
Pakistan

Innovations for Climate Adaptation and Resilience

Current Status and Needs Assessment

2021

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Executive Summary

This report describes the Climate Innovation Challenge (CIC) consultative process undertaken in Pakistan and related innovation opportunities under CIC for South Asia being administered by ADPC through Program for Asia Resilience to Climate Change, a trust fund administered by the World Bank funded by United Kingdom's FCDO. In this sequence, it essentially provides an overview of Climate Risk Profile of Pakistan in general and its vulnerability to climate induced disasters in particular that builds an underlying rationale for the launching of CIC in the region.

The Global Climate Risk Index has placed Pakistan on the fifth spot on the list of countries most vulnerable to climate change in its annual report for 2020, released by Germanwatch. The country is estimated to have lost nearly 10,000 lives to climate-related disasters and suffered losses amounting to about \$4 billion from 152 extreme weather events in that period. Analysts have estimated Pakistan's climate migrants over the past decade at around 30 million people. Building resilience and adaptation to climate change is becoming indispensable for Pakistan.

Acknowledging that the present government is paying earnest attention to address the climate-related issues and has been undertaking concerted actions to deal with the policy and institutional challenges, in line with the CIC project outcomes, this report also accentuate the problem statement underpinning the CIC, major relevant portion of National Adaptation Plan, Policies and Strategies of the Government of Pakistan. In addition, this report also emphasizes the key thematic areas of the Technology Needs Assessment report endorsing the CIC process in Pakistan as well as accounting the ongoing various climate adaptation initiatives funded by external agencies.

Over the past several years, Pakistan has undertaken several policy and planning initiatives with respect to climate change and within the current scenario it presents an urgent imperative and an opportunity to derive the full potential of innovative technological advancement to reduce vulnerability to disasters and climate risks. In order to understand, appreciate and analyze the climate impacts on key sectors, the technology options in Pakistan presents a realistic approach for harnessing innovative solutions that fundamentally target the end users (beneficiaries) for ascertaining such efficacy. Besides, most importantly as part of the CIC process for South Asia, it draws up the results of National Consultation on CIC aimed at assessing the needs for cutting-edge technology solutions as one of the key tools for bridging the gap of adaptation and reducing disaster risk.

The CIC consultation inevitably spurred discussion about attaining the overall objective with encouraging participation especially from the concerned government officials and key sector specialists that buttressed the key idea of ensuring ownership of CIC by them, at the core of

which lies the inherent need for innovative tech solutions. The CIC consultation succeeded in delivering the basic message related to encouraging the innovators to demonstrate tech solutions that are potentially scalable and transferable. The CIC consultation provided an opportunity to ADPC in technically providing suggested key thematic areas for possible innovation challenge in Pakistan and sought concurrence from the concerned Ministries/Departments. Besides, parallelly suggestions from the participating organizations were also elicited that revealed the unmet innovation needs emanating from them. It categorically accomplishes the CIC consultation by capturing the discussion summary and meeting outcomes.

1. Background

Climate change is a major driver of disaster losses and failed development. Climate related disasters, including the extreme weather events, have dominated the global disaster landscape in the 21st Century, which is shaping new approaches to science and practice in disaster risk reduction, resilience building and climate change adaptation.

The Climate Adaptation and Resilience (CARE) for South Asia project implemented by the Asian Disaster Preparedness Center (ADPC) and supported by the World Bank empowers decision-makers with tools, products, and services to act locally on climate-sensitive issues such as disaster related public policy and planning, agriculture, water, and transport. The Climate Innovation Challenge (CIC) for South Asia and the Tech-Emerge Resilience India Challenge are two important initiatives being administered by ADPC through the Program for Asia Resilience to Climate Change, a trust fund administered by the World Bank funded by the United Kingdom's the Foreign, Commonwealth & Development Office (FCDO).

The CIC for South Asia aims to identify innovations to reduce climate risk and build climate resilience of communities vulnerable to such risks and extremes through award of grants to innovators and scale-up pilots across different sectors, and tiers (national, sub-national and local/community) for greater impact/optimal results. Selected innovators will receive support and grant funding from a pool of 2 million USD to pilot their innovations regionally and/or in the selected countries.

Any innovation and the factors that contribute to it depend on its applicability aimed at spurring priority economic sectors and or targeted areas for which the technology is needed. The technological innovation in addressing climate adaptation and resilience must address societal problems. There has been growing interest in recent years on ways to foster such innovation, in particular, the role that governments can and should play in that process. The Climate Innovation Challenge is a global call for innovators who can bring forward technological solutions that aims to enhance climate resilience, local market and institutional capacity building and create a higher degree of awareness and knowledge among the different types of stakeholders on the use of technology. Scaling up and scaling out pilot initiatives in addressing climate adaptation and resilience is important with appropriate technology and policy planning and implementation.

2. Climate Risk Profile of Pakistan

Geography and Climate: Pakistan extends over an area of 796,000 km² with a great diversity in temperature and precipitation. The eastern areas of the southern half mainly receive precipitation through the southwest summer monsoon (from June to September), while the northern and western areas of the southern half of the country get rains mainly through western weather disturbances in winter (from December to March). Pakistan has distinct climate zones, with high altitude mountains in the north and west, arid deserts in the south, the hot and dry Indus River Valley in the center and south, and a humid 990-km coastline. Generally, the lower half of the country is hot and dry, while the north is more temperate and wet. During summer monsoon months (July–September), average temperatures do not exceed 15°C in the north, but reach 35°C in the south and central Indus Valley. Most of the country receives very little rainfall (less than 200 mm/year on average nationally), with the majority occurring in the summer monsoon season. During winter months (December–March), average temperatures are well below 0°C in the highest northern altitudes and 20°– 25°C in the low-lying south. Winter also brings substantial precipitation in northern regions. Interannual rainfall varies significantly, leading to successive patterns of flood and drought

Climate Threats: The Intergovernmental Panel on Climate Change (IPCC) Fifth Assessment Report (AR5) for the Asia region notes that sensitivity to climate change threats, in agriculture- dependent economies (such as Pakistan), arises from their distinct geography, demographic trends, socioeconomic factors, and lack of adaptive capacity that when taken together, determine the vulnerability profile by perpetuating a vicious cycle of poverty. The climate change projections of the AR5 for South Asia as a whole show that warming is likely to be above the global mean and climate change will impact the glaciers' melting rate and precipitation patterns, particularly affecting the timing and strength of monsoon rainfall. Consequently, this will significantly impact the productivity and efficiency of water-dependent sectors such as agriculture and energy.

2.1: Pakistan vulnerability to climate induced disasters

Besides the long-term effects of climate change, as above, there has also been a recorded, dramatic increase in the number and scale of extreme, weather-related events. The British Government (DFID) notes that, 'Climate change is resulting in an increase in the frequency and severity of climatic extremes, which increases the frequency of weather-related disasters. Climate change hits the poor hardest and the greatest impacts are likely to be on food security, the productivity of agricultural export crops, health, water security and quality. It is also likely to result in the displacement of people.' Weather-related disasters from less than 200 every year in the decades of 1980s and 1990s, rose to one every day on average between 2000 and 2006. Over the past 10 years, weather-related disasters have affected 2.5 billion people. 98% of those killed in natural disasters across the world are in developing countries, underlining the link between vulnerability to disasters and poverty. Typically, many resources are spent after disasters, rather than

trying to prevent the damage they cost by helping the poor to adapt. Not enough is being done globally to adapt to the effects of climate change and prevent weather-related extreme events from turning into human disasters. To-date, there has been no systematic mapping or trend-analysis of weather-related natural disasters in Pakistan.

2.2: National Adaptation Policies and Strategies of Pakistan

Institutionalization of climate change in Pakistan finds its roots in the early environmental efforts dating back as early as the mid-1970s. Pakistan ratified the United Nations Framework Convention on Climate Change (UNFCCC) in June 1994 and was among the first South Asian countries which realized the need to control the anthropogenic contribution to global climate change and need to respond effectively to its adverse impact. Pakistan signed and ratified 14 international environmental commitments between 1971–2001, including the UNFCC and Kyoto Protocol, which acted as stimuli in initiating and guiding the policy processes and efforts on climate change in the country.

The national policies on Climate Change and development priorities are reflected in the following government policies:

The perspective plan, “Pakistan Vision 2025” recognizes climate changes as one of its priority areas. It states that climate change had already begun to impose steep social and economic costs, especially in developing countries. These costs have manifested themselves conspicuously in Pakistan, and include high intensity floods (Flash floods & Glacial lake outburst floods), avalanches and land-slides; persistent drought, sea water intrusion, and cyclone.

The First National Communication submitted to UNFCC in 2003 describes the endeavours of Pakistan to overcome the challenges posed by climate change. It also outlines the planned efforts and strategies to achieve goals of national development. Pakistan’s Second National Communication (SNC) on Climate Change was prepared submitted to UNFCC in 2018 after rigorous research and analytical work and presents the case of Pakistan’s unique vulnerabilities. SNC encompasses the challenges associated with integrating these concerns with policies and further translation into actions while touching finance, capacity and awareness raising on climate change. Besides, it also highlighted the need for a Focal institution for promotion of innovation in engineering and technology.

In May 2011, the Global Change Impact Studies Centre (GCISC) started undertaking preliminary stocktaking and stakeholders’ consultation for this purpose. The work started by reviewing the relevant documentations and identifying the relevant stakeholders. The consultations took three forms: correspondence, personal meetings, and workshops.

The goal of National Climate Change Policy 2012 is to ensure that climate change is mainstreamed in the economically and socially vulnerable sectors of the economy and to steer Pakistan towards climate resilient development. NCCP recognizes and prioritizes adaptation measures over mitigation. It gives a set of policy measures for adaptation in the following sectors: water resources, agriculture and livestock, human health, forestry,

and biodiversity and other vulnerable ecosystems.

The development of this Framework for Implementation of NCCP is a follow-up of the National Climate Change Policy (NCCP), the parent document providing broader framework concerning how to adapt to the changing impacts of climate and how to play a role in its mitigation.

The National DRR Policy provides an overall guiding framework for addressing the high levels of disaster risk permeating Pakistani Society. It covers both natural and man-made hazards. The policy seeks to promote priority measures to ameliorate already existing vulnerability to hazards, and equally important measures to ensure future development processes and programs strengthen resilience.

The National Sustainable Development Strategy (NSDS) defines sustainable development and the pathway to a “green economy” in Pakistan’s context. It also focuses on preparing for climate change and its accompanying uncertainties through comprehensive adaptation and mitigation planning and concrete implementation measures.

Pak-INDC (Pakistan’s Intended Nationally Determined Contribution) is rooted in the country’s strategic plan ‘Vision 2025’. It is aligned with the respective policies, plans and sectoral growth targets set by various ministries and other government entities. Pak-INDC outlines a broad range of potential adaptation and mitigation measures. It also lists the challenges associated with the realization of these measures in both current and future scenarios.

The National Disaster Risk Reduction Policy (2013) aims to build the nation’s resilience by reducing its exposure to various types of hazards. The policy objectives recognize climate change challenges in the context of national capacity building and development planning,

The National Environment Policy 2005 was formulated at a time when understanding among policy makers about the country’s climate change challenges was low. The environment policy recognizes various issues such as dwindling water resources and desertification that could be linked to the serious outcome of climate change in Pakistan. In this policy document, climate change is one of the key environmental issues.

In order to achieve the objectives of these policy initiatives, the country has considerably improved and strengthened its climate governance structure over time. Climate change and environmental protection have been extensively recognized in national long-term plans, annual Economic Surveys of Pakistan, annual budgets and associated Public Sector Development Programmes (PSDP). Specific budgetary allocations have been made at national and sub-national levels for execution of the Framework for Implementation of the Climate Change Policy.

2.3: Priority Adaptation Actions of Pakistan

- a) Conserve water by adopting appropriate techniques and measures
- b) Develop and implement integrated water resource management
- c) •Develop and enforce regulations to protect water resources from climate related vulnerabilities
- d) Enhance awareness of and capacity to manage hydrological system

- e) Develop adaptation to climate change impacts on coastal and marine ecosystems
- f) Build climate change resilience into Pakistan’s agricultural system
- g) Improve irrigation practices and land management
- h) •Enhance capacities of the relevant institutions to undertake research on agriculture and livestock
- i) •Enhance farmers’, agricultural industries’, and policymakers’ understanding of CC issues
- j) Conduct research to improve understanding of the relationship between forests and climate
- k) Minimize damage to and increase resilience of forest ecosystems
- l) Improve governance and management of forests
- m) Build awareness of and institutional capacities for climate change adaptation
- n) Strengthen legal and institutional set-up for biodiversity conservation
- o) Enhance scientific research and institutional capacity
- p) •Address the impact on human health Develop climate change–resilient infrastructure
- q) •Introduce innovations in town planning to adapt to and mitigate the impacts of climate change
- r) Increase awareness of impact of climate induced natural disasters and our capacity to respond
- s) Develop integrated hazard-mitigation strategies
- t) Assess future flood levels in the Indus River system against climate scenarios
- u) Provide reliable natural disaster information and early-warning systems

2.4: Climate Change projection and impacts on key sectors

Pakistan has 11 climate zones due to its range of topographies and ecosystems, and each of these climate zones experiences different weather and climate patterns. Generally, coastal areas of the country are dry and hot and the northern uplands get progressively cooler. The winter months (December-February) are cool and dry. The country experiences monsoons from June through September, with a lesser degree of monsoon activity in October and November as well. Widespread changes in extreme temperatures have been observed in Pakistan over last 50 years. Cold days, nights, and frost have become less frequent whereas hot days, nights, and heat waves have become more frequent. Average rainfall in the arid and coastal plains of Pakistan has decreased by between 10 and 15 percent since 1960, while increasing during the same time period over northern Pakistan. Heavy rainfall events have increased, with nine heaviest rains recorded in 24 hours all being registered in 2010. The low-lying plains along the coast of Pakistan are exposed to the impacts of sea level rise, with conservative scenarios projecting an increase of 40 cm by 2100. Pakistan has experienced about 18 extreme weather events since 1990, including the historic 2010 floods, as well as droughts, cyclones, and landslides. Due to heavy monsoon rains during the summer months, Pakistan often experiences severe flooding in the Indus River basin, where much of the population lives on low-lying lands. Rain- or otherwise- triggered landslides are common

in the northern regions of Pakistan, particularly those connected to Azad Jammu Kashmir province.

Much of the Pakistani population depends on agricultural activities for food and income. Under future climate scenarios, rising temperatures and erratic rainfall could limit the country's ability to sustain its current levels of agricultural and livestock production. Agriculture uses 92 percent of the country's extracted water, which makes it highly vulnerable to changes in hydrologic balance. Pakistan is ranked fourth in the world in terms of the extent of irrigated.

IPCC predicts a continued decline in freshwater availability (Climate Change and Water", IPCC Technical Paper VI-June, 2008), particularly in large basins like the Indus, the flow of which constitutes main source of surface water in Pakistan. According to Water and Power Development Authority (WAPDA), per capita surface water availability plunged from 5260m³ per year in 1951 to 1100m³ in 2006, and is expected to decrease further with the dual impacts of rising temperatures and increasing demand. A critical irrigation supply scenario is expected to emerge in Pakistan by the year 2012-2013, contributing to a projected 12 million tons deficit in grain production.

Climate Change enhances the susceptibility of agricultural zones to episodic natural catastrophes such as storms, floods and droughts, in turn exposing countries to the threat of socio-economic losses. The multi-functionality of agriculture is a recognized feature of Pakistan's socio-economic system. These observations confirm findings from studies that have demonstrated a sensitivity of cereal and tree crop to changes in temperature and moisture. With just a 1C rise in temperature, wheat yield in Pakistan is estimated to decline by 6-9%. Even lower temperature rises can severely impact cash crops like mango and cotton. In view of the forecasts for future food security, water quality, increasing heat stress and growing frequency of natural disasters, the direct implications of Climate Change for human health are daunting. Furthermore, vector-borne diseases such as malaria, dengue, typhoid and cholera that are already a significant cause of mortality and morbidity in Pakistan are climate sensitive and known to thrive in warmer regions. An increase in epidemic potential of 12-27 per cent for malaria and 31-47 per cent for dengue is anticipated as a consequence of climate change.

The cost of health in Pakistan, which already exceeds one billion US dollars, will keep escalating with the projected climatic changes, and further impact poverty reduction and health improvement targets of the country. Moreover, increasing prevalence of disease in the region has consequences for food security as well: an increasing prevalence of certain types of diseases and ailments among livestock has been observed in the country as an effect of rising temperatures.

In recent years, enormous pressures have been put on Pakistan's ecosystems to support the ever-growing demand for natural resources. The most affected areas are coastal and marine ecosystems, forests and mountainous regions and the flora and fauna within

them. Climate change will have a profound effect on the future distribution, productivity, and health of forests. Grassland productivity is expected to decline by at least 40 per cent for an increase in temperature of 2 – 3° C, combined with reduced precipitation in the semi-arid and arid regions of Asia.

The climatic and agro-agriculture zones in Pakistan are as sensitive as they are diverse and some are already under threat of extinction as a consequence of global warming. At particular risk from the ecological dis-equilibrium are populations in marginal zones, coastal/maritime, mountain and arid areas. Those living in coastal zones are even more vulnerable. Swelling sea levels on the 990km coastline coupled with rising sea surface temperatures could potentially wreak havoc on many coastal towns and cities. Coastal Karachi, Pakistan's largest urban center, is increasingly subjected to floods and storms, resulting in the deaths of hundreds of people. The survival of important coastal ecosystems like mangrove swamps is also under threat with the intrusion of saline water and rising temperature. The loss of mangroves not only weakens the protection from floods but also destroys the habitat of various species residing within the swamps, some of which are sources of livelihood for poor communities engaging in sustainable fishing.

3. Ongoing Climate Resilience Initiatives in Pakistan

The number of adaption focused projects and programs underway in Pakistan is moderate in comparison to other South Asian countries. Water is the sector most represented in Pakistan's current adaptation initiatives, followed by risk reduction, policy formulation, agriculture, energy, forestry, coastal zones, and nature. Donors of these projects include the Adaptation Fund, Asian Development Bank (ADB), the Department for International Development (DFID), the Food and Agriculture Organization (FAO), Italy, the Netherlands and World Bank with implementation organizations including the International Centre for Integrated Mountain Development (ICIMOD), International Crop Research Institute for the Semi-Arid Tropics (ICRISAT), International Fund for Agricultural Development (IFAD), International Union for the Conservation of Nature (IUCN), and United Nations Environment Programme. The Special Climate Change Fund (SCCF) is currently considering funding two regional projects in Pakistan and other Asian countries, both of which focus on agriculture and water considerations.

The Government of Pakistan and United Nations Development Programme (UNDP) have launched a new US\$37 million project that will benefit more than 30 million people with scaled-up early warning systems, training on glacial lake outburst flood (GLOF) preparedness and response, and the creation of new protective infrastructure.

A two-year project to develop the adaptation plan, supported by the UNEP and funded by the Green Climate Fund with USD 2.7 million, was formally launched in 2021. National Adaptation Plans are widely seen as one of the most important mechanisms for adapting to climate change. They aim to reduce vulnerabilities to climate impacts by creating comprehensive medium- and long-term plans, including the integration of adaptation measures into national policy.

The World Bank is funding \$728 million through four projects to put Pakistan on the path of climate resilient development which will benefit millions of its citizens. These projects will protect the environment and improve the quality of life in cities while being engines of growth and promoting sustainable water management through efficient irrigation, robust weather forecasting and improved disaster preparedness.

The Asian Development Bank (ADB) has endorsed a new 5-year country partnership strategy (CPS) to help restore economic stability and growth in Pakistan, enhance people's well-being, create jobs, and expand economic opportunities as the country works to overcome the coronavirus disease (COVID-19) pandemic. Climate change and disaster resilience are strategic pillars.

GEF is transforming the Indus Basin with Climate Resilient Agriculture and Water Management Transforming agriculture in the Indus Basin by increasing resilience among the most vulnerable farmers and strengthening government capacity to support communities to adapt. The GCF has signed an agreement to implement a project by the FAO to enhance the climate resilience of farmers in Pakistan's Indus Basin.

4. Need Assessment for Innovations in Pakistan

4.1: Problem Statement

Pakistan Council of Research in Water Resources sought the inclusion of Rainwater Harvesting in the innovation since the water issue not only contributes towards the drought but also in the urban flooding in Pakistan emerging as a new phenomenon. The Rainwater harvesting has been broadly highlighted in both national and provincial level policies of Pakistan. Besides, it all cut across with other major policies of government e.g. Energy, Agriculture etc.

The Agricultural Department suggested that CIC should broaden the scope of Climate Smart Agriculture and precisely outlined sub thematic area in the CIC call that can possibly include specific fertilizers in the context of adaptation to climate impact, innovative climate smart irrigation technology, using innovative tools (e.g., earth observation tools, remote sensing and other latest technological breakthroughs) and also crop diversification; introducing climate resilient crops (Pearl millet, Sorghum etc) in the existing systems as well. The idea is to emerge from the traditional approaches of innovations in climate smart agriculture. In addition, the CIC innovation should essentially explore the technological solution to the recent massive locust attack in Pakistan which heavily eroded the agricultural sector last year. Such innovation should aim to monitor and eliminate the vast spread of invasive species that are enormously impacting the agriculture sector. **National Climate Change Policy and INDC has highlighted such needs that can be referred for assessment.**

Water Resources

The Irrigation Research Institute has highlighted that irregular availability of water is one the key issues for Agriculture production. The sub component of the Integrated Water Resource Management has a bigger picture therefore it calls for adding sub-themes in the CIC. Pakistan is the fourth largest groundwater withdrawing country in the world. Ground water resources are overly harvested, especially in Punjab province and at the same time the groundwater is exposed to the risk of pollution. Owing to such high risk, it lays a strong emphasis for constant monitoring of the groundwater and therefore it should be potentially included in the CIC call. **The National Water Policy 2018 has inextricably linked with the impending climate change scenario that has serious implications for Pakistan's water resources.**

The devastations and damages caused by climate change are apparent across the globe, specifically in the South Asian region where vulnerabilities to climate change among residents are high and climate change adaptation and mitigation awareness are extremely low. Pakistan's low adaptive capacity due to high poverty rate, limited financial resources and shortage of physical resources, and continual extreme climatic events including varying temperature, continual flooding, melting glaciers, saturation of lakes, earthquakes, hurricanes, storms, avalanches, droughts, scarcity of water, pest diseases, human healthcare issues, and seasonal and lifestyle changes have persistently

threatened the ecosystem, biodiversity, human communities, animal habitations, forests, lands, and oceans with a potential to cause further damages in the future.

This is ironical for a country, which ranks 135th in the world in terms of global green house gases (GHG) emissions per capita, but ranks 16th in terms of vulnerability to climate change. The likely effect of climate change on common residents of Pakistan with comparison to the world and their per capita impact of climate change are terribly high with local animal species facing extinction regardless of generating and contributing diminutively to global GHG emissions. Pakistan has faced overwhelming losses due to only floods that have negatively impacted infrastructure and the agriculture sector in Pakistan. In 2010 alone, those losses exceeded US\$ 9.6 billion. Since 2010, five consecutive floods resulted in more than US\$25 billion of economic loss in damages to different sectors like agriculture, irrigation, public infrastructure, health and educational facilities, etc. Industries associated with cotton, which is the main cash crop in the country, are among the most affected. Pakistan's economy has been punched heavily by the continuous spell of droughts for many years, particularly in the provinces of Balochistan and Sindh. The droughts in these areas have reduced the river flows, resulting in drying up of the irrigation canals, leading to a severe agricultural deprivation. The increased temperatures because of the increased greenhouse gases as well as a mismanagement of the water reservoirs need to be blamed for the condition. As an ill effect of global warming, the annual mean surface temperatures in Pakistan have been steadily increasing during the past century. According to the United Nations forecast, world's population is expected to increase from 7.2 billion today to 8.1 billion in 2025. Likewise, Pakistan is also facing the same situation of increasing population and climate change impacts on economy. Severe increase in temperature and heat waves has also negative impacts on food production as well as energy sustainability. Climate change is adversely affecting the yield of major crops by rise in temperature, irregular precipitation and extreme droughts. It has been increasingly realized that climate change is the most important factor that is likely to affect productive resources and ultimately the agriculture production in a number of ways. During FY- 2016, cotton production stood at 10.074 million bales as compared to 13.960 million bales in FY- 2015 and registered a drastic decline of 27.8%.

It is evident that comparatively investments requiring technological innovations and financial resources for adaptation have been less attractive in the country and for that Pakistan would need the support of international community. Innovative technological progress has been barely implemented in Pakistan as well which would be a much more cost-effective method for environmental protection rather than expending billions on large-scale infrastructure whose benefits are debatable. Pakistan's high vulnerability to adverse impact of climate change, specifically extreme climatic events, imply that the country is in critical need of innovative adaptation to protect its natural ecosystems along with people and properties. Innovative adaptation of these technologies is poised to play an essential role in adapting to climate change which has been widely unexplored for its exploitation.

4.2: Climate Innovation Needs Assessment

Pakistan's TNA process largely remained country driven, participatory in nature for identifying its priority technologies to adapt for sectors economically important and vulnerable to climate change. Pakistan adopted three tiered approach which included to a) identify sustainable development needs and priorities of the country in the face of climate change challenges; b) identify and prioritize climate vulnerable sectors; c) identify, assess and then prioritize adaptation technology needs of the country within these prioritized sectors through multi criteria decision analysis (MCDA) tool.

Based on the final total weighted score, three prioritized technologies identified through TNA process for water sector of Pakistan are:

1. Surface rainwater harvesting
2. Ground water recharge
3. Urban stormwater management

Likewise, priority adaptation technologies identified for agriculture sector of Pakistan are:

1. High efficiency irrigation systems for irrigated and rain-fed areas
2. Drought tolerant crop varieties
3. Climate monitoring and forecasting - early warning system

5. Stakeholder Consultation on Climate Innovation

Objective of the Consultation

- Explore possibility of co-development of products and tools with the end-users.
- Identify innovation projects that demonstrate regional applicability and scalability.
- Discuss the innovations and technologies that can be applied in Pakistan and transferred among SAR countries.
- Familiarize the audience with ADPC and CARE for South Asia project.

5.2: Summary of the Discussion

Welcoming the participants, Mr. Sajid Naeem, ADPC Pakistan Country Representative made introductory remarks related to the CIC National Consultation that revolves around identifying the innovation needs of Pakistan. Following the introductory session, Mr. Naeem requested Mr. Aslam Perwaiz (Deputy Executive Director, ADPC) to deliver a short presentation on CIC.

While presenting, Mr. Aslam Perwaiz, Deputy Executive Director of ADPC, laid stress on the innovation themes being explored in the CIC event and should aim to bring alignment with the needs of the Government of Pakistan. Further to it, he attracted the attention of all the participating organizations towards the key considerations of the CIC Project that is guided by four major pillars namely partnership, Scaling up, leveraging existing knowledge and sustainability.

Mr. Aslam emphasized the importance of ensuring the CIC project is owned by the government as it would eventually contribute towards building this initiative sustainable, scalable and replicable. He further added that APDC has launched the CIC project of such kind in South Asia for the first time that seeks to realize its full potential in collaboration with the government in the driving seat and technically led by the innovators along with their local partners.

Mr. Faizan Hasan - Deputy Director, Pakistan Council of Research in Water Resources expressed his desire to understand the geographical scope of the CIC outreach in Pakistan and also the allocation of CIC funding per country/region. Accordingly, Mr. Aslam responded to his query that the geographical focus is not confined as such. Ideally, the innovation can be at any geographical place that should unrestrictedly provide a niche to government, private businesses and local organizations in applying. Besides, most importantly it should also be in proportion to the protocol and local regulations of the government. According to the CIC norms, the CIC has not been narrowed down to innovation per country. ADPC is seeking quality and applicability oriented innovative ideas and concurrently it should be aligning with CIC's four principles (referring back to the presentation). Instead of division/allocation of funds per country, the call is seeking ideas that can be scalable and relevant to most South Asia countries.

Mr. Rasool Baksh appreciated the idea of CIC in Pakistan and subsequently sought clarifications related to the resilient infrastructure in the larger perspective of the call; whereas Pakistan needs resilient water infrastructure innovation to address climate change issues.

In response to his query, Mr. Aslam elucidated that the CIC call on resilient water infrastructure also qualifies as per the eligibility criteria since it also falls within the broader purview of a resilient infrastructure -transport and power. It is not limiting the innovators; rather it opens up a wide canvas for a larger inclusion. The Resilient infrastructure presents a larger scope that encompasses the climate resiliency of critical infrastructure including water infrastructure.

Mr. Khalid appreciated the idea of CIC in Pakistan, however, at the same time raised his concern about the grounds for a low-budgetary provision in CIC process. Mr. Aslam elaborated that there are seven areas around it that would form the basis for launching the CIC call for proposal. The seven areas are broad and brings (relatively) small amount and limited period are the key challenges. At ADPC we reflected on the challenges in the CIC process and as a result instead of curtailing the thematic areas, we kept them as it is offered. The underlying rationale is to encourage innovations that are primarily workable and scalable in the country, regionally and possibly globally. ADPC believes that by limiting the areas, we might fail to benefit from some of the potential innovation already underway in the country.

In consultation with the concerned Ministry/ Department the applicant would be responsible to come up with an idea and its pilot testing. The market rollout has been intentionally excluded in the CIC call. One of the key challenges is to manage risks around innovations as many promising innovators cannot test or pilot their ideas taking into account that their organizations cannot afford the financial risks. As a result, ADPC has decided that CIC would also be enabler for the disruptive ideas which are often associated with high financial risks. In fact, ADPC is facilitating to create an enabling environment in Pakistan for the promotion of innovations around contemporary climate challenges.

In his concluding remarks, Mr. Mr. Iftikhar Khalid, Country Project Lead thanked everyone for richly contributing in the consultative process by reiterating the four key pillars of the CIC which forms the bedrock of the CIC.

5.3: Outcome of the National Consultation

Mr. Wakil Suggested that CIC should broaden the scope of Climate Smart Agriculture and precisely outline sub thematic area in the CIC call that can possibly include specific fertilizers in the context of adaptation to climate impact, innovative climate smart irrigation technology, using innovative tools (e.g., earth observation tools, remote sensing and other latest technological breakthroughs) and also crop diversification; introducing climate resilient crops (Pearl millet, Sorghum etc) in the existing systems as well. The idea is to emerge from the traditional approaches of innovations in climate smart agriculture. In addition, the CIC innovation should essentially explore the technological solution to the recent massive locust attack in Pakistan which heavily eroded the agricultural sector last year. Such innovation should aim to monitor and eliminate the vast spread of invasive species that are enormously impacting the

agriculture sector.

Mr. Ghulam Zakir, Director, Irrigation Research Institute (IRI), Irrigation Department Government of the Punjab highlighted that Irregular availability of water is one the key issues for Agriculture production. The sub component of the Integrated Water Resource Management has a bigger picture therefore it calls for adding sub-themes in the CIC. Pakistan is the fourth largest groundwater withdrawing country in the world. Ground water resources are overly harvested, especially in Punjab province and at the same time the groundwater is exposed to the risk of pollution. Owing to such high risk, it lays a strong emphasis for constant monitoring of the groundwater and therefore it should be potentially included in the CIC call.

Mr. Faizan, enquired about building linkages for regional cooperation in case if the innovation is regional. In response to his query, Mr. Aslam assured that ADPC with the help of its country based team members would provide technical and managerial support for the regional cooperation.

6. Key Recommendations

The Climate Innovation Challenge for Pakistan would potentially aim to bridge the gap for investments in innovation in those sectors that are most vulnerable to climate change, namely the water resources, agriculture and energy, planning and transport. However, considering the enormity of the investment needs, it lays a strong emphasis to forge partnerships and collaboration across the South Asia region to (i) understand existing technologies that may be replicated and applicable in another SAR country without needing to reinvent the wheel; and (ii) co-develop and share technological innovations that require higher investments considering the economies of scale. As envisaged, with the purpose to steer this collaborative initiative, ADPC's role as a facilitator is crucial in this collective and collaborative climate innovation initiatives.

In Pakistan, Civil Society is considered as an umbrella phrase for a range of non-state and nonmarket citizen organizations and initiatives, network and unions operating in a expansive gamut of social, economic and cultural fields.

The Civil Society Coalition for Climate Change (CSCCC) is a licensed Coalition dedicated to highlighting the subject of climate change in Pakistan and influencing policymaking at the regional, national and sub-national levels through research, knowledge-sharing, and advocacy. CSCCC provides a networking platform for civil society organizations, climate experts, academia, researchers, media, private sector and concerned citizens to exchange ideas and build synergies while preserving and strengthening the autonomy and independence of its members.

The National Network on Climate Change (NNCC) is composed of representatives from the Government, NGOs, Academic/ Research institutions, Associations/ Networks representing the civil society, donor agencies, industry and media interested in climate related matters. The membership of network is restricted and may vary depending on requirements. Besides, other climate networking organizations representing large number of community based organizations are actively involved in CCA in Pakistan.

National Alliance for Climate Action - (LEAD) Pakistan, Fellows Network, National Network on

Climate Change (NNCC), All-Foresters Network, Climate Action Network South Asia (CANSA), Climate & Development Knowledge Network (CDKN), Climate Leaders Action Network (CLAN), Indo-Pak Media Group on Climate Change (IPMGCC), Knowledge Network on Climate Change (KNCC), Leadership for Reproductive Health (LRH) Forum.

In this backdrop, considering that ADPC places much emphasis on investing in community resilience, the grant challenge initiative is a good opportunity to build innovations in community resilience by engaging civil society organizations and grassroots communities and placing the emphasis of the grant challenge in continuing the opportunities for CSOs to engage with communities as well as working on technological innovations is both timely and appropriate. Such key potential CSOs need further handholding by ADPC in terms of honing their capacity that would enable them in making grant application.

Despite the strength of CSOs, academic institutions and communities in delivering effective community services, they lack such technical capacities in grant writing and subsequently can emerge as strong contender to diverse funding opportunities available. With the purpose to fill such crucial gap, it essentially calls for providing technical guidance to the civil society organizations by ADPC and its country partners in demystifying and simplifying innovative concepts and ideas and translating them into actionable proposals and programs.

Considering the nature of grant ceiling, there are untapped opportunities for agencies and entities to collaborate, co-develop and generate innovations through startups and disruptive technologies engaging youth, CSOs, academic institutions and communities to gain a comparative advantage of the CIC grants. Besides innovations, investments in research have always been a necessity to look at solutions to climate challenges in the sectors most vulnerable to climate change.

Opportunities

A key component of adaptation is technology. Technology can help protect society from changing climate conditions, improve productivity, and help in the more efficient use of threatened resources such as water. It is crucial to identify a number of existing and emerging technologies that can help Pakistan adapt to climate change. The objective encompasses in identifying and analyzing adaptation technologies that can ameliorate the potential adverse impact of climate change. In this context, CIC is intended to address the barriers that impede developing countries from the transfer, development and deployment of climate innovations.

Development benefits define climate change adaptation technologies, which offer the greatest value to Pakistan in meeting its current national development priorities. Implementation potential defines scale of implementation and diffusion of the technology, which can be realistically achieved if key barriers are overcome. Contribution to climate change response goals defines technologies, which will make the biggest contributions to the country's efforts for facilitating adaptation to climate change that will contribute to the country's effort to undertake and implement the climate-resilient development strategies and actions. Based on the assessment of innovation needs, ADPC identified key thematic areas focusing on partnerships, applicability and scalability of innovations and technologies.

Subsequent to the questions and answers session, the following themes for innovative technology were suggested for some of the major sectors in Pakistan:

- a) Specific fertilizers in the context of adaptation to climate impact, innovative climate smart irrigation technology, using innovative tools (e.g., earth observation tools, remote sensing and other latest technological breakthroughs) and also crop diversification; introducing climate resilient crops
- b) Locust invasion eliminator
- c) Groundwater monitoring

7. Annexes

Annex-1: Key Stakeholders Consulted

Sr._No.	Organization	Ministry/Dept/Instituion/NGO	Name of Invitees	Designation
1	Ministry of Water Resources (MoWR), Islamabad	International Water Logging and Salinity Research Institute (IWASRI), a research institute of WAPDA, Lahore	Mr. Munwar Ahmed	Director General
		Mona Reclamation Experimental Project (MREP), Mona, Bhalwal, Sargodha	Mr. Hafeez ur Rahaman Soomro	
		Lower Indus Water Management and Reclamation Research Project (LIM), Hyderabad.	Mr. Shakeel Ahmed	Director SMO, WAPDA/PD LIM
2	Ministry of Food Security and Research (MoFS&R)	Federal Water Management Cell (FWMC), Islamabad	Mr. M. Tahir Anwar	Director General Federal WM Cell
		Climate Change, Alternate Energy and Water Resources Institute (CAEWRI), NARC/PARC, Islamabad	Dr Bashir Ahmed	

3	Ministry of Science & Technology (MoST) -	Pakistan Council of Research in Water Resources (PCRWR), Islamabad	Dr. Muhammad Ashraf	Chairman
4	Ministry of Defence	Pakistan Meteorology Department (PMD), Islamabad.	Mr. Riaz Khan	Director General
5	University of Engineering and Technology, Lahore	Center of Excellence in Water Resources, Lahore	Dr. Noor Khan	Director
6	PMAS-Arid Agriculture University Rawalpindi	Faculty of Agricultural Engineering and Technology	Dr. Jehanzab Chema	
7	Ayub Agriculture Research Institute, Faisalabad		Dr. Asmat Ullah	Senior Scientist
8	Ghazi University, Dera Ghazi Khan	Department of Environmental Sciences	Dr. Muhammad Ishaq Asif Rehmani	
9	Buraq Integrated Solutions, Rawalpindi		Mr, Muhammad Asad	
10	National University of Sciences and Technology		Dr. Muhammad Azmat	

	(NUST), Islamabad			
11	UK Pakistan Science & Innovation Global Network (UPSIGN), Rothamsted, UK		Dr. Khalid Mehmood	
12	Institute of Soil & Environmental Sciences, University of Agriculture Faisalabad		Dr. Abdul wakeel	
13	Disaster Management Authority	National Disaster Management Authority (NDMA)	Muhammad Idrees Mahsud	Member (DRR)
14	NGOs	Baanh Baeli	Mr. Javed Jabbar / Mr. Younas Bandhani	Founding President
15		LEAD Pakistan	Syed Ahmed Hassan/ Mr. Kashif Rasheed	GM Operations/ Assistant Manager Finance
16		Mountain & Glacier Protection Organisation (MGPO)	Ms. Aisha Khan	Chief Executive
17		Pakistan Agricultural Colation	Mr. Naushad Ahmed Zuberi	
18		Participatory Integrated Development Society(PIDS)	Mr. Babar Shah Khan	Chief Executive Officer
19		Society for Safe Environment and Welfare of Agrarians in Sindh Pakistan	Obed Caleb, Irfan Safdar	Chief Executive Officer/Programme Manager

20		Society for Sustainable Agriculture & Friendly Environment (SAFE)	Muhammad Sharif/ Mr. Shoukat Ali Keerio	CEO,President/Admin & Finance Officer
21		World Wide Fund for Nature - Pakistan (WWF)	Mr. Hammad Naqi Khan/ Mr. Tahir Mehboob Ali	Director General-Ceo/Senior Manager Administration
22		Taraqee Foundation (TF)	Dr. Allah Dad Luni	Chairperson
23		DOABA	Mr. Liaquat Ali/ Mr. Javed Iqbal	Executive Coordinator/ Manager Programs
24		Help in Need	Mr. Saghir Yousaf/ Mr. Zahid Khan	Chief Operating Officer/ Sr manager Admin & HR
25		Strengthening Participatory Organisation (SPO)	Mr. Aaref Farooqui	Company Secretary
26		Association for Water, Applied Education and Renewable Energy (AWARE)	Mr. Ali Akbar/ Mr. Muhammad Siddique	ED/ Program Manager
27		Balochistan Rural Development Society (BRDS)	Mir. Haider Shahwani/ Mir. Ahmed	CEO/ Programme Director
28		Health and Nutrition Development Society (HANDS)	Dr. Shaikh Tanveer Ahmed	Executive Coordinator
29		Pakistan Rural Development Society (PRDS)	Sayed Ali Shah	Executive Director

30		Water, Environment and Sanitation Society (WESS)	Mr. Pervez Iqbal/ Mohammad Rafiq	Chief Executive/ Director Programs & Operations
31		Agha Khan Foundation, Islamabad	Ms. Nusrat Nasab	Global Head of Emergency Management



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