
Nepal

Innovations for Climate Adaptation and Resilience

**Current Status and Needs Assessment
2021**
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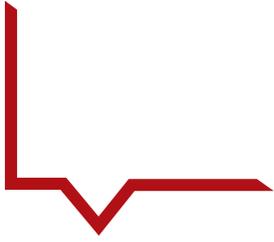


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Executive Summary

This report briefly outlines the Climate Innovation Challenge (CIC) consultation in Nepal 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. It basically provides a review of Climate Risk Profile of Nepal in general and its vulnerability to climate induced disasters in particular that builds a strong basis for the launching of CIC in the region.

As a least developed country located in the climate change hot spot of the Himalayas, Nepal has been one of the leading countries in the global south in recognizing climate change-related threats to its economy and initiating relevant actions. In view of the key role played by the Government agencies of Nepal in response to the climate impacts and in line with the CIC project outcomes, this report also put emphasis on the major relevant portion of National Adaptation Plan, FC1 & FC2 to UNFCCC, Policies and Strategies of the Government of Nepal. In addition, it also underlines the key thematic areas of the Technology Needs Assessment report highlighting the need for CIC process in Nepal as well as status of the ongoing various climate initiatives in the country funded by external agencies for building climate resilience.

The Government of Nepal has recognized climate change and its impacts as a key risk to the country's economy and its citizens, and has undertaken a series of climate risk management policies and strategies at the national, district, and local levels. The current scenario in Nepal presents a pressing situation and an opportunity to attain the full potential of innovative technological advancement to reduce vulnerability to disasters and climate risks. Nepal presents a realistic approach for assessing the extent to which efforts in addressing the country's critical need for harnessing innovative solutions that fundamentally target the end users. 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 created the scope in discussing its overall objective along with active participation from concerned government officials and key sector specialists that contributed in validating the basic idea of CIC. The CIC specifically encourages innovators to demonstrate tech solutions that are potentially scalable and transferable. The CIC consultation provided an opportunity to ADPC in technically providing suggested thematic areas for possible innovation challenge in Nepal and was also able to extract suggestions as well from the concerned Ministries/Departments. This document minutely concludes the CIC consultation by summing up the discussion summary, question & answers session 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 Nepal

Nepal is a landlocked country in South Asia, located in the Himalayas between India and China. The terrain is generally mountainous and contains many of the world's highest peaks, including Mount Everest (8,848 meters [m]). The country also has low-lying areas in the south with elevations less than 100 m. About 80% of the country's 28 million inhabitants (2019) live in rural areas. Small-scale, subsistence agriculture is the mainstay of Nepal's economy, employing 69% of the country's workforce (2015). Despite this, agriculture contributed only 25% to GDP in 2019, compared to a 60% contribution from the service sector. Nepal's National Planning Commission estimated in 2018 that around 28.6% of the population experiences multidimensional poverty with a clear divide between rural areas, where the rate is 33% compared to urban areas where the rate is 7%. An estimated 8% of Nepal's population is undernourished. Water and forests are Nepal's most abundant natural resources, with freshwater (derived from glaciers, snowmelt, and rainfall) accounting for an estimated 2.27% of the total world supply. This water feeds the country's major rivers: Koshi, Gandaki, and Karnali. Together, these river systems supply freshwater to a large portion of the 500 million people who live in the Ganges river basin. Nepal is highly vulnerable to climate change impacts and recent studies by the Asian Development Bank suggested Nepal faces losing 2.2% of annual GDP due to climate change by 2050. Due to a combination of political, geographic, and social factors, Nepal is recognized as vulnerable to climate change impacts, ranked 128th out of 181 countries in the 2019 ND-GAIN Index. The ND-GAIN Index ranks 181 countries using a score which calculates a country's vulnerability to climate change and other global challenges as well as their readiness to improve resilience.

2.1: Nepal vulnerability to climate induced disasters

Nepal experiences significant disaster risk, ranked 31st on the 2019 INFORM Risk Index. Key drivers of risk in Nepal include its high exposure to flood hazard as well as its lack of coping capacity. Nepal also holds moderate exposure to drought hazard, and moderate levels of vulnerability. However, the largest source of exposure-risk derives from earthquake. While not directly linked to climate change, earthquake exposure remains relevant in the context of a changing climate. More precipitation and higher temperatures affect the stability of terrain and hence susceptibility to hazards from mudflows, avalanches, GLOFs and landslides that could be triggered by an earthquake. Additionally, risk of simultaneous, multi-hazard, exposure is significant for instance hydro-climatic hazards following an earthquake have been shown to compound damages.

Drought

Two primary types of drought affects Nepal, meteorological (usually associated with a precipitation deficit) and hydrological (usually associated with a deficit in surface and subsurface water flow, potentially originating in the region's wider river basins). At present Nepal faces an annual median probability of severe meteorological drought of around 2%, as defined by a standardized precipitation evaporation index (SPEI) of less than -2. There is some evidence that drought frequency in Nepal increased between 1981–2012.

Flood

The World Resources Institute's AQUEDUCT Global Flood Analyzer can be used to establish a baseline level of flood exposure. As of 2010, assuming protection for up to a 1 in 10-year event, the

population annually affected by river flooding in Nepal is estimated at 157,000 people and the expected annual impact on GDP is estimated at \$218 million. This is higher than that of UNISDR who placed a figure of \$143 million on average annual losses to all types of flood in 2014. Nepal also faces a growing hazard from glacier lake outburst floods. Nepal is believed to contain well over 1,000 glacier lakes although most do not represent a threat to Nepalese communities.

Landslide

Landslide is one of the very common natural hazards in the hilly region of Nepal. Both natural and human factors such as steep slopes, fragile geology, high intensity of rainfall, deforestation, unplanned human settlements are the major causes of landslide. The risk of landslide is further exacerbated by anthropogenic activities like improper land use, encroachment into vulnerable land slopes and unplanned development activities such as construction of roads and irrigation canals without proper protection measures in the vulnerable mountain belt. The hilly districts of Nepal located in the Siwalik, Mahabharat range, Mid-land, and also fore and higher Himalayas are more susceptible to landslide because of steep topography and fragile ecosystem.

Heatwaves and Cold Waves

The current median probability of a heat wave (defined as a period of 3 or more days where the daily temperature is above the long-term 95th percentile of daily mean temperature) in Nepal is around 3%. The median estimated probability of cold wave also sits at around 3% (defined as a period of 3 or more days where the daily temperature is below the long-term 5th percentile of daily mean temperature).

2.2: National Adaptation Policies and Strategies of Nepal

Nepal has established a set of very progressive and forward-thinking climate policies and plans, and an adequate institutional architecture to ensure adaptation planning is inclusive and bottom-up. For example, Nepal's 2001 MDG initiatives and its 2003 Sustainable Development Agenda both included addressing climate change issues as key to achieving its goals.

In 2016, Nepal submitted its Intended Nationally Determined Contributions (INDC) to the UNFCCC. In 2010, Nepal launched its National Adaptation Plan (NAP) process, which aims to reduce the country's vulnerability to climate change and to facilitate the integration of climate change adaptation in policies, programs and activities across sectors and levels (Ministry of Population and Environment [MoPE], 2016). Nepal's NAPA was approved by Cabinet in September 2010. It serves as a strategic tool to assess climate vulnerability and systematically respond to climate change adaptation issues through the development of appropriate adaptation measures. Nepal's NAP process builds on past experience with adaptation planning, including through the National Adaptation Programme of Action (NAPA), developed in 2010, and the Framework on Local Adaptation Plans for Action (LAPA), developed in 2011, which has facilitated development of adaptation plans by Village Development Committees across the country. In 2019, the government of Nepal has held a national level consultation workshop to share the outcomes of its recent seven provincial level workshops on its NAP for laying the groundwork for integrating adaptation into development planning. Recently the Government of Nepal has presented its enhanced second Nationally Determined Contribution (NDC) under the Paris Agreement for the period 2021-2030. The Government of Nepal has sent its first National Communication to UNFCCC in 2004 and its second National Communication National Communication to UNFCCC in 2015

The Fifteenth Plan (Fiscal Year 2019/20 – 2023/24) prepared by National Planning Commission has a key focus on Climate Change and aims to increase the adaptive capacity by

minimizing the adverse effects of climate change. Besides, accessing international finance and technologies available for mitigation and adaptation and distribute the benefits equitably.

Nepal released its Climate Change Policy in 2011 (GON, 2011). Its content is influenced by the NAPA, and it was developed out of a need to address climate change impacts. It also aims to take advantage of opportunities arising from efforts to address climate change to in turn improve livelihoods while driving climate-friendly physical, social, and economic development.

There has been a fair amount of restructuring in the Nepali government in recent years, which has led to a dynamic situation in relation to responsibilities for climate change. At the highest level is the Climate Change Council, a 25-member apex political body established in 2009 under the chairmanship of the prime minister. It has also set up Climate Change Council, Climate Change Coordination Committee and REDD Coordination and Monitoring Committee at the political levels and Multi-stakeholder Climate Change Initiatives Coordination Committee and REDD Working Group chaired by Secretaries of the concerned ministries provide guidance, ensure coordination and function to align climate change with development activities.

Nepal's National Water Resources Strategy, developed in 2002, recognizes climate variability and its potential impacts on the country's water resources. Similarly, National Water Plan from 2005 enhances institutional capabilities and measures for managing water-induced disasters and mitigation of their adverse effects.

The National Strategy for Disaster Risk Management in Nepal (2008) is an integrated effort to reduce disaster risk by defining five main priorities and associated activities. Climate change is has been recognized as a serious risk in the Strategy that intensifies the problem of GLOFs and increases climatic variations that lead to frequent floods and droughts.

The Nepal National Biodiversity Strategy and Action Plan, 2014–2020, is a guiding framework for the management of the country's biodiversity. The plan outlines some of the likely impacts of climate change on biodiversity, along with some of the main climate change mitigation and adaptation gaps, issues, and challenges Nepal is facing.

Nepal's National Urban Development Strategy (2015) identifies climate change as a major risk factor, particularly in the context of increasing poverty trends in urban areas and the likelihood of increased numbers of refugees moving to urban areas due to disasters.

In 2011, the Climate Change Adaptation and Disaster Risk Management in Agriculture: Priority Framework for Action 2011–2020 was developed by the Nepalese Ministry of Agriculture and Cooperatives (MOAC), with a 10-year timeline ending in 2020. The Agricultural Development Strategy, which supports investments in agricultural research and strengthening of services ensures Climate Smart Agriculture promotion.

2.3: Priority Adaptation Actions

The National Adaptation Plan for Nepal framework is thematically profiled into adaptation

pathways as follows:

THEME	ADAPTATION PATHWAYS
Agriculture and Food Security (Thakur, 2017b)	<ul style="list-style-type: none"> • Development of adaptive technologies, varieties and breeds • Development of efficient irrigation and water management systems • Promotion of climate-resilient agricultural practices • Climate information services, including early warning systems and sectoral information systems • Improvement of grain and food storage and distribution systems • Promotion of financial services and insurance • Development and strengthening of farmers' networks and institutions
Forests and Biodiversity (Karki, 2017a)	<ul style="list-style-type: none"> • Establish objectives for the future forest under climate change • Increase awareness and education within the forestry community about adaptation to climate change • Determine the vulnerability of forest ecosystems, forest communities and society • Develop present and future cost-effective adaptive actions • Manage the forest to reduce vulnerability and enhance recovery • Monitor to determine the state of the forest and identify when critical thresholds are reached • Manage to reduce the impact when it occurs, speed recovery and reduce vulnerability to further climate change
Water Resources and Energy (Adhikari, 2017c)	<ul style="list-style-type: none"> • Analyze climate change trends and future scenarios for water resources and energy • Conduct vulnerability assessment for the sector • Identify and appraise adaptation options • Develop strategies for implementing adaptation options • Integrate adaptation options into policies and plans
Climate-Induced Disasters (Chhetri, 2017a)	<ul style="list-style-type: none"> • Strengthening the hydrological and meteorological infrastructure and scientific information systems • Enhancing the Early Warning Systems for climatic hazards throughout the country • Addressing the risk of GLOFs in the Himalayan regions • Building infrastructure to protect major assets such as roads, hydropower installations and water and irrigation systems • Building and enhancing flood and landslide management systems, including watershed and catchment management to address flash floods • Promotion of water management and water saving technologies for domestic use, recreation, irrigation and energy production • Strengthening national disaster management systems and institutions, including by building human resources • Setting up and allocating funds to prepare for and respond to climate-induced disasters

THEME	ADAPTATION PATHWAYS
Public Health and WASH (Pandit, 2017b)	<ul style="list-style-type: none"> • Capacity building for professionals, government institutions and other stakeholders to support adaptation-related activities • Improvement of physical systems and infrastructure to withstand climate risks • Strengthening of services and institutions to manage climate-related health risks • Promoting research and development on climate change and health • Establishment, management and application of databases to track climate change impacts and adaptation in the health sector • Reaching the unreached and most vulnerable populations and settlements with health services • Fostering collaboration among and across sectors to promote adaptation for health
Tourism, Natural and Cultural Heritage (Devkota, 2017a)	<ul style="list-style-type: none"> • Analyze current and future impacts of climate change on tourism, including the economic impact • Conserve and build upon indigenous knowledge systems for adaptation • Development of guidelines and enforcement of standards for climate resilience of tourism and cultural infrastructure • Develop insurance mechanisms for tourism activities and infrastructure • Integration of climate change adaptation into tourism and cultural policies and plans, and vice versa • Strengthen early warning systems, safety provisions and rescue and recovery plans for the tourism sector • Allocate funds and implement climate change adaptation projects and programs in the tourism sector • Establish coordination mechanisms for adaptation in the tourism sector, bringing in stakeholders from government and the private sector
Urban Settlements and Infrastructure (Joshi, 2017a)	<ul style="list-style-type: none"> • Develop early warning systems and raise awareness of risks from landslides, floods, GLOFs and other climate risks • Enforce land-use planning and bylaws to reduce construction in highly exposed areas such as floodplains and landslide-prone areas • Develop climate-resilient design guidelines for critical infrastructure such as roads, bridges, dams and public buildings such as schools and hospitals • Emergency planning for urban areas • Establish insurance mechanisms • Physical protection measures such as retaining walls, drainage systems, trapping dams, etc. • Relocation of at-risk communities and infrastructure

THEME	ADAPTATION PATHWAYS
Gender and Social Inclusion (marginalized groups) (Mainaly, 2017b)	<ul style="list-style-type: none"> • Introducing agricultural technologies that are socially and gender-inclusive • Addressing resource access issues related to forests, water and energy for women and marginalized groups • Structural changes in social norms and values • Inclusive early warning systems • Awareness programs and insurance mechanisms for women and marginalized groups engaged in tourism-related businesses • Identification of options for diversification of livelihoods for women and marginalized groups
Livelihoods (Bishokarma, 2017b)	<ul style="list-style-type: none"> • Support diversification of livelihoods, including non-farm-based strategies • Enhance adaptive capacity of marginalized groups • Land reform • Climate change education • Increase access to financial services • Create financial incentives for adaptation (such as subsidies and payments for ecosystem services) • Promote alternative industries
Governance (Bishokarma, 2017b)	<p>Establish climate change sections in all development ministries</p> <p>Establish functional local disaster management committees</p> <p>Climate change financing framework</p> <p>Integration of climate change in local-level planning processes</p> <p>Increase private sector investments in adaptation</p> <p>Enable asset building and access to insurance for vulnerable groups</p>

2.4: Climate Change projection and impacts on key sectors

Warming in Nepal is projected to be higher than the global average. By the 2080s, Nepal is projected to warm by 1.2°C–4.2°C, under the highest emission scenario, RCP8.5, as compared to the baseline period 1986–2005. The range in possible temperature rises highlights the significantly lower rates of warming expected on lower 21st century emissions pathways. Rises in maximum and minimum temperatures are expected to be stronger than the rise in average temperature, likely amplifying the pressure on human health, livelihoods, and ecosystems. Temperature increase is expected to be strongest during the winter months. Climate change is already having significant impacts on the environment in Nepal, species' ranges are shifting to higher altitudes, glaciers are melting, and the frequency of precipitation extremes is increasing. Natural hazards such as drought, heatwave, river flooding, and glacial lake outburst flooding are all projected to intensify over the 21st century, potentially exacerbating disaster risk levels and putting human life at risk. Modelling has suggested that the number of people annually affected by river flooding could more than double by 2030 as a result of climate change. At the same time the economic impact of river flooding could triple. The vulnerability of Nepal's communities, particularly those living in poverty, in remote areas, and operating subsistence agriculture, increases the risk posed by climate change.

Climate change will influence food production via direct and indirect effects on crop growth processes.

Direct effects include alterations to carbon dioxide availability, precipitation and temperatures. Indirect effects include through impacts on water resource availability and seasonality, soil organic matter transformation, soil erosion, changes in pest and disease profiles, the arrival of invasive species, and decline in arable areas due to dryland expansion and shifts in local hydrology. On an international level, these impacts are expected to damage key staple crop yields, even on lower emissions pathways. Tebaldi and Lobell (2018) estimate 5% and 6% declines in global wheat and maize yields respectively even if the Paris Climate Agreement is met and warming is limited to 1.5°C. Shifts in the optimal and viable spatial ranges of certain crops are also inevitable, though the extent and speed of those shifts remains dependent on the emissions pathway. Both historical and projected measurement of the impacts of climate change on crop productivity in Nepal presents a mixed outlook.

A further, and perhaps lesser appreciated influence of climate change on agricultural production is through its impact on the health and productivity of the labor force. Dunne et al. (2013) suggest that global labor productivity during peak months has already dropped by 10% as a result of warming, and that a decline of up to 20% might be expected by the 2050s under the highest emissions pathway (RCP8.5). This phenomena could impact Nepal's lowland areas where extreme high heats will increasingly be experienced. Further research is required on the net effect as there may also be potential for productivity gains in upland areas where warming will make previously extremely cold environments more tolerable. In combination, it is highly likely that the above processes will have a considerable impact on national food consumption patterns both through direct impacts on internal agricultural operations, and through impacts on the global supply chain.

The spatial and temporal distribution of fresh water is highly sensitive to climate change resulting in more unfavorable situation. These impacts are more prominent in mountainous country like Nepal. The dense orographic barriers and substantial snow and glacier cover areas are mainly accountable for such responses affecting the planning, development and management of water resources of the country. Trend of annual discharge of three major river basins (Koshi, Gandaki and Karnali) indicates that discharge in these major basins is decreasing annually but contrary to this fact, annual discharge in southern basins are in increasing trend. Bagmati river basin which originates in Middle mountain region also has decreasing annual flow. Time series analysis of monthly discharge data shows a decreasing trend in monsoon season (June – September) whereas an increasing trend in other months. 2nd Communication to UNFCCC

Nepal is home to a wealth of biodiversity, many unique Himalayan ecosystems, and natural resources. As well as their intrinsic value and the cultural value these assets hold to local communities, Nepal's natural resources underpin many sectors of the country's economy. Studies suggest significant changes are already under way in many Himalayan eco-regions as a result of climate changes. A key indicator of change is the increase in the length of the plant growing season which has been widely documented. Earlier onset

of the growing season has been documented particularly in the higher altitude areas of the Himalayas where highest rates of warming have also been measured. Indicators such as the length of the growing season, the average precipitation, precipitation as snow, and the seasonality of precipitation and temperature all signal likely shifts in the suitable geographical ranges of flora and fauna.

The World Food Program estimate that without adaptation the risk of hunger and child malnutrition on a global scale could increase by 20% respectively by 2050. Springmann et al. assessed the potential for excess, climate-related deaths associated with malnutrition.⁷⁴ The authors identify two key risk factors that are expected to be the primary drivers: a lack of fruit and vegetables in diets, and health complications caused by increasing prevalence of people underweight. The study suggests there could be approximately 61.9 climate-related deaths per million population linked to lack of food availability in Nepal by the year 2050 under RCP8.5. Many vector-borne diseases are prevalent in Nepal, including: malaria, dengue, chikungunya, Japanese encephalitis, visceral leishmaniasis, lymphatic filariasis. Most are endemic in the lowland Terai and hills of Nepal placing about 80% of the population at risk. Climate change is also expected to increase the potential for transmission of water-borne diseases.

In recent years, Nepal has experienced an increase in soil erosion, landslides and flash floods across the country and has raised concern related to impact of Climate Change on Infrastructure. Extreme weather events are projected to increase in intensity and frequency, damaging homes and infrastructure, including roads, bridges, hydropower plants and public buildings, including schools. Impacts are expected to be concentrated around urban settlements, water resources and energy infrastructure. Rising temperatures in the Himalayas can also result in GLOFs, which can trigger flash floods of debris and water from high elevations to downstream communities, damaging infrastructure and causing property loss.

Effects of climate change on water resources yield multiple implications either due to too much and/or too little water. Climate-induced water stresses directly affect agricultural productivity, food security and human health conditions. At the same time, too much water induces floods, and other geological hazards with consequences on human settlements, critical infrastructures and land resources. Changes in the flow regime of its water bodies will have a direct implication on its renewable energy sector including hydropower projects.

3. Ongoing Climate Resilience Initiatives in Nepal

GCF funded project “Improving Climate Resilience of Vulnerable Communities and Ecosystems in the Gandaki River Basin in Nepal.” This cross cutting project amounting to USD 32 million adopts an ecosystem-centred and community-based approach to address key barriers identified in reducing climate vulnerability

GCF funded project Building a Resilient Churia Region in Nepal. The project takes an integrated approach in restoring ecosystems, including forests, while taking into account land use needs. It includes an element of strong stakeholder engagement, including with all levels of government and community-based organizations.

ADB agreed a Country Partnership Strategy (CPS) with the Government of Nepal covering the period 2020–2024 to support for Nepal’s efforts to cope with climate are addressed under the fifth of five thematic drivers, environmental sustainability.

The World Bank agreed a Country Partnership Framework (CPF) with the Government of Nepal covering the period 2019–2023. Climate change is addressed in the third focus area of the CPF.

Funded by Least Developed Countries Fund and in partnership with the WHO the “Building Resilience of Health Systems in Asian LDCs to Climate Change” would increase the adaptive capacity of national health systems and institutions, and sub-national level actors, to respond to and manage long-term climate-sensitive health risks in six Asian LDCs including Nepal.

The Government of Nepal, United Nations Development Programme (UNDP) and the Global Environment Facility-Least Developed Countries Fund launched a new US\$42 million climate adaptation project to help secure sustainable livelihoods and food security for vulnerable rural communities in east of the country.

Oxford Policy Management with Practical Action Consulting is supporting the UK- DFID with designing a second phase of Nepal’s Climate Change Support Programme (NCCSP) in collaboration with the Government of Nepal. NCCSP Phase II is an important government-led climate adaptation and disaster risk reduction project in Nepal.

ICIMOD supported “Enhanced resilience and adaptive capacities of Hindukush Himalaya region” including Nepal through research, piloting, and adoption of resilient solution packages, along with knowledge sharing and capacity building. It aims to increase the resilience of women and men in the HKH to socio-economic and environmental changes, including climate change.

4. Need Assessment for Innovations in Nepal

4.1: Problem Statement

Nepal has observed trend of annual increase in temperature per decade by 0.41°C which is much higher than global average. Climate change is relatively new challenge of global scale but have strong local effects. The evidences of the global warming and climate change are more prominent on the Himalayan region of the globe with melting of ice, glacier retreat, and worst of all the incidence of glacial lake outburst floods with the aftermath falling directly on the ecosystem. The most critical areas are the resource poor developing countries like Nepal which are first to face this calamity yet helpless to implement any concrete ideas still. Nepal has to develop its mechanism to disseminate information regarding climate change and its rational use in planning and implementing adaptation policy processes with simultaneous approach to follow the trend of climate change. The high vulnerability score and low readiness score of Nepal places it in the upper-left quadrant of the ND-GAIN Matrix. It has both a great need for investment and innovations to improve readiness and a great urgency for action. Nepal is the 44th most vulnerable country and the 64th least ready country.

Nepal lies in Hindukush Himalaya region. A report published “The Hindu Kush Himalaya Assessment: Change, Sustainability and People” published by ICIMOD has come up as a wakeup call for the international community. It warned that the Himalayan region will face a tremendous meltdown if concrete actions are not taken immediately to cut world carbon emissions. The report concluded that such “larger warming could trigger a multitude of biophysical and socio-economic impacts, such as biodiversity loss, increased glacial melting, and less predictable water availability—all of which will impact livelihoods and well-being in the Hindu Kush Himalaya region.

Review of research papers shows that vulnerability of Nepal may be alleviated by the fact of country's fragile ecosystem, uneven topography, high dependency on agriculture, hydroelectricity and low GDP. It was seen that climate impacts many key sectors of Nepal like agriculture, hydroelectricity, food security, tourism and many others. Climate change is expected to cause many other climate-induced hazard like flood, drought, landslides. Thus, these impacts will directly impact the economy of the country and hence the livelihood of the people.

Agriculture and food security

In terms of agriculture and food security, local communities have identified changes in climate as being largely responsible for declining crop and livestock production. Nepal's vulnerable subsistence farming economy is facing risk due to changes in the reliability of stream flow, a more intense and potentially erratic monsoon rainfall, and the impacts of flooding. Decline in rainfall from November to April adversely affects the winter and spring crops. Rice yields are particularly sensitive to climatic conditions and these may fall in the western region where a larger population of the poor live and this could threaten overall food security (DFID, 2009). Assessment also shows that climate change is posing a threat to food security due to loss of some local land races and crops (Regmi and Adhikary, 2007).

Water resources and energy

Effects of climate change on water resources could yield manifold implications either due to too

much and/or too little water. Climate-induced water stresses directly affects agriculture productivity, malnutrition, human health and sanitation. On the other hand, too much water impacts human settlements, infrastructure and agriculture land. Local communities highlighted that climate-induced events have direct impacts on renewable energy sources. For instance, changes in river flow will have direct implications for micro-hydro projects in the hills and mountains; an increase in the number of cloudy days and changes in the form of precipitation (from snowfall to hailstones) adversely affects solar power potential in the mountain; and increased incidence of forest fires threatens the availability of already scarce fuel-wood sources.

Nepal's development is being severely restricted by lack of access to energy. Over 85% of the population relies on traditional biomass for their energy supplies and 18 million people do not have access to electricity.⁵ Approximately 90% of Nepal's electricity production is from hydropower. Irregularities in streamflow affect the reliability of hydropower, and siltation from landslides and flood events further reduces power generation efficiency.

Forests and biodiversity

Increased temperature and rainfall variability have resulted into shifts in agro-ecological zones, prolonged dry spells, and higher incidences of pest and diseases. Studies show that new alien and invasive species are emerging and their habitat is spreading at a fast rate. Extreme climatic conditions have led to increased incidence of fire in recent years affecting more than 50,000 people⁷ and loss of large areas of productive forest land. These changes (amongst other drivers) lead to species and habitat loss. Communities also observed that they are experiencing seasonal changes observed in terms of early sprouting, flowering and fruiting. In some cases, these changes have benefited communities by increasing the ecological range of cultivation for certain crops. In other cases, climate change has negative impacts, for example, productivity of some species like panch aule (*Dactylophiza hatageria*), silajit (Rock Exedutes) amala (*Embliba officianalis*), ritha (*Sapindus mukurosii*), timur (*Zanthoxylum armatum*), and bel (*Agle marmelos*) are declining and shifting to higher altitude and green grasses have declined sharply in the Himalayan region (eg. Mustang). The review conducted by the TWG on forests and biodiversity also suggests that critical ecosystem and serious such as wetlands are depleting due to more frequent disasters and water scarcity.

Public health

The current lack of primary healthcare for majority of populations also contributes to their vulnerability to future climate change. Because of the poor state of health services in Nepal, public health can indeed be at a higher risk than before from adverse impacts of climate change. Effect on human health is the outcome of several factors, the main factor being the environment. Human health is already at risk from a number of diseases and malnutrition. Human-induced climate change may soon become another major contributor to the spread of infectious diseases.

Many vector-borne and water-borne infectious diseases are known to be sensitive to changes in climatic conditions. The present analysis reveals potential impacts of climate change on health especially on the growing risk of malaria, kala-aza (visceral leishmaniasis) and Japanese encephalitis outbreaks with mosquitoes being the vector of these diseases. Subtropical and warm temperature regions of Nepal would be particularly more vulnerable to Japanese encephalitis as well. Many of the common diseases in Nepal are climate-related. With changes in the climate, diseases such as malaria, Japanese encephalitis and kala-azar may spread to new regions (Regmi and Adhikari, 2007).

Urban settlement and infrastructure

In the context of urban settlement and infrastructure, most impacts are cross-thematic in nature and are largely related to climate-induced disasters. These disasters have severely affected the infrastructure, such as road, bridges, community and public buildings, and schools. The impacts are concentrated around urban water and energy resources and adversely affected infrastructure and human health. The urban planning process has increasingly become more challenging due to influx of climate-induced rural-urban migration. In terms of public health and climate-induced disasters, changes in climate are likely to exacerbate a number of existing health-related problems.

The problems of today, such as drought, forest fires, and flooding, will only be magnified by climate change in this country. In Nepal, changes in monsoon patterns will greatly exacerbate the situation of unacceptable presence of poverty and inequalities of opportunities in the country. While many Nepalese people are coping autonomously to current stresses, the government must design and implement effective strategies to adapt to climate change impact to achieve economic and social progress and concurrently tap innovative adaptation technologies. Adapting to climate-related problems with innovative adaptation technologies calls for a creative engagement among government, private actors and the civic movement. While taking adaptive innovation measures, Nepal would need active support through global efforts for adjusting to the climate change.

4.2: Climate Innovation Needs Assessment

The NAPA process for Nepal identified climate change adaptation needs across sectors depending on the climate sensitivity of each sector. In a cluster of priority activities drafted under the NAPA process, the climate adaptation needs are profiled as needs for

1. Community based integrated management of agriculture, water, forest and biodiversity.
2. Improved system and access to services related to agriculture development.
3. Community-based disaster management and disaster risk reduction.
4. Forest and ecosystem management.
5. Improving and empowering community through public health education, response, forecasting/early warning and surveillance systems.

The need for technology innovation in the agriculture sector, which in turn is directly related to Nepal's food security are set in the broader perspectives of sustainable agricultural land use system, agrobiodiversity management, and favorable and conducive governance mechanisms to facilitate local level adaptation measures. This targets the need for access to seeds, technology, market, increasing agro-ecosystem resilience and crop productivity enhancement and improving cropping practices. Recognizing the increasing significance of climate change effects on the sector, the NAPA process has identified the need for adaptation practices in improving disaster resilience, diversifying livelihoods, providing insurance and early warning system in a community led process and initiatives.

The priority needs in the water sector focus on better and more accessibility to information and technology, stronger and more adaptable institutions, and natural and human-made infrastructures to store, transport and treat water. Immediate needs in this sector are efficient and

multipurpose water uses, conservation of watershed areas, and improved hydrological and meteorological stations.

The priority need in the forest and biodiversity sector focuses on dealing with impacts as well as opportunities by way of ensuring ecosystem health through watershed and landscape level management, empowering communities and service providers

Adaptation priority need in the health sector are largely focused on awareness raising and public health initiatives at the community level such as increasing access to information and knowledge on the impacts of climate change on human health particularly with regard to emergence and outbreak of climate related diseases.

With regard to climate change adaptation in the urban settlement and infrastructure sector, the need focuses on climate smart urban settlement including climate resilient building codes, rehabilitation, increasing groundwater use efficiency, and efficient water planning and implementation.

With the support of the UNEP the Ministry of Science, Technology and Environment (MOSTE) has prepared Technology Needs Assessment (TNA) as a part of the activities included in the UNFCCC. Technology transfer is an important mechanism to assist Nepal in addressing climate change. Nepal is using both traditional (indigenous) and modern technologies to address climate change.

Indigenous water resource management practices: Examples of indigenous knowledge and technology on water resource management include underground canals, water storage by tank system, and water transfer by gravity. Traditional water mill (pani ghatta) used for grinding wheat, maize, millet etc. is a fine example of indigenous technology.

Indigenous forest management practice: Ban on cutting certain type of trees on religious beliefs, and declaring certain species as scared species help in maintaining ecosystem health and to cope with unpredictable climates.

Indigenous pest management practices: Indigenous people often use locally available plant materials for pest management. Instead of using pesticide, the use of titepati juice, neem powder, ash, or oilcake can effectively safeguard crops from pest attack.

Technology is an important mechanism to assist Nepal in addressing climate change. In this context, the available technologies that fit best to overcome the burgeoning pressure of climate change can be categorized as water conservation, preparation of extreme weather events and diversification of water supply.

Existing technologies in this area are listed below:

Water conservation: Increasing the use of water efficient fixtures and appliances e.g. drip irrigation, sprinkler irrigation; leakage management e.g. detection and repair in canal/pipe system.

Preparation of extreme weather events: Bio-engineering; flood forecasting system; bore holes as drought intervention; use of permeable spurs. Diversification of water supply: Rain water harvesting from roofs; water reclamation and reuse

The fulfillment of water demand for crop cultivation under dire climatic variability is possible only with the water conservation measures (as discussed in water resources sector). In such situation, the technology requirement can be assessed based on two priorities namely resource management and niche-based farming.

Resource management: Integrated farming systems (IFS)-crop and livestock; minimum tillage; biochar.

Niche-based farming: Organic nutrient management; stress-tolerant crops and varieties; poly cropping.

Access to safe and clean drinking water is the indicator of the development status of the country and this directly links with the health status of the citizens. Efforts have been made to improve and increase the access of people to health support centers; however, the development has not been sufficient.

Water borne diseases: Healthcare liquid waste management; drinking water quality surveillance; water and sanitation (WASH) practice. Vector borne diseases: Mosquito nets; bacillus thuringiensis israeliensis (Bti); breeding area reduction.

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 Nepal and transferred among SAR countries.
- Familiarize the audience with ADPC and CARE for South Asia project.

5.2: Summary of the Discussion

The consultation began with the welcome address by Mr. Purna Chandra Lal Rajbhandari, Country project lead of CARE for SA. In his welcome remarks, he addressed and welcomed all the distinguished guests and participants by sharing an overview of CARE of SA project in Nepal.

The Opening Remarks was presented by Mr. Avani Mani Dixit, DRM Specialist of World Bank Nepal office. In his remarks, he highlighted the growing concern related to the severity of climate change impacts in South Asia. He further emphasized the overall objective of CARE for South Asia Regional Project supported by the World Bank in the three countries (Nepal, Nepal and Pakistan) aiming to work together and mitigate the transcending impact of climate change. He further laid stress that CARE project should endeavor to foster knowledge exchange and cooperation among the three countries.

The keynote speech was delivered by Mr. Aslam Perwaiz, the Deputy Executive Director of ADPC. He asserted that the main purpose of the consultation is to identify needs and priorities of Nepal thereby exploring a series of innovative and demand- driven technology-based solutions accompanied by local partnership for enhancing climate resilience in the country. He also took the opportunity to attract the attention of all towards the ADPC's engagement in Nepal and ongoing projects addressing climate resiliency in the country. CARE for South Asia project would a great opportunity for Nepal to take advantage of ADPC and RIMES' expertise. Later, he elaborated in his presentation about the CIC Outcomes, selection procedures for the innovators, project timeline and perspectives of CIC.

Subsequently, ADPC discussed the following key points in a threadbare:

The needs-based technological innovation should aim to identify such innovations that can be scaled up in the different geographical locations of Nepal. Winning applicants should demonstrate projects that are demand driven with a scope of regional scalability or transferability, and that also brings local partnerships.

The role of ADPC involves in providing technical support to the winning applicants and managing sub-grants throughout the implementation. ADPC would allow a full year to the applicants' projects to test and demonstrate their plan.

The innovations as envisaged may or may not succeed but it must strive to connect with government level- either city level or rural level. As a result it essentially builds a strong basis for inviting country consultation and seek Government's and other key stakeholder's inputs to receive meritorious proposals.

The call for proposals would be a global call inviting proposals. The jury would constitute members representing diverse backgrounds. ADPC assured that the selection procedures would deeply look into the equity, inclusiveness and transparency. The application process documentation would be provided to the local applicants in all relevant languages at each stage.

Mr. Anil Pokhrel presented vote of thanks to ADPC and RIMES for launching the CIC in Nepal also to the World Bank for funding support. In his concluding remarks, he proposed to exploit the knowledge sharing like success stories, good practices etc. from Bangladesh and Pakistan to Nepal for contributing in the learning outcomes.

5.3: Outcome of the National Consultation

Stress was laid for reaching out to 753 local bodies in Nepal in the CIC Consultation. Addressing such need of communicating the 753 local bodies, the National Disaster Risk Reduction and Management Authority (NDRRMA) offered to work together with ADPC team for ensuring proper communication about the CIC call. It was also felt that the Social media platforms such as Facebook, Twitter, Radios and Community radios are more effective in communicating these days than television in Nepal which should be considered for widespread dissemination of CIC.

The Transport sector resilience from climate risks and the investment required for enhancing its resiliency was also emphasized. There are various apps being developed but the results that it brings remains ineffective. Besides, NDRRMA also suggested ADPC/RIMES to jointly venture out in the risk communication that can be used to develop forecast system and support the DSS etc.

It was agreed upon to reach out the private sector which has recently exhibited large number of promising innovations. Besides, the traditional models of innovations bring lots of potential which needs to be explored while simultaneously plenty of innovations examples from the World Bank website should also be looked at. ADPC would widen the CIC scope in the mountains apart from the lowland areas as they are hardest hit regions of Nepal. Besides, Nature based solution innovations was discussed at length and was consequently endorsed.

The Geo-Environment and Social Unit Department of Roads suggested designing mobile apps as an innovation for mapping landslide vulnerable areas and also for warning/alerting by disseminating prior information to the travelers / transport sectors.

The Ministry of Forests and Environment laid stress to render certain due weightage to proposals submitted by the local level organizations/women groups as this would enable the representation of traditional knowledge and practices as well as the unrepresented groups

The Department of Hydrology and Meteorology highlighted key problem related to communication gaps in disasters. Innovating ways of communicating to end-users and passing on their recommendation/ feedback to different tiers of the government for timely disaster response.

The Ministry of Energy, Water Resources and Irrigation highlighted the need of collaborating with

academic institutions for exploring such innovative ideas as these academic institutions bring sound research based innovations. It was further suggested to include community EWS, Automatic Weather Stations, Automatic water level sensor etc. should be installed in case of GLOF.

The Climate Change Management Division, Ministry of Forests and Environment suggested to ramp up the scope in the mountain ecosystem in view of its low capacity to achieve resiliency. Besides, GESI Responsive innovation was also suggested.

The Ministry of Federal Affairs and General Administration emphasized on connecting with sub-national government and rural municipality. The rural municipality has innovative ideas, which we can increase their local climate resilience.

The Water Resources Civil Engineering Department, Institute of Engineering (IoE) suggested to include Hydro-climatic extremes as a part for innovation interventions along with Climate Advisory Systems – Climate Services as well.

6. Key Recommendations

The Climate Innovation Challenge for Nepal 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.

There is an enabling environment for the local Civil Society Organizations in Nepal to contribute fighting locally against the impact of climate change. Nepal's NAP process fits within the overarching institutional and policy framework for climate change and development in the country. The plan envisions integration of adaptation across the thematic areas, as well as increased collaboration among different stakeholders (including donors, INGOs, NGOs and local institutions) for implementation of adaptation actions.

The Fifteenth Five year plan of the Planning Commission of Nepal also seeks to increase the mobilization of NGOs and INGOs in social and economic development through coordination and collaboration among the three levels of government.

Within the Ministry of Population and Environment, the Climate Change Management Division, established in 2010, holds the key responsibility for advancing policy and action on climate change. It leads the established Multi-stakeholder Climate Change Initiatives Coordination Committee. The membership of the MCCICC includes the Thematic Working Group coordinators as well as representatives from the NPC, the Ministry of Finance, NGOs, academia, local government associations, and donor Climate Change Policy.

Ten Nepalese NGOs awarded cash prizes for Innovation in Climate Change: The Karyanwayan Prize, the last stage of the UK Aid-funded Adaptation at Scale (A@S) prize awarded ten non-governmental organisations (NGOs), community-based organisations (CBOs) and private sector companies with a total prize purse of £500,000 for developing innovative ways to expand community-driven climate change adaptation initiatives to benefit more communities ('scale out') and influence local and provincial policies and programmes ('scale up').

LI-BIRD has established loose network of NGOs in Nepal entitled - NGO group on Climate Change

for mainstreaming climate change issue is national priority. The network aims to raise awareness amongst key development NGOs on climate change, establish forum or group of such NGOs who carry out joint activity and support in generation of knowledge and technology transfer. Few other climate change networks namely Campaign for Climate Justice Nepal, Nepal Climate Change Network Nepal, especially to ratify Kyoto protocol initially, Disaster Network (DP-Net), NGO NCC – NGO network on climate change, NYCA – Nepalese Youth for Climate action, AINCCTF – Association for International NGOs Climate Change Task Force (which has merged (INGO deliberation platform), Climate Action Network South Asia (CANSA), Steering Committee Nepal – focus on international negotiations and SA regional issues Land rights group – land and climate change are actively working on various climate issues.

Over the period of time, extensive capacity building to these local CSOs have been carried out to collaborate on joint research studies, implementation projects, and regional knowledge-sharing programmes, grant application and shared fundraising opportunities. 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 grassroot communities and placing emphasis of grant challenge in continuing opportunities for CSOs to engage with communities as all as working on technological innovations is both timely and appropriate. Such key potential CSOs needs 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 the youth, CSOs, academic institutions and communities to gain a comparative advantage of 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.

Innovation 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 Nepal 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 Nepal 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. Areas of innovation may be one or all of the following:

- **Community -level-early warning systems**
- **Agriculture and Food Security**
- **Bio-diversity and ecosystems**
- **Health**
- **Infrastructure**
- **Water and enegyry**

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

- 1. Nature based solution innovations**
- 2. Traditional models of innovations**
- 3. Mobile apps for mapping landslide vulnerable areas and for Early warning**
- 4. Technology for addressing communication gaps in disasters**
- 5. Promoting Gender Responsive Disaster Risk Reduction**
- 6. Hydro-climatic extremes with Climate Advisory Systems – Climate Services as well.**

7. Annexes

Annex-1: Key Stakeholders Consulted

S.N	Organization	Representative / Designation/ Contact
Ministries / Departments / Research Institutions		
1.	Ministry of Federal Affairs and General Administration (MoFAGA)	Mr. Rishi Raj Acharya / Section chief and Under Secretary - Environment and Disaster Management Section,
2.	National Disaster Risk Reduction and Management Authority (NDRRMA)	Mr. Anil Pokhrel / CEO
3.		Mr. Krishna H. Pushkar / Joint Secretary
4.		Mr. Janardan Gautam / Under Secretary
5.		Mr. Nabaraj Jaisi / Under Secretary
6.		Mr. Ankit Karna / Associate
7.		Mr. Dinesh Subedi / Armed Police Force
8.		Mr. Sabin Katel / Armed Police Force
9.		Ministry of Energy, Water Resources and Irrigation (MoEWRI)
10.	Ministry of Agriculture and Livestock Development (MoALD)	Mr. Shankar Sapkota / Under Secretary
11.		Mr. Shib Nandan Shah / Project Director Agriculture Management Information System Project
12.	Ministry of Forests and Environment (MoFE)	Dr. Radha Wagle, Joint Secretary & Chief of Climate Change Management Division (CCMD)
13.		Dr. Arun Prakash Bhatta / Under Secretary, CCMD
14.		Ms. Srijana Shrestha Under Secretary, CCMD

15.		Mr. Somnath Gautam / Section Officer
16.	Department of Roads (DoR)	Ms. Shuva Shrestha / Sociologist, Geo-Environment and Social Unit
17.		Ms. Daisy Tamrakar / Engineer, Geo-Environment and Social Unit
18.		Mr. Hari Sharan Ghimire / Environment Safeguard Inspector Geo-Environment and Social Unit
19.		Ms. Rojina Tandukar / Computer Operator, Geo-Environment and Social Unit
20.	Department of Local Infrastructure (DoLI)	Mr. Krishna Bahadur Katwal / Senior Divisional Engineer
21.	Department of Hydrology and Meteorology (DHM)	Dr. Indira Kadel / Sr. Divisional Meteorologist
22.	Water and Energy Commission Secretariat (WECS)	Mr. Dinakar Khanal / Sr. Divisional Engineer
23.	Department of Electricity Development (DoED)	Mr. Jeebachh Mandal Deputy Director General
24.	National Agriculture Research Council (NARC)	Dr. Dhruba Bhattarai / Outreach Research Division Head
25.	Institute of Agriculture and Animal Science (IAAS)	Dr. Khem Raj Dahal / Professor
26.	Department of Water Supply & Sewerage Management (DoWSSM)	Mr. Anil Bhadra Khanal / DDG Climate Resilient Large Water Supply Project
Academic Institutions		
27.	TU - CDES (Tribhuvan University – Central Department of Environmental Science)	Dr. Kedar Rijal / Professor
28.	Institute of Engineering (IoE)	Dr. Vishnu Prasad Pandey Professor, Water Resources Civil engineering Department
29.	Kathmandu University (KU)	Mr. Prabin Acharya /

30.	TU - CDHM (Tribhuvan University - Central Department of Hydrology & Meteorology)	Dr. Deepak Aryal / Professor
<i>National Media</i>		
31.	Rastriya Samachar Samiti (RSS) National News Agency, Nepal	Mr. Krishna Adhikari / Editor
32.	Fox of Nepal Media	Mr. Surendra Shah / Editor
<i>World Bank</i>		
33.	World Bank Nepal	Mr. Avani Mani Dixit / DRM Specialist
<i>ADPC Country Representation in Nepal</i>		
34.	Asian Preparedness Partnership (APP) Program for Enhancement of Emergency Response (PEER)	Mr Man Thapa / Country Representative
44.	Building Resilience through inclusive and climate-adaptive Disaster Risk Reduction in Asia-Pacific (BRDR)	Ms. Premuka Rai / Programme Coordinator
45.	Regional Integrated Multi-Hazard Early Warning System for Africa and Asia (RIMES)	Dr. Dilip Kumar Gautam / Country Lead (Technical)
46.		Mr. Yoga Raj Pokhrel / Finance Expert
47.		Mr. Subesh Dhakal / Country Coordinator



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