



Sri Lanka

Innovations for Climate Adaptation and Resilience

Current Status and Needs Assessment

2021

(Updated Version-June 2021)

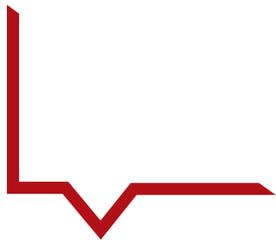


Table of Contents

EXECUTIVE SUMMARY	2
1. BACKGROUND	3
2. CLIMATE RISK PROFILE	4
2.1: VULNERABILITY TO CLIMATE INDUCED DISASTERS	4
2.2: NATIONAL ADAPTATION POLICIES AND STRATEGIES	4
2.3: PRIORITY ADAPTATION ACTIONS	6
2.4: CLIMATE CHANGE PROJECTION AND IMPACTS ON KEY SECTORS	6
<i>Projections and their Physical Effects</i>	6
3. ONGOING CLIMATE RESILIENCE INITIATIVES IN SRI LANKA	8
4. NEED ASSESSMENT FOR INNOVATIONS IN SRI LANKA	10
4.1: PROBLEM STATEMENT	10
TRANSPORT AND RESILIENT POWER INFRASTRUCTURE SECTOR.	10
EARLY WARNING FOR FOOD AND WATER SECURITY	10
AGRICULTURE AND CLIMATE SMART AGRICULTURE	10
AQUACULTURE AND COASTAL ZONE MANAGEMENT	10
4.2: CLIMATE INNOVATION NEEDS ASSESSMENT	11
5. STAKEHOLDER CONSULTATION ON CLIMATE INNOVATION	12
5.2: SUMMARY OF THE DISCUSSION	13
5.3: OUTCOME OF THE NATIONAL CONSULTATION	13
6. KEY RECOMMENDATIONS	15
7. ANNEXES	18
ANNEX-1: KEY STAKEHOLDERS CONSULTED	18

Executive Summary

This report succinctly introduces Climate Innovation Challenge (CIC) consultation in Sri Lanka 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 Sri Lanka 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 2019 lists Sri Lanka as the second most impacted country in 2017 for having faced extensive losses due to climate catastrophes in a single year. With extreme weather events predicted to increase with rising levels of impact, the assessments call for rapid adaptation, particularly in terms of livelihoods vulnerable to an increasingly unpredictable climate. According to the report, South Asia's Hotspots: "The Impact of Temperature and Precipitation Changes on Living Standards" in Sri Lanka, areas in northern and north-western provinces are the most likely to experience increases in average temperature and more variable precipitation by 2050.

Acknowledging the central role played by the Government agencies in response to the climate impacts in Sri Lanka, it also underscores the National Adaptation Plan, Policies and Strategies of the Government of Sri Lanka especially the Technology Needs Assessment also influences the CIC process in Sri Lanka as well as the ongoing various climate initiatives being executed to tackle the impact of climate change supported by external funding agencies. Sri Lanka's various sectors are majorly well-matched to technology options for climate change adaptation with a view to understand the relative importance or contribution of each of them in negating or lowering the adverse impacts on relevant sector. Besides, most importantly as part of the CIC process for South Asia, it extensively sketches out the results of National Consultation on CIC aimed at assessing the needs for cutting-edge technology solutions to build resilience of communities bearing the belligerent impacts of climate change in the country. The CIC consultation achieved its objective with encouraging participation from Senior Government officials and key sector specialists that reinforced the key idea related to the CIC that optimally support innovators in demonstrating tech solutions that are potentially scalable and transferable. The CIC consultation provided an opportunity to ADPC in scientifically providing suggested key thematic areas for possible innovation challenge in Sri Lanka and sought concurrence from the concerned Ministries/Departments and concomitantly suggestions from them were implicitly extracted. In this sequence, this document methodologically outlines the CIC consultation entailing the discussion summary, question and 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

Sri Lanka is a small island nation lying between 6°N and 10°N latitude and 80°E and 82°E longitude in the Indian Ocean, with a land area of approximately 65,000 square kilometers (km²). The island consists of a mountainous area in the south-central region and a surrounding coastal plain. The climate of Sri Lanka is wet and warm, ideal for forest growth; almost all of the nation's land area was at one time covered with forests. Over the last century, more than two-thirds of this forest cover, rich in biodiversity, has been removed to accommodate human use. Nonetheless, rich natural resources remain and, alongside its vibrant cultures, contribute to the nation's successful tourism industry.

The economy of Sri Lanka is dominated by the service sector (61.7% of Gross Domestic Product [GDP] as of 2017), with major contributions from trade, transportation, and real estate activities. While the agricultural sector has shrunk in its contribution to GDP (7.8% as of 2017), it remains a significant employer (27% of the labor force as of 2016). Approximately a quarter of Sri Lanka's population are believed to live within the metropolitan area of its commercial capital, Colombo. However, official statistics suggest Sri Lanka's urban population is relatively low, reportedly 19.3% in 2016. A large proportion of Sri Lanka's population remains undernourished (22.1% in 2014–2016)

Sri Lanka's high temperatures, unique and complex hydrological regime, and exposure to extreme climate events make it highly vulnerable to climate change. In 2012, the Ministry of Environment submitted its Second National Communication to the UNFCCC (NC2), which highlights key vulnerabilities in the agriculture and water resources sectors, as well as significant risks to human health and in coastal zones.² These key climate-related risks were again emphasized in Sri Lanka's Nationally Determined Contribution (NDC) submitted after it signed and ratified the Paris Climate Agreement in 2016. Sri Lanka's NDC outlines the country's commitment to addressing its vulnerability to climate change in line with its commitments to a low carbon pathway through sustainable development efforts

2.1: Vulnerability to climate induced disasters

Sri Lanka faces moderate disaster risk levels, ranked 97th out of 191 countries by the 2019 INFORM Risk Index³⁰ (Table 4). Sri Lanka has moderate exposure to flooding (ranked 56th), including riverine and flash flooding. Sri Lanka also has some exposure to tropical cyclones and their associated hazards (ranked 45th). Drought exposure is slightly lower (ranked 76th). Sri Lanka's overall ranking on the INFORM risk index is somewhat mitigated by its comparatively high coping capacity score. Landslide hazard is present in many parts of Sri Lanka, but is not explicitly captured by the INFORM risk index. The section which follows analyzes climate change influences on the exposure component of risk in Sri Lanka. The ND-GAIN Index presents an overall picture of a country's vulnerability and capacity to improve its resilience. In contrast, the Inform Risk Index identifies specific risks across a country to support decisions on prevention, preparedness, response and a country's overall risk management.

2.2: National Adaptation Policies and Strategies

With the signing of Paris Agreement in April 2016 and ratifying the same in September 2016 by Sri Lanka, its global commitments on climate change will mainly focus on the INDCs that have been already submitted.²

National Adaptation Plan for Climate Change Impacts: (2016 – 2025)

The National Adaptation Plan for Climate Change Impacts in Sri Lanka (NAP) was prepared in line with the broad set of guidelines set forth by the UNFCCC for the development of national adaptation plans. The NAP expect the external support for further strengthening the national adaptation planning process in the country, and technical and financial assistance to make these actions realistic at the ground level.

In process of meeting these adaptation commitments, Sri Lanka will make extra efforts to build synergies between adaptation and mitigation while capitalizing on mitigation co-benefits of adaptation actions. The most vulnerable sectors to adverse effects of climate change identified for developing the adaptation NDCs are from the sectors of health, food security (agriculture, livestock and fisheries), water and irrigation, coastal and marine, biodiversity, urban infrastructure & human settlement, and tourism & recreation.

Readiness Phase 2017-2019

The readiness phase till 2020 allowed the country to prepare for the full-scale implementation of chosen NDCs. A host of groundwork and preparations need to be carried out to ensure successful implementation of NDCs to achieve the set GHG emission reduction targets by 2030. A Readiness Plan for the Implementation of the INDCs of Sri Lanka was developed in consultation with relevant stakeholders, led by line ministries that cover the 14 sectors identified in the NDCs of Sri Lanka.

In addition to the Policy and the Strategy on climate change, the environment sector has a number of other national policies, strategies and action plans. Some of these policies have recognized climate change as a key environmental challenge faced by the country. In this section, a brief review of most relevant policy documents is presented.

National Action Plan for Haritha (River) Lanka Programme: The Haritha Lanka Programme has identified climate change as the third mission and selected certain strategies/actions relating to both mitigation and adaptation (NCSD, 2009).

Sri Lanka Comprehensive Disaster Management Programme 2014-2018 (SLCDMP): The SLCDMP is a policy document, which has a close connection to the National Adaptation Plan (NAP). _____

National Action Programme for Combating the Land Degradation of Sri Lanka (NAP- CLD): The NAP-CLD has recognized climate change as a factor that can intensify the degradation of land resources in future (Ministry of Environment and Natural Resources, 2014).

Coastal Zone Management Plan (CZMP): The CZMP has also recognized climate change as a factor that can intensify the degradation of coastal resources in future. Its main concerns include coastal erosion, coastal pollution and degradation of coastal habitats.

National Physical Plan 2011-2030 (NPP): The NPP has identified global warming as a concern that can affect physical development activities of the country. In addition, it covers some aspects of disaster risk management too.

Sri Lanka Water Development Report 2010 (SLWDP): The SLWDP has identified climate change as a major driver of change in the water resources sector.

Draft National Agriculture Policy: The presently available draft framework of the National Agriculture Policy

for public comments identified 'Assuring food security' and 'Ensuring environment sustainability' as two major pillars of the policy in making. It recognized 'Natural resource management & climate change adaptation' as a key strategic/intervention area that cover soil conservation, water management, agriculture climate forecast and disaster risk reduction.

2.3: Priority Adaptation Actions

The adaptation NDCs of Sri Lanka was developed in consultation with relevant stakeholders, based on the National Climate Change Adaptation Strategy (NCCAS) and the National Adaptation Plan for Climate Change Impacts in Sri Lanka (NAP). Consequently five major broader adaptation targets were identified:

1. Mainstreaming climate change adaptation into national planning and development.
 2. Enabling climate resilient and healthy human settlements.
 3. Minimizing climate change impacts on food security.
 4. Improving climate resilience of key economic drives.
- Safeguarding natural resources and biodiversity from climate change impacts.

2.4: Climate Change projection and impacts on key sectors

Academics and researchers have conducted a number of studies on trends that can be observed from analysis of past meteorological data and they indicate that Sri Lanka's climate is changing gradually. Areas that attracted researchers' attention most were trends in temperature, changes in precipitation patterns and observations on extreme events. Evidence suggests that atmospheric temperature is gradually rising almost everywhere in the country. The following Table presents the physical effects identified for each type of projections.

Projections and their Physical Effects

Projections	Physical effects/dimensions	Time horizon
Increased concentration of GHG	Rising atmospheric CO ₂ concentration	Short-term
	Increased concentration of climate altering pollutants (non-CO ₂)	Short-term
	Progressive increase in acidity of rainfall	Long-term
	Ocean acidification	Long-term
Rising atmospheric temperature	Increased day and night air temperature	Short-term
	Increased evaporation and evapotranspiration	Short-term
	Alteration of optimal ranges of temperature for biological organisms (pests, pathogens, parasites, vectors)	Medium-term
	Increased concentration of dust/ soil particles in atmosphere	Short-term
	Heat island effect	Short-term
Rising oceanic temperature	Physio-chemical changes in oceanic environment	Long-term
Changing patterns of precipitation	Irregular/erratic changes in established patterns of rainfall	Short-term

	Regular incidents of intense rainfall with high cloud cover	Short-term
	Regular and extended dry spells	Short-term
	Boundary shift in climatic zones	Long-term
Increased incidence and severity of extreme events	Increased frequency and severity of floods	Short-term
	Increased frequency and severity of droughts	Short-term
	Increased frequency of cyclones and high winds	Short-term
	Increased incidence of lightening	Short-term
	Increased incidence of landslides	Short-term
	Increased wind and waves (Turbulent weather)	Short-term
Sea level rise	Salt water intrusion	Medium -term
	Inundation of low-lying areas	Long-term

These physical effects create hazards and vulnerabilities on different sectors. These physical hazards and vulnerabilities are the root causes of sectoral impacts. They could create multiple impacts on sectors with socio-economic outcomes. Experts suggested that the same physical effects could lead to create different impacts on different sectors. Similarly, physical effects could act in combination with each other on different sectors. For instance, rising temperature would lead to create pronounced impacts on crops and natural biodiversity together with periodic dry spells or droughts, generating losses to farmers and peripheral communities around forest.

Emerging evidence from various sources suggest that climate change could alter natural systems connected to the water cycle, the ecosystems and the bio-diversity of the country. This could lead to decline of various ecosystem services which are indispensable for the welfare of human population. In addition, impacts of climate change appear to have significant repercussions on health of the citizens and human settlements of the country. Overall, the impacts of climate change are widespread and they are likely to create negative socio-economic outcomes on many sectors in Sri Lanka. Even though Sri Lanka has been successful in reducing the poverty head count ratio to a single digit, studies on multi-dimensional poverty indicate that people who are marginally over the poverty line could fall below the line easily due to various livelihood shocks. Hence, climate change impacts have the potential to reverse the country's achievements in poverty alleviation unless countered through appropriate measures of adaptation.

Availability, supply, distribution, use and conservation of water resources are directly dependent on climate conditions. The water resources sector in Sri Lanka has to cater to the domestic, agricultural and industrial needs of water. Besides fulfilling human needs, the survival of all ecosystems also relies heavily on the availability of water. Relationship between water and ecosystems is a complex one. Hence, in addition to fulfilling human needs, managers of water resources have to be mindful about ecosystems also. Only a limited segment of households in the country have access to safe drinking water. Sri Lanka has invested heavily on agricultural water supply and a significant share of the country's power generation capacity also is dependent on water resources. A growing number of industrial facilities also create demand for water resources and this has led to high level of extraction of groundwater as well as increased pollution of water resources. Overall, water is an important sector that has implications for all major economic sectors and human activities that need special attention in adaptation climate change.

Food security is one of the most critical areas that need special attention in climate adaptation in Sri Lanka.

Key components that contribute to food security in Sri Lanka are rice, other food crops, fruits and vegetables (horticultural crops), animal production and fisheries. The country has achieved self-sufficiency in rice. However, the country depends on imports for a number of other food products.

Hence, agriculture development efforts in the country are mainly targeted at achieving self-sufficiency or reducing the import dependency of at least main categories of food such as milk and milk products and sugar. Relative contribution of the agriculture sector to the national economy has reduced to around 10 per cent of GDP. However, agriculture still occupies around 30 per cent of the workforce and a significant share of farmers live under poverty. Of all the economic sectors, agriculture is the most climate sensitive sector and climate related hazards have significantly affected the agricultural production and farm assets during the recent past. Hence, high climate sensitivity and livelihood dependency of a large section of population makes food security a highly vulnerable sector to climate change impact that needs special attention in national adaptation plan.

Sri Lanka is an island nation surrounded by a low-lying coastal belt. Around a third of the country's population is concentrated in the coastal belt. There are several townships located in the coastal zone and relatively well developed infrastructure facilities are found in those areas. Fisheries and tourism are among the significant economic activities in the coastal zone and numerous fishing villages, harbours and anchorages are located around the country. Nearly a quarter of a million families make their living on coastal and offshore fishing. The coastal belt is rich with numerous coastal and marine ecosystems. Beyond the beach zone, fertile strips of rice and coconut lands are located that support the food security and export earnings of the country. Overall, coastal areas contribute the country's economy significantly and a large share of population is dependent on them. Sea level rise, a major physical effect associated with climate change, is likely to create significant impacts over the coastal zone. Tsunami in 2004 has indicated that Sri Lanka's low-lying coastal areas will be highly vulnerable to inundation³

Hydropower currently supplies 46% of Sri Lanka's energy needs but the major sites have all been tapped.

Thus, there is increased investment in thermal (diesel, oil, and coal) power plants to meet expanding energy requirements. The current policy is to move from diesel and oil power plants to coal-fired power plants. Cleaner sources of power generation are also being promoted by the government through establishment of nonconventional renewable energy, such as solar, wind, and dendro-thermal power, and mini-hydropower. Sri Lanka receives its highest rainfall (about 60%) during two seasons: the southwest monsoon and second intermonsoon period. Reservoirs used for hydropower normally recharge during these periods. Annual average rainfall has decreased over the last 57 years at about 7 mm per year, resulting in water scarcities in the dry zone (Rathnayake, et al. 2009). Lower rainfall during the first inter-monsoon and changes in rainfall generally have affected hydropower generation (Rathnayake et al. 2009). This puts additional stress on the already insufficient energy resource base; this is in addition to high transmission and distribution losses. Increasing temperatures also mean higher demand for cooling buildings.

3. Ongoing Climate Resilience Initiatives in Sri Lanka

Green Climate Fund supported Strengthening Climate Resilience of Subsistence Farmers and Agricultural Plantation Communities residing in the vulnerable river basins, watershed areas and downstream of the Knuckles Mountain Range Catchment of Sri Lanka: The project seeks to strengthen the adaptive capacity of smallholder subsistence farmers to address climate-induced irrigation and drinking water shortages by improving the resilience of farm- and land-management practices, and by climate proofing the underlying ecosystems in the Knuckles/Amban Ganga highlands and lowlands.

Green Climate Fund supported strengthening the resilience of smallholder farmers in the Dry Zone to climate variability and extreme events through an integrated approach to water management: This is a climate adaptation project amounting to USD 52.1 million and works for improving integrated water management within the Dry Zone of Sri Lanka in order to strengthen the resilience of smallholder farmers in the face of rising temperatures and extreme weather events attributable to climate change.

ADB supported Building coastal resilience in Asia-Pacific involving Sri Lanka: The Asian Development Bank is supporting a regional technical assistance (TA) in Building coastal resilience in Asia-Pacific involving Sri Lanka. It requires adopting long-term and integrated planning approaches that favor adaptive management, a risk-based approach, inclusive processes, and consider the full spectrum of coastal resilience options

ADB supported Power System Reliability Strengthening Project: The project amounting to USD 275 million is focusing on system reliability, optimization of existing fault clearance system of the utility network and the settings of the main protection systems. The project will ascertain the performance of existing protection system associated with transmission lines, transformers and generators connected to 220 kV and 132 kV networks and improve efficiency and reliability of the medium-voltage network in the distribution.

ADB supported Integrated Water Productivity Improvement Project: The project amounting to USD 170 million will focus on river basins that are mostly located within two provinces: North Western Province and Uva Province.

Adaptation Fund supported Climate Change Adaptation Project: The 'Climate Change Adaptation' project strengthens livelihoods of communities affected by changing weather patterns. The project operates in both Polonnaruwa and Walapane - two locations that are prone to adverse effects of climate change. The project introduces climate smart and non-chemical agricultural practices for farmers and provides alternate sources of income for those who find it difficult to make their livelihoods sustainable.

USAID supported Sri Lanka & Maldives Climate Change Adaptation Project: The project will strengthen the capacity of key project partners to integrate climate risk management into decision-making processes and support proactive management of climate risks to enhance the resilience of public, non-governmental, and private sector stakeholders to natural disasters and climate change.

4. Need Assessment for Innovations in Sri Lanka

4.1: Problem Statement

Transport and resilient power infrastructure sector.

The appropriateness of green technology was highly accentuated for feeding into the context of Sri Lanka for Transport and Resilient power infrastructure sector. Sri Lanka has extensive bitumen-surfaced roads, especially around the coast, low-lying areas, and to major tourist destinations. Given its location, transport infrastructure is highly vulnerable to climate change impacts through storm surges and slow sea level rise, droughts and high-intensity rain, particularly because a considerable length of the major road and railway network runs along the coast and in low-lying areas. Since roads are high vulnerable to climate impact, and vulnerable to devastating flash floods in certain areas, the scope for risk assessment of roads across different parts of the country would be inevitably seen as one the key focus areas. Such need was further corroborated through the National Physical Plan 2011–2030 which has identified global warming as a concern that can affect physical development activities of the country. In addition, it covers some aspects of disaster risk management too.

Early warning for food and water security

The National Thematic Research Programme (NTRP) of the National Science Foundation has identified Food Security, Climate Change & Natural Disasters and Water Security as the priority areas to start with under the NTRP. According to them the Disaster Management Center (DMC) is equipped with a typical early warning system. The DMC normally receives warning from technical forecasting agency in the country and subsequently disseminates it to the community. However, several gaps have been identified in the dissemination of early warning system necessitating the need of further advancement in EWS. The National Adaptation Plan for Climate Change Impacts: (2016 – 2025) was also referred which has aptly underscored such needs.

Agriculture and Climate Smart Agriculture

The Agronomy & Land Use Policy Planning Department laid stress on the agriculture sector in Sri Lanka that has been the hardest hit increasingly due to impact of climate change. Many vulnerable and poor people are dependent on agriculture that are highly susceptible to temperature increases and variability in precipitation patterns. Due to modest changes in rainfall and temperature patterns has pushed marginalized people into poverty as they lack the means to recover from shocks. Extreme events occurring in combination, has significantly eroded poor peoples' assets and further **undermined their livelihoods in terms of labor productivity, housing, infrastructure, and social networks**. Despite conventional regular agricultural activities in field, Agriculture sector is seeking climate-smart agriculture including heat-tolerant, flood-tolerant crop varieties and addressing water stress in plants. Accordingly, it was reflected that the National Agriculture Policy of Sri Lanka has appropriately laid stress of such needs for addressing it in the context of Climate Change.

Aquaculture and coastal zone management

The Marine Environment Protection Authority raised the concern about the extreme events such as cyclones, tidal surges, flood, river erosion and salinity stress have been severely affecting agriculture, fishing or fish cultivation and livestock rearing. The communities remain extremely vulnerable to these events that impeded the key livelihoods in the coastal areas

than any other place. The traditional agriculture cropping is decreasing in coastal areas due to variation of fresh water and salinity level and increasing abrupt weather events, tidal inundation and water logging. In particular the marginalized and landless coastal people who have limited access to natural, social and institutional services of local govt. institutions are losing adaptive capacity in the long-run. They identified a critical need for the inclusion of climate-smart aquaculture and salinity barriers in line with the Coastal Zone Management Plan that has also recognized climate change as a factor that can intensify the degradation of coastal resources in future.

4.2: Climate Innovation Needs Assessment

The Technology Needs Assessment (TNA) for climate change adaptation in Sri Lanka was undertaken by the Climate Change Secretariat of the Ministry of Environment and Renewable Energy from June 2011 to April 2013. The main objective of the Climate Change TNA is to identify and assess environmentally sound technologies that have synergy between reducing the impact of climate change and the rate of GHG emissions in Sri Lanka within national development objectives. Finally, the priority sectors identified for adaptation were Food, Health, Water, Coastal and Biodiversity. Sri Lanka's National Report on TNA and Technology Action Plans for CCA was developed for the policy makers, potential investors, technology developers, scientists and all other stakeholders who are actively participating in sustainable development efforts of the country. Identified Adaptation Technologies in the following sector:

Food sector: The adaptation technology options identified are a) Sustainable Land Management b) Crop Diversification & Precision Farming c) Ecological Pest and Disease Control d) Rain Water Harvesting e) Solar-powered Drip Irrigation f) Development of Appropriate Breeds g) Development of Appropriate Varieties h) Responsive Agricultural Extension i) Sustainable Culture-Based Fisheries

Water sector: Seven (07) potential adaptation technologies were identified as priority technologies through stakeholder consultations and the technologies so identified are focused on the following three aspects.

Technologies in response to risk of flooding due to increase in rainfall intensity

Technologies in response to sea water intrusion into surface and ground water as a result of sea level rise.

Technologies for resilience to water quantity and quality degradation

- (i) Rainwater harvesting from rooftops for drinking and household uses
- (ii) Surface runoff rainwater harvesting c) Household drinking water treatment and safe storage
- (iii) Boreholes/tube wells as a drought intervention for domestic water supply
- (iv) Solar distillation
- (v) Restoration/rehabilitation of minor tank networks
- (vi) Desalination of brackish water by reverse osmosis.

Coastal sector:

- (i) a) Restoration of coral reefs as soft defense mechanisms
- (ii) Replanting of sea grasses as a soft defense mechanism
- (iii) Sand dune rehabilitation as a soft defense mechanism
- (iv) Beach nourishment
- (v) Restoration of mangrove habitats
- (vi) Construction of dikes
- (vii) Floating mariculture for sea weeds
- (viii) Floating mariculture for fish
 - i) Construction of groins & sea walls (revetments)

Biodiversity sector:

- (i) Restoration of degraded areas inside and outside the protected area network to enhance resilience
- (ii) Increasing connectivity through corridors; landscape and matrix improvement and management

Health sector:

- (i) Diagnostic facilities to detect water borne diseases.
- (ii) Technology to detect, prevent and control water borne diseases
- (iii) Technology for Early Warning Systems and net-working for information exchange on extreme events and other Climate Change related events.
- (iv) Research to identify the magnitude of diseases and other aspects affecting human health due to climate change
- (v) Drinking water quality improvement through continued surveillance during and after extreme weather events
- (vi) Technology to improve urban health inputs to adapt to climate change and extreme weather events related adverse health impacts.

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

5.2: Summary of the Discussion

The Sri Lankan government officials emphasized their concerns in employing large but scarce resources in recovery by rebuilding the damaged infrastructure resulting from climate induced disasters every year. In order to deal with such loss and damages, it basically calls for investing in the innovative technology to combat with the impact of climate change.

ADPC through CIC aims to build capacity of emerging markets and disseminate the knowledge and innovation with institutions. In this regard, the four key considerations for CIC proposals Innovation, Leverage, Partnership and Scalability were explained in threadbare to the participants in the consultation.

Mr. Aslam interacted with the participants by discussing innovative ideas that are feasible in Sri Lanka, in addition the key criteria of selection process when ADPC receives proposals, along with identifying the innovation needs from different parts of the country. As a result the participants provided their inputs as sought. This small exercise eventually led to better reflect the expectation, ownership and innovation needs of Sri Lanka.

It has been long felt need and eventually it was widely discussed about exploring innovative ways to combat climate challenge in Sri Lanka. However, the CIC is expected to fill the gap of piloting innovative technologies. ADPC also defines innovation by considering partnerships of government and other stakeholders for such innovations that are relevant in Sri Lanka.

ADPC intends to focus on those innovations that aren't solely business activities and also leveraging the existing knowledge from the Ministry of Mahaweli Development and Environment, and concerned Ministries such as agriculture, water resources, infrastructure and transport.

Mr. Aslam explained in detail about the compatibility of the seven themes that aligns in the perspective of Sri Lanka, and further requested participants to suggest new themes based on the unidentified needs that can be added to the current list of themes. Accordingly the participants provided their suggestions outlined at Innovation Opportunities section.

Once the call for applications is over, ADPC would begin the validation process and subsequently pass on to the jury with the number of applications received along with the selection criteria. The innovators' proposals would be assessed with due diligence procedure and would only be selected purely on the basis of the merit in their proposals.

ADPC is envisaging CIC as an opportunity that has been launched in South Asia for the first time. Since 2012, through the GFDRR, UK-AID, World Bank have been implementing large number of innovation challenges that were tested in Africa, Latin America and other parts of the world. ADPC wants to tap some of these relevant innovations which have been not touched upon but has a very high potential.

Mr. Bandula concluded the session by thanking all the participants and highlighted that there will be a call for proposal soon and all concerned would be intimated once the call is launched.

5.3: Outcome of the National Consultation

The salient features of selection process involved in CIC application was deliberated upon in consultation. ADPC would constitute a jury of eminent members comprising of such experts who are adept in assessing these types of innovative technologies outside from South Asia region. Besides, in order to ensure it reflects transparency and ownership of the government, the jury would also consist of one or two nominated officials from Government as well.

Any prospective firm within or outside of South Asia can apply but the applicant preferably needs to demonstrate a local partnership available in Sri Lanka. The requirement that warrants the applying organizations need to comply. One of the key requirements is that such applicants experiencing in deploying climate resilience technological solutions should potentially work for the next 12 months in consonance with the deliverables framework in line with the World Bank project contractual guidelines. ADPC would be funding to such grants that are scalable both within the country and outside the country.

The National Science Foundation in Sri Lanka has a repository containing database of all the researchers and innovation conducted in the country. In the selection process he suggested that it would be advisable to crosscheck with those agencies in ensuring the validity of the research to avoid duplication of innovative solutions.

ADPC intends to define their innovation based on the Sri Lanka's innovation needs and in order to execute; a risk assessment of an innovation would be carried out in such a way that it would support the government to quantify the risk financing instrument.

The appropriateness of green technology was highly accentuated for feeding into the context of Sri Lanka for Transport and Resilient power infrastructure sector. Since roads are high vulnerable from climate impact, causing flash floods as a result the scope for risk assessment of roads across different parts of the country would inevitably be seen as one the key focus areas. Considering the vastness of infrastructure resilience ADPC is focusing on specific innovations that are anticipated to be successful and as a result it would lead to scaling up in future.

The Disaster Management Center (DMC) Sri Lanka represented the need for climate information and community level early warning system through technological innovation. There is a crucial need for a comprehensive database in the central system in the five thematic areas which can be accessed by researchers and institutions from DMC's perspective. At present DMC is equipped with a typical early warning system. DMC normally receives warning from technical forecasting agency in the country and subsequently disseminate it to the community. However, several gaps have been identified in the dissemination of early warning system. In the early warning prospective, developing impact based early warning systems was sought from the CIC.

The agriculture sector in Sri Lanka has been the hardest hit increasingly due to impact of climate change. Despite conventional regular agricultural activities in field, Agriculture sector is seeking climate-smart agriculture including heat-tolerant, flood-tolerant crop varieties and addressing water stress in plants are some of the areas that needs innovation and technology-based solution. Taking into account the innovation from the perspective of food security, the agriculture sector possesses critical need as it is grossly affected by the climate change.

Subsequent to the concentrated discussions with the concerned Ministries/Departments/Universities officials from Ocean University of Sri Lanka, Department of Plant Sciences, University of Colombo & Chairperson, Rubber Research Institute of Sri Lanka Chairperson, Marine Environment Protection Authority in the consultation meeting few other key themes were identified which established the critical need of the inclusion of rubber plantations/incubators, climate-smart aquaculture and salinity barriers.

Mr. Irfan stated that among other activities with the involvement of national level key stakeholders in a regional platform for CAP South Asia- that was launched by ADPC and RIMES late last year invited the governments from eight South Asian countries. Sri Lanka was one of the invited

member countries and was represented by Dr Anil Jaysinghe, Secretary, Ministry of Mahaweli Development and Environment. Such event gave an opportunity to effectively discuss the South Asia level focused regional platform that would provide sector specialists and officials from Ministries to initiate small group discussions around technical policies, standards and tools. ADPC is craving another niche that would aim to engage with the key sectors. It would intend to focus first on these three countries at national level, and assessing if the good practices can be disseminated within the wider South Asia group.

Mr. Irfan asserted that ADPC would like to include Sri Lanka in the trainings and capacity building activities with a focus on these sectors with the underlying focus on climate resilience. He further underlined that his colleagues from Sri Lanka (Bandula/Nirmala) would discuss thematic areas and would be keen to invite experts from Sri Lanka to Climate Talks.

ADPC has launched a quarterly CARE for South Asia newsletter which publishes technical articles as well as good practices surrounding the broader subject and theme of climate adaptation and resilience, particularly focusing on key sectors such as policy, planning, finance, agriculture, water resource management and road transport sector. ADPC has planned to scale up this to the regional level and further they would welcome key stakeholders' participation in this newsletter from Sri Lanka that would ensure wider engagement with them.

6. Key Recommendations

The Climate Innovation Challenge for Sri Lanka 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.

The role of Civil Society Organizations (CSOs) has been commonly highlighted in the NAP of Sri Lanka. The NAP of Sri Lanka identifies adaptation actions at three levels. Out of these levels of actions, the third level "**Community level actions: Actions that are targeted at the grass-root level**". As per the NAP, the Forum of Civil Society Organizations (CSO), a group of partner agencies, will be a coordination body established to support actions that have grass root level operations. It will be established to support the implementation and coordination of community-based interventions involved with sectoral and cross-cutting levels proposed by NAP. It will function as a supporting body for both Climate Adaptation Cells and National Working Group. Besides, UNDP Sri Lanka has inducted four leading CSO as partners in the newly-launched Green Climate Fund-supported project in the Dry Zone, ensuring communities will play a leading role in building their own resilience to climate change. A brief of four UNDP's partner CSOs are outlined below:

The first partner Janathakshan, meaning "people's technology" or "technology for people", is a non-profit organization promoting sustainable and green solutions in development. The second partner Palm Community Development Services is a non-government community development organization adopting a holistic approach to implementing community development. The third partner South Asia Partnership Sri Lanka (SAPSRI) is a non-profit organization following a participatory approach in planning and implementation of development activities aimed mostly at empowering women. SAPSRI

has worked with UNDP previously on the GEF Small Grants Programme. Lastly the fourth partner Sri Lanka Red Cross is an independent non-government humanitarian organization with over 100,000 members and 6,500 active volunteers, focused on reducing risk and creating universal access to services through volunteerism and partnership. In addition quite a few local organizations working on Climate Change in Sri Lanka and connected through Climate Networking Organizations like Southern Voices on Climate Change, Climate Action Network South Asia (CANSAs) etc. other similar local organizations like Janathakshana promoting sustainable and green solutions in development. 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 grassroots communities and placing the emphasis of the grant challenge in continuing the 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 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.

Innovation Opportunities:

Accelerating technological innovations is essential to help reduce the current and long-term impacts of climate change in Sri Lanka. Taken together these factors often make developing countries the passive recipients of technologies developed elsewhere. This can lead to the deployment of technologies unsuited to local conditions, and also prevent developing countries from exploiting the economic potential of one of the most promising sectors of the 21st century. CICs are intended to address the barriers that impede developing countries from the transfer, development and deployment of climate innovations.

In practical terms, the Climate Innovations in Sri Lanka would mean managing water stress through enhanced storage, conservation, and recycling; technologies for increasing the resilience of agricultural systems, including modified crops, improved cropping systems and practices, and land management; infrastructural technologies to protect against climate impacts, such as seawalls and dykes for coping with sea-level rise, floods, and storm surges, or improved building techniques to increase resilience to coastal storms; and risk reduction technologies such as advance warning systems. However, the need to deploy innovative climate technologies could also represent opportunity for developing countries. Much of the required adaptation will happen in these countries, and since many are in the early stages of development, they will construct a huge amount of infrastructure in the coming decades in any case. 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:

1. Community level- early warning systems. 2. Food security and water 3. Bio- diversity and coastal resources 4. Human Health 5. Human settlements and infrastructure 6. Tourism, energy, industry and infrastructure 7. Export agriculture

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

-Sustainable Culture-Based Fisheries

-Rubber production-Incubator

-Solar panel system/ Solar Power

7. Annexes

Annex-1: Key Stakeholders Consulted

Sl.	Name	Designation/Organization
1	Ms. K.N. Kumudini Vidyalkara	Director, Climate Change Secretariat, Ministry of Environment
2	B.A.P. Kapila	Deputy Director Ministry of Fisheries
3	Dr. Chandana Siriwardana	Senior Lecturer, Department of Civil Engineering, University of Moratuwa
4	Dr. Wasana Wijesuriya	Principal Research Officer, Rubber Research Institute of Sri Lanka
5	Madara Weerasooriyagedara	Scientific Officer (Coordinator of National Thematic Research Programme on Climate Change and Natural Disasters), National Science Foundation, 47/5, Maitland Place, Colombo 07.
6	Eng. Chandrika Pitawala	Deputy General Manager (Development), National Water Supply & Drainage Board, Sri Lanka
7	DharshaniLahandapura	
8	Wasana Wijesuriy	
9	Dayan Munasinghe	National Building Research Organisation
10	Ms. Manisha Rajapakse	Chief Executive Officer, National Research Council of Sri Lanka
11	Dharshani Lahandapura	Chairperson, Marine Environment Protection Authority
12	L.G. Priyanthi De Silva	Assistant Director, M/Water Supply
13	ChampaAmarasiri	Ocean University of Sri Lanka
14	Professor SudheeraRanwala	Department of Plant Sciences, University of Colombo &Chairperson, Rubber Research Institute of Sri Lanka
15	M.Kirupamoorthy	Deputy Director (Agronomy), Land Use Policy Planning Department
16	Dr. N. S .Abeysingha	Faculty of Agric. Rajarata University
17	Dr. DushanKumarathunge	Coconut Research Institute, Lunuwila, Sri Lanka
18	Ravichandran	JanthakshanGte Ltd,
19	Uditha Gamhewa	Department of Fisheries
20	Mr. Sunil Jayaweera	
21	BuddikaHemashantha	ClimateSI
22	DinekaJayasooriya	Director(land policies)



Asian Disaster Preparedness Center
SM Tower, 24th Floor, 979/66-70 Paholyothin
Road, Phayathai, Bangkok 10400 Thailand
Tel: +66 2 298 0681-92
Fax: +66 2 298 0012
Email: adpc@adpc.net



www.adpc.net



Asian Disaster Preparedness Center - ADPC



@ADPCnet



Asian Disaster Preparedness Center (ADPC)