles of the SFDRR which helps to mitigate climate-induced disasters. During the Glasgow event of COP26, 2021, Pakistan presented its INDCs which demonstrated effective implementation at some levels in the context of disaster management and preparedness. This included many proactive policy approaches by the Ministry of Climate Change which is again a line ministry of the NDMA. Pakistan further promised to deliver in the context of disaster resilience development and mitigation planning during the Glasgow event. However, gaps in the institutional framework, coordination mechanism, and lack of awareness and effective proactive implementation strategies have persisted in terms of mitigating vulnerabilities and improving livelihoods in the urban sectors of Pakistan.

6. Analysis: Assessing national climate policies and sectoral policies related to urbanization

Climate change is playing a critical role in reshaping and redefining urban resilience, specifically in developing and vulnerable countries like Pakistan. The rising temperature, increase in intensity of extreme hydrometeorological events is providing evidence on how resilience building needs to be integrated. For resilience building, some important elements generally considered are economy, social inclusion, environment, and governance. However, different global institutions have designed different elements to measure and map urban resilience. For example, the Rockefeller Foundation launched its first Global 100 Resilient Cities project in 2013 and continues to promote program to improve the resilience of cities. Furthermore, a rapid risk assessment tool developed by UNISDR assessed community resilience in terms of the skills needed to cope with common disasters, derived from the Sendai Framework for Disaster Risk Reduction 2015–2030. To assess the report, the following elements have been assessed in the context of urban resilience in Pakistan.

78 Khan, I., Ali, A., Waqas, T., Ullah, S., Ullah, S., Shah, A.A. and Imran, S., 2022. Investing in disaster relief and recovery: A reactive approach of disaster management in Pakistan. International Journal *of Disaster Risk Reduction*, *75*, p.102975.

Table 2: Elements of urban resilience and their assessment in context of Pakistan

Elements	Challenges and gaps	Opportunities & implementation plans
Economy	• Geopolitical scenario • Local political instability • Disasters • Debt crises • Inflation	• Service-based macroeconomic incentives • Strengthening public-private partnership • Stable and standardized macroeconomic policies for businesses and industries
Society	• Poverty • Unemployment • Over population • Public health issues • Gender Inequality	• **Social protection program like Ehsaas/ BISP** • **Panah Gah shelter homes for the homeless** • **One Health Agenda** • **Sehat Sahulat Program** • **Gender Action Plan launched by Ministry of Planning and Development (This plan addresses the need to mainstream gender protection under the climate action and finance). Since it was launched this year, it's mechanism of implementation is still under review.** • **Green job stimulus program** • **Skill-based learning program under the e-Rozgaar Program**
Environment	• Hydrometeorological disasters • Natural resource depletion • Urban sprawl causing urban heat island effects	• Disaster resilience and preparedness plan by MoCC and NDMA • Parks and horticultural authorities green cover programes • Control on illegal housing projects by the city development authorities • Promoting renewable energy for building insulation. • Rainwater harvesting projects by PCRWR. • National Climate Change Policy 2021 launched by the MoCC
Governance	• Lack of coordination among the government departments • Local governance structure non-existent in many cities.	• Participatory political approach between provincial and federal government • Establishment of anti-corruption plans and policies. • Community based disaster response plans by NDMA and MoCC

Review of sectoral policies from resilience lens

Impacts of urbanization in developing countries has been a global research agenda due to its potential impacts on deforestation, water diversions, sewerage lines, etc. Based on an urban context and the needs of urban poor, Pakistan has articulated many development plans, programes, policies, and strategies for an efficient planning process. Urban town planning was made a pre-requisite adaptation measure in National Climate Change Policy as well (Abdul and Yu 2020). National Housing Policy of Pakistan however did not discuss any interventions on the impacts of climate change. Both climate and environment did not become a part of that policy (Tariq et al. 2018).

Policy implementation, institutional gaps, and challenges

Challenges exist in reflecting environmental and climate change policy and program from the national level down to the provincial level, and across sectoral program.

- At the institutional level, Pakistan remains one of the few countries to have a dedicated ministry for climate change; in 2015 the Ministry of Climate Change was reinstated (changing from the Climate Change Division [CCD] as part of the Cabinet Secretariat), suggesting a renewed importance being placed on climate change (CC) at the highest levels of government.
- Pakistan's National Climate Change Policy, which was approved in 2012, and then updated in 2022 provides an overarching framework for addressing the challenges that Pakistan faces or will face in future due to CC. The follow-up to the NCCP was the Framework for the Implementation of the Climate Change Policy (of 2013), promotes the preparation of a National Adaptation Plan (NAP), Nationally Appropriate Mitigation Actions (NAMAs), a Second National Communication to the United Nations Framework Convention on Climate Change (UNFCCC), as well as detailed provincial and local adaptation action plans. In 2022, the Ministry for Climate change has updated the policy as National Climate Change Policy which has provided a much-detailed plan on addressing climate change crises in the country. This policy now addresses issues including the climate related financing gaps and gender-based approach.
- Climate change was firmly positioned within the 'environmental' sector, both in central and devolved administrations, and invariably allied with the well-known Pakistan Environment Protection Act (PEPA), 1997 and the now enacted PEPAs by the provinces.
- At the provincial level, after the 18th Amendment Provincial Environment Departments taking lead in dealing with the CC challenge at the provincial level. After 2010, provinces were not only expected to be able to set policy objectives and assess climate change-related expenditure priorities, but also target interventions with the most cost-effective outcomes.
- For the urban poor, who often live in informal settlements or slums with inadequate infrastructure and basic services, such as water and sanitation, the impacts of climate change can be severe. Climate-related hazards, such as floods and heatwaves, can exacerbate existing vulnerabilities and lead to loss of lives and assets. Moreover, the lack of access to reliable and affordable energy and transport services further limits their ability to cope with climate change impacts.
- However, the lack of a coherent institutional setup, policy leadership and capacity in provinces is undermining some of the locally specific benefits of devolution. Hence, mainstreaming climate change across sectors is somewhat limited and may well remain so until there is a clear and agreed mandate on post-18th Amendment roles and responsibilities across the Ministry of Climate Change, Ministry of Finance and federal line ministries.
- Federal-provincial and cross-sectoral clarity in institutional roles and responsibilities in climate change are crucial to address the challenges related to climate change. To ensure the efficient and effective use of resources, it requires a 'whole-of government' approach by including systemic and process reforms relating to climate change in all public financial management entities (most notably the Ministry of Finance [MoF] and the Ministry of Planning, Development and Reforms

[MPDR]), key delivery sectors (e.g., health and social services, education, agriculture, transport, energy, infrastructure) and all levels of government (e.g., federal, provincial, district). And the effective response must deliver across all sectors including health, social services, education, transport, energy and infrastructure, etc.

- No policy has quantified how much cost or investment would be required to implement any specific policy intervention or even a complete policy. Only cumulative values of cost requirements have been provided (that too in very few cases) for sectors while investment required for any sub-sector is completely missing. Furthermore, no assessment has been carried out on the costs of in-action, or any mention of financial losses resulting from non-compliance of a policy.

Sectoral perspective

- What is evident when going through progress made at the government level is, that Pakistan's overall climate strategies are largely focused on mitigation and conservation rather than the development of a **national eco-environmental plan** that promises long-term sustainability and economic growth.
- When analyzing the impact of climate change on various economic sectors, there exist knowledge gaps with respect to the **water** sector - specifically the response of hydrological regimes to a change in climatic conditions, particularly glaciers. In fact, monitoring of climate impacts on glaciers in the Hindu-Kush-Himalayan region is scant and needs attention. This makes it challenging to estimate the exact impact that climate change will have on water availability and resources in the country. This uncertainty extends to various other sectors, where water remains a key input.
- **Sectoral issues, such as inadequate infrastructure and services, are resulting in overcrowding, informal settlements, and poor living conditions for the urban poor. Institutional weaknesses, including fragmented governance structures, limited financing mechanisms, and weak regulatory frameworks, further exacerbate the challenges faced by these communities. Moreover, the limited capacity of local governments and the lack of awareness among the public regarding climate change risks are also impeding the development of climate resilience measures.**
- While much literature exists on the assessment of water scarcity resulting from climate change with respect to **agriculture and irrigation,** very little is available on the consequences of climate change on urban and domestic water availability, as well as municipal water supply in the country. Finally, despite its importance, groundwater remains the least regulated and researched area in the country due to a number of institutional and operational constraints. Pakistan also lacks the appropriate mechanism required to map groundwater supply.
- Pakistan faces significant challenges in the **energy sector** with one-third of the population lacking access to grid electricity. At the same time, it is the largest contributor to GHG emissions of Pakistan, and the emissions are projected to rise by 97% between 2012 and 2030. The major factors leading to the energy crises are (i) the gap between end-user and cost-recovery tariffs (ii) capacity payments and (iii) lack of transparency, etc..

- There is lack of **harmonization of efforts between federal and provincial governments for a sustainable energy portfolio.** Positively, the Government of Pakistan has approved an Alternative Renewable Energy Policy (AREP, 2019) which aims to achieve 30% solar and wind share and 30% hydro in the energy mix; moratorium on imported coal, Electric Vehicle Policy (EV 2020), and many programes and initiatives are highlighted to be the remarkable efforts in combating climate change. Unfortunately, however, the financial challenges tend to tempt the leaders to choose quick fixes for the short-term economic benefits, instead of more farsighted and sustainable policies. Likewise, the rhetoric behind coal-based energy generation in Pakistan is based on using the indigenous resources to provide energy security and cheaper electricity. In recent years, the total consumption of coal in Pakistan has increased from 6.56 million tons in 2014 to 21.3 million tons in 2019. Although the current share of coal in the energy mix is relatively low, yet the plan to add around 8.5 GW of coal, and 10 GW of LNG and gas in the next 10 years, as per the Indicative Generation Capacity Expansion Plan (IGCEP), recently approved by the Cabinet Committee on Energy (CCoE) on August 26, 2021, seems a deviation from the climate goals of the country. At the same time, coal imports of Pakistan have increased almost six times between 2013 and 2020 from less than 3 billion to almost 18 billion tons now, constituting about 2.75% of total import that is 1.4 billion US dollars each year, which in no way is economically viable. Hence, there exists a complete misaligned policy and lack of planning and coordination between the relevant stakeholders as well as among the provinces, which hinders the rapid and just transition to clean power to meet the goals of the Paris Agreement for avoiding dangerous climate change and limiting global warming to 1.5°C.
- From development as well as investors perspective, there are prominent issues with some sites which have been auctioned for hydro power. This along with challenges in RE investments, EV policy implementation gaps in terms of several policies such as looking into the **Pakistan Oil Refinery Policy 2021**, how do we see the growth of EVs and how do we see it impacting the refineries in terms of reallocating themselves or locking into long-term sales opportunities through across boarder investments.
- There is a gap in national GHG emission quantities. The studies on municipal **solid waste (MSW)** management in Pakistan and its impacts on greenhouse gas (GHG) emissions are glaringly missing.

Analysis of climate change adaptation and mitigation program

Despite a lot of praise from the international community, the environmentalists in the country and abroad are not satisfied with the TBTT Program's (2019-2023) approach. From lacking planning in identifying water availability before plantation, analyzing the capability of plant species to thrive outside their natural biome, to considering the land use for grazing and mitigating wildfires, the program lacks in its scientific justification for planting billions of trees (WeForum 2018).

With great resources and emphasis on tree plantation, Pakistan may be distracting itself from the other major requisites including reducing fossil fuels consumption and protecting the current forests. Moreover, it is dreaded that the budget allocated may either be insufficient for administrative costs or suffer losses like those identified in the program's parent initiative - the Khyber Pakhtunkhwa (KP) government's Billion Tree Tsunami (Malik 2020). The independent third-party evaluation to be conducted from 2020 to 2024 by the International Union for Conservation of Nature (IUCN), Food and Agriculture Organization, and the World Wide Fund (WWF) for Nature will be useful in identifying the gaps in planning and the achievement of the outcomes as claimed by the program (IUCN 2020). Also, the supposedly 45% of plantations in Balochistan under the Billion Tree Tsunami Program faces lack of implementation, and lack of transparency – being marked as a discriminatory planning against the province[79].

The initiative of Clean Green Pakistan Movement is a positive step towards increasing environmental awareness among the citizens and galvanizing cities in acting towards environmental protection. However, on the larger scale of climate change impacting both the urban and rural areas of the country, Pakistan would require more focus towards enhancing the environmental monitoring capacity of provincial and federal regulatory departments such as the EPAs (Blogs 2019). Collecting credible and consistent data on the current levels of environmental pollution and analyzing for trends will help to develop effective environmental management plans - ranging from air and water quality management, developing climate-resilient urban infrastructure, to investments in public transportation and waste management. Upon developing sound environmental management systems and monitoring capacity, the volunteer climate actions from citizens can then be evaluated for their effectiveness and contribution to the greater cause of climate change adaptation.

Climate Finance readiness (domestic and international) - tracking financing for mitigation and adaptation

Being an emerging economy, Pakistan is facing severe funding issues to finance environmental projects in the budget especially after the outbreak of COVID-19. One of the reasons were the economic losses for Pakistan that were reported around PKR 1.1 trillion during FY2021 (Rasheed, et al., 2021). Similarly, the fiscal deficit of Pakistan for the FY2021 also remains at 7% of GDP. Moreover, during the period 1998-2018, Pakistan has faced a loss of around USD 3.8 billion due to extreme weather conditions (UNDP, 2020).

79 https://tribune.com.pk/story/2325084/billion-tree-tsunami-fails-to-hit-balochistan

Recognizant of the need, Ministry of Finance (MoF) and the Ministry of Climate Change of Pakistan, provided technical assistance to create a Climate Change Financing Framework (CCFF), outlining the necessary public financial management processes and reforms in the contours of CCFF elaboration, priority action plans, delegation of institutional responsibilities, and expected timelines[80].

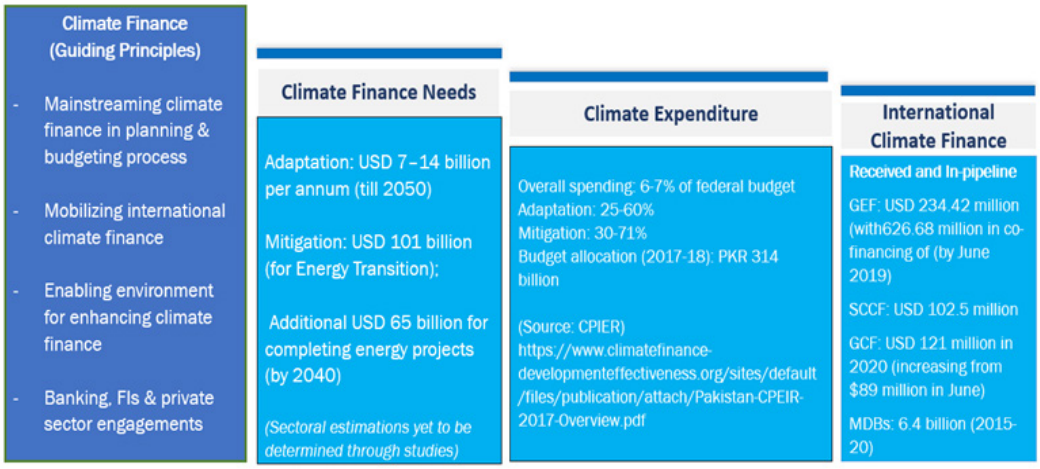

Figure 15 :Climate Finance in Pakistan

Domestic finance

The current landscape of finance in the country is reflected in their total allocations for climate change in Budget 2022-23 (under PSDP) are PKR 9.6 billion (which is 0.10% of total budget, and almost PKR 4.7 billion less than previous year). Figures 16 and 17 below provides a budget overlay of Pakistan in all sectors, including the climate-resilient urban settlements, wildlife preservation, water conservation in a form of favorable investments.

Figure 16: Budget Overlay of Domestic Climate Finance for Climate Adaptation in Pakistan

80 https://www.climatefinance-developmenteffectiveness.org/sites/default/files/publication/attach/Pakistan-CCFF-Oct-2017.pdf

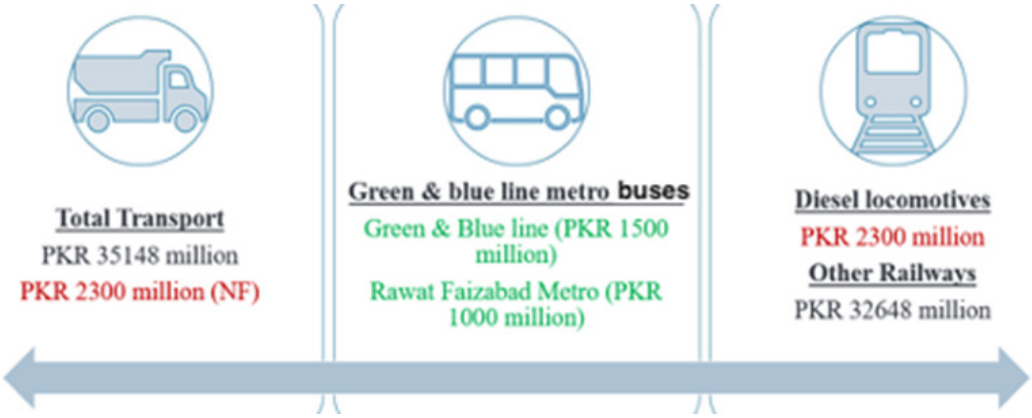

Figure 17: Budget Overlay of Domestic Climate Finance for Climate Mitigation in Pakistan

International Finance

To address the challenges of developing countries, both in adaptation and mitigation, there are several international climate financing instruments, initiatives and mechanisms funded by the global development community. The broader objective of these initiatives is to provide funds to developing countries to mitigate and adapt to various climatic impacts. Starting from Copenhagen Accord (UNFCCC, 2010)[81] and confirmed in the subsequent Conference of Parties (COP), developed countries pledged to deliver climate funding of USD 30 billion to developing countries. Under the Paris Agreement (UNFCCC, 2015)[82], the global development community resolved that "developed countries must contribute funds – USD 100 billion a year committed from 2020 - with the aim of increasing fund mobilization after 2025". Climate finance from multilateral channels rose to an all-time high of USD 61.6 billion in 2019. Over the last 10 years, there is a steady increase in climate finance and for the first time it exceeded USD half-a-trillion in 2017 and 2018.

Being the top-most vulnerable country impacted by climate change, the total cost for Pakistan to transition to a climate-resilient and low-carbon emissions development pathway is anticipated to be substantial. This figure (figure 18) identifies the climate finance needs and opportunities, which identifies that the total needs for Pakistan are USD 234 billion which is 8.9% of the total GDP. The investment needs are generally divided into three categories, i.e., Mitigation, Adaptation, and Cross-cutting. The share of Sub-Sectoral investments is also highlighted along with them.

81 UNFCCC (2010) Report of the Conference of the Parties on its fifteenth session, held in Copenhagen from 7 to 19 December 2009. Decision2/CP.15. Bonn: United Nations Framework Convention on Climate Change. https://unfccc.int/sites/default/files/resource/docs/2009/cop15/eng/11a01.pdf

82 UNFCCC (2015) Paris Agreement. FCCC/CP/2015/10/Add.1. Bonn: UNFCCC. http://unfccc.int/paris_agreement/items/9485.php

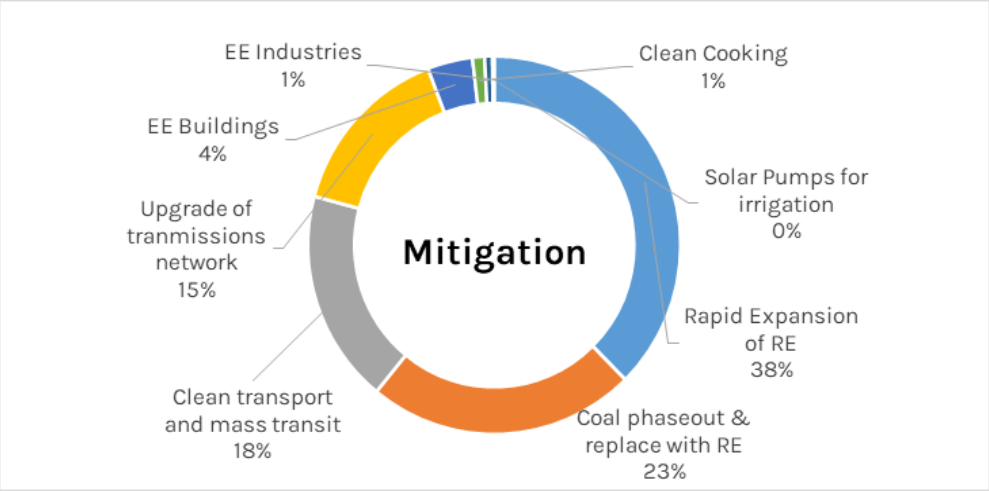

Figure 18: Climate investment needs of Pakistan

(data source: multiple sources)

Gaps in climate budget and financing

- Planning and budgeting are still two disparate domains and are not routinely considered to help development expenditure decision-making by various budget committees, including the Priorities Committee. The consequence of this is that there is no coherent financial driver for climate-sensitive budgeting in the development budgets of sectors or provinces within the MPDR or MoF.
- The analysis further indicates that none of the ministries considered in the data analysis provide climate-related data in different sectors, such as co-benefits with gender-based approach. These constraints along with methodological limitations lead to weak or missing linkages between climate change, poverty reduction and gender empowerment.
- There is a need to establish an enabling environment to support the implementation of sustainable finance tools and instruments as an important source of revenue for a government and the implementation of important public policies. The National Climate Change Policy (2012) refers to a carbon tax as a mitigation measure that can support emission reductions in the energy sector. As another example, both the National Climate Change Policy and its implementation framework (2013) put forth the introduction of incentive schemes to support GHG emission mitigation efforts. While these "incentives" are formulated in a generic manner in these documents (e.g., "economic incentives" to promote the upgrade of industrial processes and technologies, "financial incentives" for commercial transport systems to reduce emissions, etc.), they clearly lay out the basis for the consideration of a carbon pricing instrument, yet to be developed.
- In addition, there is a growing demand for decision-useful, climate-related programme information by investors which could be major driving force for private sector to enforce disclosure of climate-related information to weather-driven events resulting in significant financial impacts, providing better information on their exposure to climate-related risks.
- Lack of stakeholder awareness, lack of training, lack of information, lack of financial resources, lack of customer awareness, lack of their reputation value, lack of knowledge, lack of regulations

and standards, diversity, company culture, lack of social audits.

- Pakistan is not giving considerable attention towards Corporate Social Responsibility (CSR) as no CSR is defined at federal as well as at provincial levels. Few companies in Pakistan are seriously following the CSR guidelines and SDG goal of clean climate. Most of the organizations in Pakistan consider CSR as an altruistic action; however, only a few businesses have realized that true CSR is implementing socially responsible business practices (SRBP). Multinational corporations are more responsive than domestic corporations. Similarly, the fuel and oil sector contribute more towards CSR responsibilities in Pakistan.
- In terms of **voluntary pledges and commitments,** Nestle Pakistan has achieved the target of low emissions and low usage of electricity as per ton production, the emissions declined by 14.9% and usage of electricity by 17.3% since 2010. Also, it took a pledge to regenerate water cycle and save water. Similarly, in 2016, Bulleh Shah Packaging Group Company launched a biomass boiler with an objective to reduce carbon emissions and to protect the environment. Similarly, inspired by the tree plantation campaign, many companies voluntarily participated in the campaign. Accordingly, PTCL contributes roughly around 200,000 saplings, Habitt home store and JS Bank provided around 10,000 and 20,000 saplings respectively.
- **While there are pollution laws and liabilities according to the EPPA,** but polluting corporations do not consider the adverse effects of their waste effluents /emissions.
- Pakistan has a considerably strong model in **Public-Private Partnership** at both federal as well as provisional level. As Pakistan has a Public Private Partnership Authority (P3A) However, the regulatory system of the country remains fragmented across region and industries, as, the public private partnership regulation shifted towards provisional governments. They are now responsible for designing and implementing their own public private partnership related policies and framework. Generally, in Pakistan the public private partnership model is common in power generation, energy, and transport sector.

7. Way forward: Actions needed to build resilience on local, national, and regional level.

The actions have been discussed in Table 3 as per the following:

Action A: Institutional building, coordination, and governance - **Strengthening urban planning and development.**

Action B: Key sectors: Water, waste, energy, transport

Action C: Policy interventions, planning frameworks (spatial planning) and tools & interventions

Action D: Risk financing and approaches

Action Points	Local & National	Regional
Institutional building, coordination, and governance	• Strengthening urban planning and development • Strengthening private sector participation and their role • Actions on urban spaces and well being • Civic engagement tools including local communities and residents • a strong relationship with civil society, SMEs and local businesses and communities	• Best practices and knowledge sharing • Capacity building and trainings • Common template on streamlined procedures to acquire portability of social protection • Joint actions on regulatory and institutional reforms based on international and regional framework agreements • Focused, results-oriented governance digitalization platform.
Key sectors: Water, waste, energy, transport	• Green urban mobility • Climate-smart municipal services • Energy efficient appliances, building codes and use of clean energy sources • Circular economy • Waste-to-energy prospects • Water management and resource conservation • Climate-smart agriculture technologies • Green technologies, innovations and adoption • Need for the integration of ecosystems and nature conservation into city planning • Leading innovation amid technological change	• Co-creating knowledge on technical aspects of these sectors and fostering collaboration for data sharing and assessments. • Investments in resilient cross-border infrastructure (risk prevention, rapid recovery, data protection and safety, etc.)
Policy interventions, planning frameworks (spatial planning) and tools & interventions	• Green procurement, green supply chains • Pollution laws and liabilities • Strengthening the implementation of EIAs, and monitoring and evaluation • Policies to promote the employment of the youth, women, and migrants, to maintain social cohesion and sustainable economic growth.	• Regional forums on challenges, issues, and policy responses • Co-creating innovation platforms, support new sources of regional economic growth.
Financing	• Create sustainable revenue streams for green and resilient urbanization	• mobilizing climate finance • Dedicated regional data facility to account for precise information and evidence on the loss and damage, adaptation finance and mitigation needs.

Recommendations:

- Integration of disaster resilience planning in urban planning policies and projects.
- Enhance awareness regarding climate change action in communities through advocacy and community engagement.
- Need to replicate successful water-integrated management projects in urban areas of Pakistan where communities take the ownership and are directly engaged for sustainable operation of the projects.
- Integration of the urban poor and those living in informal settlements in the planning process as they must not be left behind and get access to basic resources like clean water, sanitation, energy.
- Collection of data from informal settlements to mainstream gender and ensure that the issues of women in those settlements are being taken care of.
- Public-Private Partnership can be an effective mechanism for ensuring climate action and urban resilience in Pakistan.
- Collaboration of public sector with the academia, research, and policy institutions to develop policies for urban resilience in Pakistan.
- Resilience building must be a multi-pronged, cross-sectoral, and holistic approach. It needs to be people-driven, tech-supported, and community-based.
- The sustainable transport system needs to be developed with a community-friendly infrastructure to avoid traffic jams and emissions in the urban areas.
- Inter-departmental coordination within departments and line departments who are engaged in urban processes must be ensured and made transparent.
- Climate advocacy through cooperation at the regional level can help support the urban resilience process within the countries in the South Asian region.
- Encouraging the adoption of green building standards and practices, such as energy-efficient design, green roofs, and rainwater harvesting systems, to reduce the carbon footprint of urban infrastructure and increase the resilience of buildings to extreme weather events.
- Increasing investment in green infrastructure, such as parks, green roofs, and rain gardens, to enhance the resilience of urban ecosystems and reduce the impact of extreme weather events.

Appendix

Annex A

Table A1 Major National Environmental and Climate Policies in Pakistan

Sr. No.	Title	Description of policies
1	**National Environment Policy (2005)**	National Environment Policy 2015 provided goals and strategies for adaptation and mitigation of environmental challenges faced by Pakistan at the federal, provincial and local government levels. For mitigation of indoor pollution, environmental quality standards and the implementation of those standards was proposed. This policy also stressed the formation of guidelines for the conservation and management of the country's environmental resources including water, biodiversity, forests, energy resources, and agriculture. It also provides cross-sectoral guidelines for relating the environment with poverty, trade, health, and gender. The policy also suggests key policy instruments including Economic and Market-based Instruments, and Implementation and Monitoring for environmental protection. For adaptation purposes, existing energy demand from non-sustainable resources such as fossil fuels was suggested to be transitioned to more sustainable resources. Public awareness on different measures of adaptation to reduce the environmental impacts was also highlighted.
2	**National Operational Strategy for Clean Development Mechanism (2006) (MoE 2006)**	The operations strategy was developed to fulfill the requirements of establishing a Designated National Authority (DNA) and ensuring transparent, participatory, and effective management of the CDM process in the country. It builds on preliminary studies for initial projects including Asia Least-Cost Greenhouse Gases Abatement Strategy (ALGAS) and Pakistan's Initial Communication on Climate Change which provides a general framework for operating CDM in Pakistan.
3	N**ational Sustainable Development Strategy (2012) (MA and Pervaiz 2012)**	(MA and Pervaiz 2012): NSDS was developed to envision and evolve a just and equitable economic growth in Pakistan, having a fair distribution of resources to the marginalized, poor, and vulnerable in the society and to future generations, without overexploitation of natural resources.
4	**National Climate Change Policy (2012)**	This policy provides guidelines for developing national adaptation and mitigation plans. It highlights efforts needed in different sectors including water, forestry, agriculture, and other vulnerable ecosystems to combat climate change impacts in the country. It also incorporates disaster preparedness, awareness, and capacity building, along with promoting Pakistan's efforts towards climate actions on international forums.
5	**Framework for Implementation of NCCP (2013)**	Provide details on Implementation of NCCP with time limits.

6	**National Disaster Risk Reduction Policy (2013) (NDMA 2013)toxic chemical products formed as secondary metabolites by a few fungal species that readily colonise crops and contaminate them with toxins in the field or after harvest. Ochratoxins and Aflatoxins are mycotoxins of major significance and hence there has been significant research on broad range of analytical and detection techniques that could be useful and practical. Due to the variety of structures of these toxins, it is impossible to use one standard technique for analysis and/or detection. Practical requirements for high-sensitivity analysis and the need for a specialist laboratory setting create challenges for routine analysis. Several existing analytical techniques, which offer flexible and broad-based methods of analysis and in some cases detection, have been discussed in this manuscript. There are a number of methods used, of which many are lab-based, but to our knowledge there seems to be no single technique that stands out above the rest, although analytical liquid chromatography, commonly linked with mass spectroscopy is likely to be popular. This review manuscript discusses (a**	This policy was aimed at increasing the country's resilience against the shocks from natural and anthropogenic activities, to address disaster risk reduction in vulnerable areas, while involving a wider range of stakeholders from government, civil society, and the private sector.
7	**Pakistan 2025: One Nation, One Vision (2014) (MoPD&R 2014)**	Provide details on Pakistan's strategy for achieving its national goals and vision of becoming one of the 10 largest economies of the world by 2047. Climate change was identified as a critical factor for the country, thus highlighting the issues of water scarcity, food security, threats for biodiversity, and energy security.
8	**National Climate Change Policy 2021 (MOCC, 2021)**	This policy provides a comprehensive guideline on adaptation, mitigation, capacity building, awareness, financing of climate change projects, technology transfer, regional and international cooperation on climate change and implementation framework of the said policy. On adaptation front, the policy has vastly covered the sectors including water resources, agriculture and livestock, human health, forestry, biodiversity, other vulnerable ecosystems, and disaster preparedness. On mitigation side, the policy has considered energy generation sector, energy efficiency and conservation, transport sector, urban planning and waste management, industries, agriculture and livestock, carbon sequestration and forestry

Table A2: Sectoral policies of Pakistan related to development and climate change

Sectoral Policies/ Strategies/ Plans	Federal	Federal, Khyber Pakhtunkhwa, Punjab, Gilgit-Baltistan, Balochistan, PAK and Governments					
		Punjab	Sindh	Gilgit-Baltistan	Khyber Pakhtunkhwa	Balochistan	PAK
Water and Sanitation	National Water Policy (MoWR 2018) National Sanitation Policy of Pakistan (MoE 2006)	Punjab Water Policy (GoP-ID 2018) Draft Punjab Sanitation Policy 2015 (GoP 2015b)	Sindh Sanitation Policy 2017 (PHERD 2017)	Adopted National Water Policy (MoWR 2018)	Water Policy 2015 (GoKP 2015)	-	-
Agriculture	National Food Security Policy (MNFSR, 2018.)	Punjab Agriculture Policy (PBIT 2018)	Sindh Agriculture Policy 2018-2030 (MoS 2018)	Provincial Agriculture Sector Policy (Draft) (GoGB 2018b)	Agriculture Policy (GoP 2015a)	Proposed Balochistan Agriculture Policy (IFPRI 2021)	-
Energy	National Power Policy (Ghumman 2020) Alternate Renewable Energy Policy 2019 National Electricity plan 2020 Indicative Generation Capacity Expansion Plan 2021	Punjab Power Generation Policy (GoP 2006)		Adopted Power Generation Policy	Hydro Power Policy 2016 (KP 2016)	Balochistan's proposed Renewable Energy Policy 2019	-
Mining policies and Acts.	National Mineral Policy, Pakistan (MNPR 2013)	Punjab Mineral Development Policy [Draft] (M&MD 2017)	Sindh Mines and Mineral Act 2021 (Tribune 2021)	-	Mines and Mineral Act of Khyber Pakhtunkhwa (KPCode 2017)	Balochistan Mineral Policy 2019 (Dawn 2019)	Pakistan Administered Kashmir Mineral and Industrial Development Corporation Act (FAO-UN 1971)

Climate	National Climate Change Policy	Punjab Climate Change Policy (Draft) (EPD 2017)	Sindh Climate Change Policy (Draft)	Climate Change Strategy and Action Plan (GB-EPA 2017b)	Climate Change Policy (Draft)	-	PAK Climate Change Policy (2017)
Development plans and programes	Public Sector Development Programme 2021-22. Annual Plan 2019–2020 (GoP 2019a, b)	Development Programme 2018–2019 (GoPB 2018a)	Sindh Annual Development Plan 2021-22	Annual Development Plan 2017–2018 (GoGB 2017a)	Annual Development Programme 2018–2019 (GoKP 2018a)	-	PAK Annual Development Programme 2021-22
Development strategy	National Sustainable Development Strategy (GoP 2017)	Punjab Growth Strategy (GoPB 2019)	-	Strategy for Sustainable Development (GoP and IUCN 2003)	Sustainable Development Strategy (GoKP 2019b)	Draft Balochistan Comprehensive Development Strategy	-
Disaster management	National Disaster Management Plan 2012–2022 (GoP 2012c)	Disaster Risk Management Plan 2008 (GoPB 2008) Punjab Environment Policy 2015 (EPA 2015)	Disaster Risk Management Plan, Sindh Province (PDMA 2008)	Disaster Risk Management Plan Northern Area 2008 (GoGB 2008)	Monsoon Contingency Plan 2019 (GoKP 2019a)	Disaster Risk Management Plan District Quetta, Balochistan	

Annex B: Concept note and details of stakeholder consultation.

Stakeholder Consultation for Developing Recommendations for a National Report on Assessing the Urban Sector's Role in Climate Change Mitigation and Vulnerability Measures

Date: 27th February 2023
Time: 2:30pm-3:30pm (PKT) hybrid

Background:

The urban sector is a critical component in mitigating and addressing the impacts of climate change. In South Asia, urban areas are projected to continue growing, with an increasing share of the population living in cities. However, urbanization also poses challenges, such as increasing greenhouse gas emissions and exposing urban populations to climate-related hazards. Last year, Pakistan faced severe urban flooding due to the monstrous monsoon season which drenched 1/3rd of the country under water. However, in urban areas, most of the destruction was caused by unplanned development. Therefore, to mitigate the disasters being exacerbated by human development policies in the urban areas and to address these challenges, it is important to understand the policies and interventions that have been implemented to promote sustainable and resilient urban development.

The objective of this stakeholder consultation is to gather perspectives from civil society organizations (CSOs) and the local administrations to help develop recommendations for a national report on assessing the urban sector's role in climate change mitigation and vulnerability measures. The consultation will focus on gathering perspectives from CSOs, as they are key actors in promoting sustainable urban development and can provide valuable insights on the challenges and opportunities for achieving climate objectives. The recommendations will be aimed at improving compliance with climate objectives, and promoting sustainable, green, inclusive, and resilient cities in South Asia. The consultation will be organized at the national level, with participants from various CSOs and other stakeholders involved in urban development. The consultation will be structured to gather inputs on the following areas:

- Policies and interventions implemented for climate change mitigation and vulnerability measures in the urban sector.
- The challenges and opportunities for promoting sustainable and resilient urban development.
- Expectations and recommendations for improving compliance with climate objectives in the urban sector.
- How the gaps in Urbanization sphere (policy; planning; forecasting etc) could be linked to the overall international climate agenda to pursue low-carbon, climate-resilient growth in the urban sector?

- How the goal of developing Green, Resilient and Inclusive Cities can be done in a way that it can help our states to not only pursue local climate and SDG agenda's but also link our actions (strengthening cities centric policies) with our respective NDCs commitment under Paris Agreement.

Expected Outcomes:

The stakeholder consultation is expected to generate valuable inputs and recommendations for the national report on assessing the urban sector's role in climate change mitigation and vulnerability measures. The report is part of a project titled "Promoting Green Inclusive and Resilient Cities in South Asia," which is sponsored by Misereor and led by Climate Action Network South Asia (CANSA) with nodal organizations from regional countries including SDPI from Pakistan. The report will serve as a comprehensive assessment of the policies and interventions implemented in the urban sector and their compliance with climate objectives. The recommendations generated from the stakeholder consultation will be critical in developing strategies to promote sustainable, green, inclusive, and resilient cities in South Asia.

The list of stakeholders engaged has been provided below:

Name	Designation/Organization
Zainab Naeem (Moderator)	Associate Research Fellow, SDPI
Dr Adam Abdullah	Assistant Professor | Department of Social Sciences and Liberal Arts, IBA Karachi, Associate Director | Karachi Urban Lab |
Syed Shujja Haider	Manager Australia Pakistan Water Security Initiative, WWF Pakistan
Nadeem Khurshid	CEO, 4th Dimension Consulting (urban resilience)
Syed Shahid Kazmi	Country Coordinator, Pakistan Humanitarian Forum
Sadaf Tahir, Deputy Manager (Project Appraisal and Management)	Deputy Manager (Project Appraisal and Management), NDRMF
Abdul Waheed, Assistant Manager, Disaster Risk Reduction	Assistant Manager, Disaster Risk Reduction, NDRMF
Zofeen Ebrahim	Environmental Activist
Afia Salam	Environmental Journalist
Nakul Sharma	CANSA (Online)
Ruchi Chaudhary	CANSA (Online)

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