

Springer Climate

Mozaharul Alam
Jeongho Lee
Puja Sawhney *Editors*

Status of Climate Change Adaptation in Asia and the Pacific

 Springer

Springer Climate

Series Editor:

John Dodson, Menai, NSW, Australia

Springer Climate is an interdisciplinary book series dedicated to climate research. This includes climatology, climate change impacts, climate change management, climate change policy, regional climate, climate monitoring and modeling, palaeoclimatology etc. The series hosts high quality research monographs and edited volumes on Climate, and is crucial reading material for Researchers and students in the field, but also policy makers, and industries dealing with climatic issues. Springer Climate books are all peer-reviewed by specialists (see Editorial Advisory board). If you wish to submit a book project to this series, please contact your Publisher (elodie.tronche@springer.com).

More information about this series at <http://www.springer.com/series/11741>

Mozaharul Alam • Jeongho Lee • Puja Sawhney
Editors

Status of Climate Change Adaptation in Asia and the Pacific

 Springer

Editors

Mozaharul Alam
United Nations Environment Programme
Bangkok, Thailand

Jeongho Lee
KACCC at Korean Environment Institute
Sejong, Republic of Korea

Puja Sawhney
Asia Pacific Adaptation Network (APAN)
Bangkok, Thailand

ISSN 2352-0698

Springer Climate

ISBN 978-3-319-99346-1

<https://doi.org/10.1007/978-3-319-99347-8>

ISSN 2352-0701 (electronic)

ISBN 978-3-319-99347-8 (eBook)

Library of Congress Control Number: 2018959857

© Springer Nature Switzerland AG 2019

This work is subject to copyright. All rights are reserved by the Publisher, whether the whole or part of the material is concerned, specifically the rights of translation, reprinting, reuse of illustrations, recitation, broadcasting, reproduction on microfilms or in any other physical way, and transmission or information storage and retrieval, electronic adaptation, computer software, or by similar or dissimilar methodology now known or hereafter developed.

The use of general descriptive names, registered names, trademarks, service marks, etc. in this publication does not imply, even in the absence of a specific statement, that such names are exempt from the relevant protective laws and regulations and therefore free for general use.

The publisher, the authors, and the editors are safe to assume that the advice and information in this book are believed to be true and accurate at the date of publication. Neither the publisher nor the authors or the editors give a warranty, express or implied, with respect to the material contained herein or for any errors or omissions that may have been made. The publisher remains neutral with regard to jurisdictional claims in published maps and institutional affiliations.

This Springer imprint is published by the registered company Springer Nature Switzerland AG
The registered company address is: Gewerbestrasse 11, 6330 Cham, Switzerland

Preface

Information and knowledge are integral parts of adaptation planning, monitoring progress, and communicating outcomes delivered through undertaking adaptation actions. Adaptation to climate change is often viewed as a knowledge-intensive exercise. Adaptation also entails engagement of actors ranging from global to local levels to create necessary means such as policies and governance, institutional and individual capacity, and access to finance and technologies to support adaptation actions. Environmental multilateralism has made significant progress by setting climate change as one of the top global issues. Several measures have been taken from global to local levels for assessing and understanding impacts, vulnerabilities, and adaptation to climate change since the Framework Convention on Climate Change and associated decisions came into force including the Marrakech Climate Accord in 2001 and the Cancun Framework for Adaptation in 2010. In 2015, the Paris Agreement established global adaptation goals including enhancing adaptive capacity, strengthening resilience, and reducing vulnerability to climate change. These indicators in the global adaptation goal, i.e., adaptive capacity, resilience, and vulnerability, present its inherent challenges for quantification and comparability, as well as aggregation of information both at national and global levels, to demonstrate the progress of adaptation.

Monitoring adaptation progress is a new and emerging issue, and needs are becoming more prominent due to the ratification of the Paris Agreement. Several initiatives in recent years have been working on this emerging need, and emphasis is placed on tracking adaptation finance and the flow of funds from developed countries to developing countries. Academic and research institutes have also developed different approaches for monitoring or tracking adaptation, focusing on outcomes, preparedness, and policy, but application of these approaches is limited. Additionally, a framework for assessing status of adaptation, and monitoring progress against predefined adaptation goals and/or objectives, and application in Asia and the Pacific region and subregional levels appears lacking. These gaps inspired the Asia Pacific Adaptation Network (APAN) and its partners to explore and make an attempt to address this topic. Strong determination and tireless efforts of APAN partners put together the rich contents in this book on “Status of Adaptation in Asia and the Pacific Region.”

In the 2014 APAN, which unceasingly mobilized adaptation knowledge in collaboration with a wide range of partners, and the Korea Environment Institute (KEI) that has supported APAN since its inception in 2009 recognized the gaps and the need to develop a framework and apply it to assess the status of adaptation in Asia and the Pacific region. The APAN and its partners has also recognized the fact that Asia and the Pacific region has made good progress in several areas to advance adaptation measures including adaptation actions on the ground.

While social, economic, and environmental diversity is high among countries in Asia and the Pacific, vulnerabilities of social and economic sectors and the adaptive capacity of society and the economy vary across the regions, subregions, and countries. Efforts to deal with adverse impacts of climate change also vary, including adaptation objectives and goals. While expression of adaptation goals varies across subregions and countries, the overarching goals are meant to protect people, development, and ecology from adverse impacts of climate change. Furthermore, priorities for adaptation interventions vary across key economic and social development sectors and spatial contexts, while adaptation actions are strongly associated with the most vulnerable sectors and are linked to the economic development and livelihoods of large populations.

This book provides an in-depth assessment and overview of climate change adaptation in the Asia-Pacific region and the status of adaptation at subregional levels (Central Asia, Pacific, Northeast Asia, South Asia, and Southeast Asia); sectors, i.e., agriculture that supports livelihoods of many people; and large ecosystems, i.e., Hindu Kush Himalaya mountain ecosystem. In addition to an in-depth assessment of the status of adaptation, the authors have made efforts to identify future actions needed for enhancing adaptation measures and indicate the support available at international and regional levels. The book also aims to contribute to current and future discourse on assessing and communicating adaptation progress at different levels, without prejudging future outcomes, and implementing the Paris Agreement goals.

The editors express their heartfelt thanks to the Ministry of Environment, Government of Korea, for providing financial support, and researchers and staff members of the Korea Environment Institute (KEI) for organizing the authors' meeting and for the continued support provided to the authors. We acknowledge the dedication of all chapter authors and support provided by their respective institutes. These include Climate Action Network South Asia (CAN-SA); International Centre for Mountain Development (ICIMOD); Local Governments for Sustainability Southeast Asia Secretariat; Research Centre for Climate Change Adaptation, Keio University; School of Environmental Science and Management, University of Philippines Los Baños; Secretariat of the Pacific Regional Environment Programme (SPREP); Southeast Asian Regional Centre for Graduate Study and Research in Agriculture (SERCA); and the Regional Environmental Centre for Central Asia (CAREC). Thanks are due to the staff of Springer International Publishing for their timely efforts in publishing this book.

Bangkok, Thailand
Sejon-si, Republic of Korea
Bangkok, Thailand

Mozaharul Alam
Jeongho Lee
Puja Sawhney

Contents

1	Adaptation Journey	1
	Mozaharul Alam	
2	Measuring Status of Climate Change Adaptation: An Assessment Framework	13
	Mozaharul Alam and Saleemul Huq	
3	Regional Overview	27
	Mozaharul Alam and Puja Sawhney	
4	Status of Climate Change Adaptation in Central Asian Region	41
	Nailya Mustaeva and Saniya Kartayeva	
5	Status of Climate Change Adaptation in Northeast Asian Region	69
	Wanglin Yan, William Galloway, and Ju Youn Kang	
6	Status of Climate Change Adaptation in the Pacific Region	97
	Espen Ronneberg and Peniamina Dougalii Leavai	
7	Status of Climate Change Adaptation in South Asia Region	125
	Ahsan Uddin Ahmed, Arivudai Nambi Appadurai, and Sharmind Neelormi	
8	Status of Climate Change Adaptation in Southeast Asia Region	153
	Ranell Martin M. Dedicatoria and Catherine B. Diomampo	

9 Status of Climate Change Adaptation in Agriculture Sector in Asia 183
Rico C. Ancog, Mariliza V. Ticsay, and Clarissa D. Ruzol

10 Adaptation in Mountain Agriculture: Food Security in the Hindu-Kush Himalayan (HKH) Region 211
Abid Hussain, Bidhubhusan Mahapatra, and Golam Rasul

11 Enhanced Actions on Adaptation 237
Mozaharul Alam

Index 247

Contributors

Ahsan Uddin Ahmed Centre for Global Change, Dhaka, Bangladesh

Mozaharul Alam United Nations Environment Programme, Bangkok, Thailand

Rico C. Ancog School of Environmental Science and Management, University of the Philippines Los Baños, Laguna, Philippines

Arivudai Nambi Appadurai Climate Resilience Practice, World Resources Institutes, Bengaluru, Karnataka, India

Ranell Martin M. Dedicatoria ICLEI–Local Governments for Sustainability Southeast Asia Secretariat (ICLEI SEAS), Quezon City, Philippines

Catherine B. Diomampo ICLEI–Local Governments for Sustainability Southeast Asia Secretariat (ICLEI SEAS), Quezon City, Philippines

William Galloway Research Center for Climate Change Adaptation (RCCCA), Keio University, Tokyo, Japan

Saleemul Huq International Centre for Climate Change and Development, Dhaka, Bangladesh

Abid Hussain International Centre for Integrated Mountain Development (ICIMOD), Kathmandu, Nepal

Ju Youn Kang Korea Adaptation Center for Climate Change (KACCC)/Korea Environment Institute (KEI), Sejong, Republic of Korea

Saniya Kartayeva The Regional Environmental Centre for Central Asia (CAREC), Almaty, Kazakhstan

Peniamina Dougalii Leavai Secretariat of the Pacific Regional Environment Programme, Apia, Samoa

Bidhubhusan Mahapatra International Centre for Integrated Mountain Development (ICIMOD), Kathmandu, Nepal

Nailya Mustaeva The Regional Environmental Centre for Central Asia (CAREC), Almaty, Kazakhstan

Sharmind Neelormi Economics Department, Jahangirnagar University, Dhaka, Bangladesh

Golam Rasul International Centre for Integrated Mountain Development (ICIMOD), Kathmandu, Nepal

Espen Ronneberg Secretariat of the Pacific Regional Environment Programme, Apia, Samoa

Clarissa D. Ruzol School of Environmental Science and Management, University of the Philippines Los Baños, Laguna, Philippines

Puja Sawhney Asia Pacific Adaptation Network (APAN), Bangkok, Thailand

Mariliza V. Ticsay Southeast Asian Regional Center for Graduate Study and Research in Agriculture (SEARCA), Manila, Philippines

Wanglin Yan Research Center for Climate Change Adaptation (RCCCA), Keio University, Tokyo, Japan

Chapter 1

Adaptation Journey



Mozaharul Alam

Abstract Continued advancement of scientific knowledge and understanding of climate change, visible sign of changes in physical system, adverse impacts on different sectors, and socio-economic development are advancing adaptation discussion both at international and national levels on a regular basis. This chapter on “adaptation journey” presents progress and advancement of adaptation to climate change discourse over time. This progression may present under four phases, i.e. (a) realization of climate change and adaptation (1979–2000); (b) beginning of adaptation actions and emergence of equal treatment (2001–2007); (c) enhancement of adaptation actions (2008–2015), and (d) global goal of adaptation, and monitoring and communicating adaptation progress (2015 onward). This chapter also highlights importance of mobilization of adaptation knowledge to support adaptation planning and implementation of actions.

Keywords Adaptation journey · Mobilization of knowledge · Adaptation finance · Adaptation technologies · Capacity building

1.1 Realization of Climate Change and Adaptation

It is difficult to determine a date or an event to be considered as inception of discussion on climate change, adverse impacts and vulnerability of climate change, and adaptation. However, recognition of changes in climatic system, potential impacts on development, and concern of humanity during 1970s and 1980s motivates multilateral organizations to take action for protecting climate within a global framework. Origination of the UN Framework Convention on Climate Change (UNFCCC) can be considered as an important step and a critical milestone at the global level to protect climate and deal with adverse impacts within wider contexts including sustainable development, biodiversity, and food production.

M. Alam (✉)

United Nations Environment Programme, Bangkok, Thailand

e-mail: alam31@un.org

Climatology as an important branch of the science and practice of meteorology (Landsberg 1945), and the basic atmospheric physics of greenhouse warming known to the scientific communities for more than a century (Houghton 2009). The first world climate conference “a world conference of experts on climate and mankind” held in 1979 is considered as an important event that brought specialists from a wide range of disciplines. This event has collectively delivered an appeal to nations to take full advantage of existing knowledge, take steps for improvement of knowledge, and to prevent potential man-made changes in climate and adverse impacts of human well-being (WMO 1979). Another important event is the Villach Conference held in 1985 that focuses on role of carbon dioxide and other greenhouse gases in climate variations and associated impacts. Scientists attended the conference has produced a highly powerful report predicting temperature rises in the first half of the twenty-first century which would be greater than any in the human history (WMO 1986).

UN resolutions in 1987 on the Environmental Perspective to the Year 2000 and Beyond, and on the report of the World Commission on Environment and Development have played critical role in the UN General Assembly (UNGA) to recognize that climate change has an impact on development. In 1988, UNGA has further recognized that climate change is a common concern of humanity. It has further determined that necessary and timely action should be taken to deal with climate change within a global framework (UN 1988). Considering pervading influence of climate on human and many fields of human activities, it has established a process and set up an Intergovernmental Negotiating Committee (INC) to negotiate the UN Framework Convention on Climate Change (UNFCCC). Two years of hectic negotiations ended with an agreed text for the UN Framework Convention on Climate Change on 9 May 1992.

UN Framework Convention on Climate Change has identified several areas of actions to address climate change including reduction of greenhouse gases, which is the primary cause of human-induced climate change, and adaptation to manage impacts as well as take advantages of climate change. It has also agreed reporting country level actions to the UNFCCC secretariat through national communication. It is worth noting that the Villach conference suggested for a programme on climate change which to be promoted by governments and the scientific community in collaboration with the World Meteorological Organization (WMO), the United Nations Environment Programme (UNEP), and the International Council of Scientific Unions (ICSU).

Efforts of the global community after entry into force of the UNFCCC in 1994 were primarily focusing on implementation of Berlin Mandate. It agrees to begin a process which will enable country to taking actions for the period beyond 2000, including the adoption of a protocol or another legal instrument (UNFCCC 1995). IPCC Second Assessment Report (IPCC 1995) informed the policy makers that the atmospheric concentrations of greenhouse gases have grown significantly against 1992 base year. Report has also confirmed that this growth can be attributed largely to human activities, mostly fossil-fuel use, land-use change, and agriculture. The Berlin Mandate delivered the first legally binding protocol “Kyoto Protocol” in

1997 to reduce emission of greenhouse gas. A comprehensive implementation rules of the Protocol was adopted at COP7 in 2001 while the protocol came into force on 16 Feb 2005.

Action at national level during this period was primarily focusing on raising awareness among key policy and decision-makers towards ratification of the UN Framework Convention on Climate Change. Entry into force of the Framework Convention on Climate Change triggered the need to develop national greenhouse gas inventory as well as to assess impacts and adaptations to climate change. Meanwhile, Intergovernmental Panel on Climate Change (IPCC) released a Technical Guidelines for Assessing Climate Change Impacts and Adaptations that enable sectors, countries, and regions to estimate impacts and adaptations to climate change (Carter et al. 1994). This technical guideline is also known as IPCC seven steps methodology for assessing climate change impacts and adaptations. Several countries, for example, Bangladesh in Asia region, have applied this technical guideline for assessing impacts and adaptation options.

The U.S. Country Studies Programme (USCSP) was one of the largest programmes during this period that supported 49 countries for assessing climate change impacts. It has assessed impacts in one or more of eight sectors: coastal resources, agriculture, grasslands/livestock, water resources, forests, fisheries, wildlife, and health. These studies were focused on analysis of first-order biophysical effects, e.g. coastal inundation, crop yield, and runoff changes. Smith and Lazo carried out a review and synthesize the results of the impact assessments of the USCSP. The studies found that sea level rise could cause substantial inundation and erosion of valuable lands. It has also revealed that protecting developed areas would be economically sound. The studies showed mixed results for changes in crop yields, with a tendency towards decreased yields in African and Asian countries, particularly southern Asian countries, and mixed results in European and Latin American countries.

While it indicated that adaptation could significantly reduce impacts of yields, but it is not clear whether the adaptations are affordable or feasible. It has also revealed that future changes in runoff could result in increases in droughts or floods. It has also appeared that country has large capacity to deal with impacts of climate change on grasslands and livestock. Considering inadequate access to health care system in low-latitude countries, human health problems are likely to increase due to climate change. It also revealed that forests composition is likely to change including reduction of biomass as well as some wildlife species. While USCSP contributed in building capacity in developing countries to assess potential climate impacts, but many studies did not analyse the implications of biophysical impacts of climate change on socio-economic conditions, cross-sectoral integration of impacts, autonomous adaptation, or proactive adaptation. It has suggested that follow-on work should attempt to conduct more integrated studies of climate change impacts (Smith and Lazo 2001).

1.2 Marrakesh to Bali: Beginning of Adaptation Actions

Scientific assessment reports of the IPCC, Third Assessment Report in 2001, the Johannesburg World Summit on Sustainable Development in 2002, and the growing recognition of inadequate mitigation efforts by Parties to the UNFCCC pursued global community to take enhanced action on adaptation. It has also recognized that the challenges of climate change would have to be addressed through a balance of mitigation and adaptation action. International awareness began to increase rapidly of the need for comprehensive climate information in support of national and international strategy for reducing greenhouse gas emissions and adapting to unavoidable climate change. Clear need also emerged on technology, finance, and capacity building.

“Marrakesh Accords”, adopted in 2001, is a key milestone for adaptation to climate change. It has established Least Developed Country Fund (LDCF) to support LDCs for addressing their immediate and urgent adaptation needs including formulation and implementation of National Adaptation Programme of Action (NAPA). It has also established a Special Climate Change Fund (SCCF) for all developing countries to deal with climate change. In order to provide technical support to LDCs for formulation and implementation of NAPA, it has also established an Expert Group for LDCs.

Strengthening capacity for information generation and flow, and role of existing national institutions have also been recognized in Marrakesh Accord as important aspects to support adaptation actions. Role of traditional skills, knowledge and practices, and information sharing in developing countries have also been recognized as important elements to support adaptation action. It has also suggested that research centres and universities and other relevant organizations should play an important role in providing capacity-building services and facilitating the flow of knowledge, best practices, and information. Marrakesh Accord has also suggested strengthening the capacity of meteorological and hydrological services to collect, analyse, interpret, and disseminate weather and climate information to support implementation of national adaptation programmes of action.

It has also recognized needs to identify, assess, and priorities technologies both for mitigation and adaptation particularly for developing country Parties. Country driven-ness, involvement of different stakeholders, and consultative process have been suggested as important approach to identify the barriers to technology transfer and measures to address barriers. It has also recognized that barriers may be related to soft and hard technologies, such as mitigation and adaptation technologies, identify regulatory options, and develop fiscal and financial incentives and capacity building. It has also recognized the need to enhance skills for adoption, adaptation, installation, operation, and maintenance of specific environmentally sound technologies and a broadening of understanding of methodologies for evaluating alternative technological options.

To facilitate and catalyse the development and dissemination of climate information and knowledge that would inform and support adaptation policies and prac-

tices, Conference of the Parties established the Nairobi work programme (NWP) in December 2005, and named the “Nairobi work programme on impacts, vulnerability and adaptation to climate change” at COP12 in Nairobi in 2006. NWP provides knowledge support on impacts, vulnerability, and adaptation to climate change as a “knowledge-to-action hub” in collaboration with partners, Parties, and other experts.

Montreal Climate Change Conference adopted several decisions among which dialogue on long-term cooperative action to address climate change. A 5-year work programme has also been established on adaptation to climate change impacts were key adaptation-related decisions for enhancing implementation of the Convention and bring balance between mitigation and adaptation. An agreement on a 1-year process to develop operational modalities for the Adaptation Fund was another milestone. This Adaptation Fund was established in Marrakesh and is a unique fund that draws on proceeds generated by the clean development mechanism and supports concrete adaptation activities in developing countries.

IPCC assessment reports brought importance of climate change adaptation and impacts of climate change and its implications on development. Adaptation to climate change requires same level of attention as mitigation.

It also revealed that adaptation agenda was driven by Least Developed Countries (LDCs) during this period. Least Developed Countries taken steps for formulating National Adaptation Programme of Action (NAPA) with financial support Global Environment Facility (GEF). Several LDCs have formulated their NAPA and couple of adaptation projects hits the ground. In addition, several developing countries have taken steps to develop their climate change strategy and action plans, etc.

1.3 Bali to Paris: Enhanced Action

In the context of adaptation to climate change, significant progress has been made during this period to enhance support for adaptation planning, financing, technologies, and capacity building. In 2007, Bali Action Plan (BAP) has been adopted in Indonesia that brought both mitigation and adaptation almost on a same footage. It took 2 years of intense discussion and negotiations within the framework of long-term cooperative action to address climate change. Unequivocal conclusion of the IPCC Fourth Assessment Report about warming of the climate system as well as further delay in reducing emissions will significantly increase the risk of more severe climate change impacts provoked stronger decision to take at the highest political level of multilateral agreement.

Bali has also launched a process to reach an agreed outcome and adopt a decision in 2009. It aims to develop a shared vision for long-term cooperative action including a long-term global goal for emission reductions as without deep cuts in global emissions the ultimate objective of the Convention cannot be achieved. In the context of adaptation, it has identified and agreed several areas that would require international cooperation and support for enhancing adaptation actions. The area of cooperation and support may be categorized into three, i.e. (a) understand impacts

and requirements for adaptation actions including technologies, finance, and capacity by undertaking vulnerability assessments, conducting exercise on prioritization of actions, assessment of financial needs; (b) develop response strategies including integration of adaptation actions into sectoral and national planning, and develop specific projects and programmes; (c) implementation of adaptation actions.

1.3.1 National Adaptation Plan

While Least Developed Countries (LDCs) were preparing National Adaptation Programme of Action (NAPA) to address their urgent and immediate adaptation needs, sharing early learning from formulation and implementation of adaptation projects, and evidences of climate change impacts presented by IPCC in its Fourth Assessment Report prompted discussion on need for medium- and long-term adaptation planning. Under the long-term cooperative action, “Cancun Adaptation Framework” has also been established with an aim to allow better planning and implementation of adaptation projects. It has broadened the scope of adaptation planning and implementation by agreeing that all countries face adaptation challenge, and international cooperation and support is urgently needed to implement adaptation actions. Though all countries need to adapt, it has recognized urgent and immediate needs of developing countries for reducing their vulnerability and building resilience. Considering special circumstances of Least Developed Country Parties, Cancun Adaptation Framework has further established a process to formulate and implement National Adaptation Plans (NAPs). It has further suggested that NAP should be building upon experience of LDCs in preparing and implementing National Adaptation Programmes of Action.

Work continued to elaborate purposes of NAP and approaches to apply for formulation. In 2011 in Durban, Parties to the UNFCCC agreed that the primary objectives of the national adaptation plan process will be twofold, i.e. (a) to reduce vulnerability to the impacts of climate change, by building adaptive capacity and resilience; and (b) to facilitate the integration of climate change adaptation into relevant policies, programmes, and activities. One of the key important aspects agreed by countries that adaptation planning is a continuous, progressive, and iterative process. While undertaking process of adaptation planning, each country will identify their priorities based on their country circumstances, national sustainable development objectives, plans, policies, and programmes. In 2012, LDC Expert Group (LEG) developed and published technical guideline for formulation of NAP.

1.3.2 Adaptation Financing

Operationalization of Adaptation Fund under Kyoto Protocol (KP), establishment of Green Climate Fund (GCF), and establishment of a mechanism to support meeting cost of adaptation under Paris Agreement are major adaptation financing instruments delivered during this period.

Though the Adaptation Fund was established in 2001 to finance concrete adaptation projects and programmes in developing countries but operationalization of the fund begun by establishment of the Adaptation Fund Board (AFB) in 2007 to supervise and manage the Adaptation Fund. Adoption of rules of procedure of the Adaptation Fund Board in 2008 laid down fundamental elements of institutional and operational structure to support concrete adaptation interventions on the ground. Within 2 years, Adaptation Fund Board developed all necessary instruments for accreditation of international and national entities, and programming instruments for project appraisal and approval. In 2010, Adaptation Fund Board approved first four adaptation projects worth of about USD 14 million.

In 2010, Parties to the United Nations Framework Convention on Climate Change established Green Climate Fund (GCF) as an operating entity of the financial mechanism of the Convention under Article 11. Main purpose of the fund is to support projects, programmes, policies, and other activities in developing country Parties using thematic funding windows. This is in operation and aims to deliver equal amounts of funding to mitigation and adaptation, while being guided by the Convention's principles and provisions. The Green Climate Fund was given an important role in serving the Paris Agreement and supporting the goal of keeping increase global temperature well below 2 °C. Paris Agreement also requested Green Climate Fund to support formulation and implementation of National Adaptation Plans.

Paris Agreement has established a mechanism to contribute to the mitigation of greenhouse gas emissions and support sustainable development. This mechanism is another possible funding window on future to meet the costs of adaptation. Idea of accessing fund directly by country presented in this mechanism is similar to Adaptation Fund under Kyoto Protocol, where a share of the proceeds from mitigation activities is used to assist developing country Parties that are particularly vulnerable to the adverse effects of climate change to meet the costs of adaptation.

1.3.3 Technology Development and Transfer

Establishment of a Technology Mechanism in 2010 consisting of (1) a Technology Executive Committee, and (2) a Climate Technology Centre and Network was another milestone for technology development and transfer for both mitigation and adaptation. Parties under UNFCCC have decided that technology needs must be determined based on national circumstances and priorities. It has further suggested

that research and development, demonstration, deployment, diffusion, and transfer of technology should be consistent with international obligations and to support both mitigation and adaptation actions.

In 2011, Parties to the Framework Convention on Climate Change reached to an agreement that arrangement to make the Technology Mechanism fully operational in 2012. It has also adopted the terms of reference for the CTCN and the selection process for the host of the Climate Technology Centre (CTC). In 2012, the UNFCCC Secretariat completed selection process of the host and awarded it to United Nations Environment Programme (UNEP) and United Nations Industrial Development Organization (UNIDO).

Due to limited focus on adaptation to climate change, definitions of technology and the concept of technologies for adaptation remain broad. In 2000, the IPCC in its special report on Methodological and Technological Issues in Technology Transfer, defines technology as “a piece of equipment, technique, practical knowledge or skills for performing a particular activity” (IPCC 2000). The UNFCCC has recognized the difficulty of defining the concept of adaptation technologies and proposes. It has defined adaptation technologies as “the application of technology to reduce the vulnerability, or enhance the resilience, of a natural or human system to the impacts of climate change” (UNFCCC 2005).

1.3.4 Capacity Building

Discussion on capacity building was initially focused on preparation of National Communication to the framework convention on climate change. Most of the capacity-building efforts were attached to preparation of national communication and technology needs assessment. Necessity of capacity building for assessing the costs of adaptation in developing countries is recognized as part of long-term cooperative action and agreed to enhance action on financial and technical support.

In Cancun, it has decided to enhance action on capacity-building support to developing countries for strengthening endogenous capacities at the sub-national, national, or regional levels. These actions will include strengthening (a) institutional capacity at various levels; (b) networks for the generation, sharing, and management of information and knowledge; (c) climate change communication, education, training, and public awareness; (d) existing and emerging capacity-building needs technology development and transfer as well as access to finance.

In 2015, Parties to the UNFCCC established the Paris Committee on Capacity Building. This committee will aim to address both current and emerging gaps and needs of developing countries. It has also decided to launch a work plan for the period 2016–2020. The work plan covers several areas including (a) an assessment on how to increase synergies through cooperation and avoid duplication; (b) identification of capacity gaps and needs as well as recommendation on way forward; (c) promote the development and dissemination of tools and methodologies for the implementation of capacity-building; (d) foster global, regional, national,

and sub-national cooperation, (e) identification of opportunities to strengthen capacity at the national, regional, and sub-national levels.

In addition to several actions related to finance, technology, and capacity building, in 2010, Parties to the UNFCCC has established Adaptation Committee to promote the implementation of enhanced action on adaptation in a coherent manner. Discussion on loss and damage has also picked up during this time. A work programme established to identify approaches to address loss and damage associated with climate change impacts in developing countries. A Standing Committee on finance has also been established during this period to improve coherence and coordination in the delivery of climate change finance, rationalization of the financial mechanism, and mobilization of financial resources.

Development of climate change strategy and action plan continued during this period including formulation and enactment of climate change policies and acts. Efforts on integration of climate change adaptation into development planning and budgeting system has also emerged. Implementation of climate change adaptation projects has increased and learning by doing become a key approach to design and implement adaptation measures. Establishment of national adaptation fund or/and climate funds also has emerged during this period.

1.4 Paris and Beyond

1.4.1 *Global Adaptation Goal*

The Paris Agreement, ratified by 175 Parties¹ to the United Nations Framework Convention on Climate Change (UNFCCC), has established the global goal on adaptation of enhancing adaptive capacity, strengthening resilience, and reducing vulnerability to climate change. Three key indicators, i.e. adaptive capacity, resilience, and vulnerability of the global goal on adaptation come with their inherent challenges of quantification and comparability. To build mutual trust and confidence and to promote effective implementation, Parties have also agreed to an enhanced transparency framework for action, including adaptation, with built-in flexibility to accommodate specific circumstances and diversities of countries. While regular submission of information related to mitigation is mandatory (Article 13.7), adaptation reporting is not mandatory, as the Paris Agreement states that Parties “should”, as appropriate, submit and update an “adaptation communication” (Article 7.10, 13.8). Parties has also requested the UNFCCC Secretariat to maintain a public registry of adaptation communications.

¹<http://unfccc.int/2860.php>, accessed on 31 March 2018.

1.4.2 Adaptation Communication

Adaptation communication is one of the key building blocks of Paris Agreement which will allow countries to communicate their adaptation status and support need. It has decided to include priorities of a country, progress in implementation of adaptation measures, support received, and future support require in adaptation communication. Discussion is still going on and aiming to complete by 2018 focusing on defining the purpose of communication, different common elements which will applicable to all parties and additional elements those country may wish to include in their adaptation communication. Without prejudging the final agreed outcomes of the negotiations under Paris Agreement, discussions on purposes of adaptation communication are centred around (a) communicate national adaptation priorities, plans, actions, and implementation and support needs, (b) contribute and inform progress towards the global goal for adaptation, (c) provide input to the global stock-take, (d) recognition of adaptation efforts, (e) strengthen visibility and profile of adaptation/parity with mitigation, (f) enhance actions and support for developing countries, and (g) enhance learning and understanding of adaptation, sharing experiences and good practices.

1.5 Contents of the Book

Importance of mobilization of adaptation knowledge such as synthesize and develop new knowledge products to support adaptation planning and interventions has been recognized in several decisions of the United Nations Framework Convention of Climate Change (UNFCCC) including Nairobi Work Programme (NWP), and Lima Adaptation Knowledge Initiative (LAKI). It has also recognized that adaptation knowledge need to be mobilized for different actors at different levels and for different sectors to improve understanding and assessment of impacts, vulnerability and adaptation, and to support informed decision-making. Effective dissemination of climate information and knowledge products at regional, national, and sub-national levels on a timely manner is equally.

The Asia Pacific Adaptation Network (APAN), developed and launched by the United Nations Environment Programme (UN Environment) in 2009 under the Global Adaptation Network (GAN), is the first regional adaptation network. The Ministry of the Environment of Japan is supporting implementation of APAN's activities since its inception. Over the years, APAN has established a good partnership with key sub-regional organizations and become a key adaptation knowledge mobilizer in the Asia and the Pacific Region. It is responding to the request of CoP21 to the United Nations specialized organizations and agencies to support the adaptation efforts of Parties including strengthen cooperation on enhancing action on adaptation, sharing information, good practices, experiences and lessons learned related to science, planning, policies, and implementation. APAN is also supporting

the Nairobi Work Programme (NWP) and Lima Adaptation Knowledge Initiative (LAKI) of the United Nations Framework Convention on Climate Change (UNFCCC) particularly development of knowledge products to improve understanding and assessment of impacts, vulnerability and adaptation, support informed decision-making as well as the effective dissemination of knowledge products at the regional, national, and sub-national levels. Asia Pacific Adaptation Forum become the largest gathering of adaptation practitioners for sharing and learning from each other.

This book is an outcome of collaborative efforts among Asia Pacific Adaptation Network (APAN), Korea Adaptation Centre for Climate Change (KACCC) of Korean Environment Institute (KEI), and APAN sub-regional and thematic partners. This book has tried to summarize various aspects of adaptation under eight essential areas of adjustment as argued in Chap. 2. This chapter on adaptation journey presents chronological development of adaptation trajectory mostly covering progress under the United Nations Framework Convention on Climate Change (UNFCCC) and efforts at national level. Chapter 2 presents an assessment framework, which has been applied for assessing status of climate change adaptation in five sub-regions, i.e. Central Asia, South Asia, Southeast Asia, Northeast Asia, and Pacific. This assessment framework has also been applied for assessing status of adaptation in Agriculture Sector in Asia, and Agriculture and Food Security in Hindu Kush Himalaya region. Chapter 3 provides an overview of status of adaptation in Asia and the Pacific region highlighting prevailing commonalities and differences. Five sub-regional level chapters, i.e. Chap. 4: Central Asia, Chap. 5: Northeast Asia, Chap. 6: Pacific Region, Chap. 7: South Asia, and Chap. 8: Southeast Asia, present status of adaptation at sub-regional level. Chapter 9 summarizes status of adaptation in Agriculture Sector while Chap. 10 provides status of adaptation in Hindu Kush Himalaya region. Chapter 11 provides an overview of country needs and mechanisms available at international and regional levels to support countries to enhance adaptation actions and address gaps.

References

- Carter TR, Parry ML, Harasawa H, Nishioka S (1994) IPCC technical guidelines for assessing climate change impacts and adaptations. Department of Geography, University College London, London
- Houghton JT (2009) Global warming: the complete briefing. Cambridge University Press, Cambridge
- IPCC (1995) Climate change 1995. IPCC second assessment report
- IPCC (2000) Special report on methodological and technological issues in technology transfer. A special report of IPCC working group III, published for the intergovernmental panel on climate change
- Landsberg H (1945) Climatology. In: Berry FA, Bolla E, Beers NR (eds) Handbook of meteorology. McGraw Hill, London
- Smith JB, Lazo JK (2001) A summary of climate change impact assessments from the U.S. country studies program. *Clim Change* 50:1–29 (Kluwer Academic)

- UN (1988) UN resolution, A/RES/43/53 protection of global climate for present and future generations of mankind, New York
- UNFCCC (1995) Report of the conference of the parties on its first session, Berlin, April 1995
- UNFCCC (2005) Report on the seminar on the development and transfer of technologies for adaptation to climate change. FCCC/SBSTA/2005/8
- WMO (1979) Declaration of world climate conference, IOC/SAB-IV/INF.3. World Meteorological Organization, Geneva
- WMO (1986) Report of the international conference on the assessment of the role of carbon dioxide and of other greenhouse gases in climate variations and associated impacts. WMO-No. 661, Geneva

Chapter 2

Measuring Status of Climate Change Adaptation: An Assessment Framework



Mozaharul Alam and Saleemul Huq

Abstract The global adaptation goal is one of the key outcomes of the Paris Climate Change Agreement. This goal includes enhancement of adaptive capacity, strengthening of resilience, and reduction of vulnerability, while adaptation to climate change is defined as adjustment in natural or human systems in response to actual or expected climate stimuli or their effects. Tracking or measuring adaptation to climate change is a new aspect of this international discussion and ideas are emerging fast. Several initiatives are already in place and several relevant papers have been published in recent times. This assessment framework for measuring the status of climate change adaptation is an effort to contribute to the global discussion and understand different elements of adaptation. This assessment framework suggests a combination of readiness and outcome-based approaches to measure the status of adaptation by analyzing the adjustments required for achieving the adaptation objective(s). It also suggests how past adjustments can be used as evidence and demonstrate effectiveness in achieving similar adaptation objective(s). This assessment framework has been applied to analysis of the status of climate change adaptation in five subregions in Asia, and two sectors and elements are fine-tuned during its application.

Keywords Measuring climate change adaptation · Adjustment · Adaptation objectives · Status of adaptation

M. Alam (✉)
United Nations Environment Programme, Bangkok, Thailand
e-mail: alam31@un.org

S. Huq
International Centre for Climate Change and Development, Dhaka, Bangladesh
e-mail: saleemul.huq@iied.org

2.1 Introduction

Avoidance of dangerous anthropogenic interference in the climatic system could have been the best method of lowering impacts associated with climate change and lessening the enormous adaptation needs arising today. More than 20 years ago, political leaders realized the need for addressing climate change and reached an agreement known as the United Nations Framework Convention on Climate Change (UNFCCC). The UNFCCC aims to stabilize concentrations of greenhouse gases in the atmosphere at a level that would prevent dangerous anthropogenic interference with the climate system. The main reasons behind the objective of stabilization were to (a) allow ecosystems to adapt naturally to climate change; (b) ensure that food production is not threatened; and (c) enable economic development to proceed in a sustainable manner (UNFCCC 1992). UNFCCC negotiations over more than two decades reached a political agreement to keep the global temperature rise below 2 °C compared to the preindustrial level and aspired to keep it within 1.5 °C (UNFCCC 2015). However, the progress toward stabilization of greenhouse gas concentrations that is required to keep the temperature rise below 2 °C is negligible. The latest scientific assessments have revealed that the temperature might even rise by more than 4 °C by the end of this century.

Since 1992, regular assessment reports published by the Intergovernmental Panel on Climate Change (IPCC), as well as other assessments including those from the International Energy Agency (IEA), have clearly revealed continuous growth of greenhouse gas emissions and concentrations at the global level. The IPCC's *Fifth Assessment Report* stated that carbon dioxide concentrations have increased by 40% since preindustrial times, primarily from fossil fuel emissions and secondarily from net land-use change emissions. The IPCC reports have also revealed that changes in climate have caused impacts on natural and human systems on all continents and across the oceans in recent decades. Evidence of climate change impacts is strongest and most comprehensive for natural systems and there are some impacts on human systems too. Continued emissions of greenhouse gases will cause further warming and changes in all components of the climate system (IPCC 2013, 2014).

The IPCC has defined adaptation as adjustment in natural or human systems in response to actual or expected climate stimuli or their effects. This adjustment aims to moderate harm or exploit beneficial opportunities. Various categories of adaptation include anticipatory and reactive adaptation, private and public adaptation, and autonomous and planned adaptation (Smith et al. 2001). There are several critical aspects in defining adaptation to climate change including adaptation for whom (natural and human systems), to what (temperature, rainfall, sea level rise, and salinity), at what scale (national, subnational, geospatial, etc.), and for which time frame. Actors' perception of climate change risks is an equally important factor for defining adaptation, as some risks may be routine and/or the consequences so minor that they are accepted, while risks that pose fundamental threats to actors' objectives or the sustainability of natural systems may be judged as intolerable (Klein et al. 2014).

Discussion on adaptation goal(s), adaptation objective(s), and adaptation gap(s) is appearing increasingly in the climate change discourse both in the scientific literature and in the climate change negotiations. The IPCC's *Fifth Assessment Report* stated that adaptation goals are often expressed in a framework of increasing resilience (Noble et al. 2014). It also appears that the difference between the current state and some predefined adaptation goals is a more likely way to define the adaptation gap. However, it is being noted that there is no common definition or set of elements used for defining adaptation goal(s), objective(s), and gap(s), and therefore all aspects stated above are important. While discussion is progressing on adaptation objective(s), several approaches are emerging for assessing the status of adaptation through tracking of climate finance; outcome-based approaches; preparedness-, process-, and policy-based approaches; and developmental outputs and outcomes of climate adaptation investment approaches, etc. (CFU 2013, Ford et al. 2013, Brooks and Fisher 2014).

2.2 Typologies for Tracking Adaptation

Though tracking adaptation is new and emerging, there are several relevant initiatives and papers that have been published in recent times. These include information on tracking climate finance by Climate Funds Update (CFU); outcome-based approaches; preparedness-, process-, and policy-based approaches (Ford et al. 2013); and developmental outputs and outcomes of a climate adaptation investment approach called Tracking Adaptation and Measuring Development (TAMD) (Brooks et al. 2013).

Climate Funds Update (CFU) is an independent website that provides information on the growing number of international climate finance initiatives designed to help developing countries to address the challenges of climate change. It is a joint initiative of the Heinrich Böll Stiftung (HBF) and the Overseas Development Institute (ODI), in an effort to increase the transparency of climate finance flows. It provides information on funds from the stage of donors' pledges for funding through to the actual disbursement of financing for projects.

The Tracking Adaptation and Measuring Development (TAMD) framework offers a "twin track" approach that focuses on assessing and comparing the effectiveness of interventions that directly or indirectly help populations adapt to climate change. It differs from other assessment frameworks by emphasizing the need to assess development interventions in the light of changing climate risks. This is to avoid missing effective interventions whose outcomes are obscured by increasing risks and vulnerability (Brooks et al. 2013).

Ford et al. (2013) have developed a typology of approaches by which climate change adaptation can be tracked globally at a national level. They have come up with two main typologies: (a) outcome-based approaches, which directly measure adaptation progress and effectiveness of avoidance of climate change impacts; and (b) preparedness-, process-, and policy-based approaches, which systematically

measure adaptation readiness, processes undertaken to advance adaptation, policies and programs implemented for adaptation, and measures of the impacts of these policies and programs on changing vulnerability. Table 2.1 lists the key elements/indicators of the tracking approaches mentioned above.

Table 2.1 Key elements/indicators of several tracking approaches for adaptation to climate change

Name of framework	Key elements/indicators for tracking adaptation
CFU	<ul style="list-style-type: none"> • Where and by whom climate change funds are being developed • Scale of proposed and actual financing • What the funds support, in terms of focus, regions, and projects
TAMD	<ul style="list-style-type: none"> • Tracking elements at the national level: climate change integration (mainstreaming) into planning; budgeting and finance; institutional knowledge/capacity; use of climate information; planning under uncertainty (using appropriate information and methodologies); participation (of relevant stakeholders in national planning processes); awareness among stakeholders
Outcome evaluation: reduced negative climate change impacts	<ul style="list-style-type: none"> • Climate-related losses, mortality, and morbidity, over time and in relation to adaptation • Impacts of climatic hazard events before and after adaptation
Adaptation readiness: presence of key governance factors essential for effective and successful adaptation	<ul style="list-style-type: none"> • Evidence of political leadership; institutional organization; stakeholder involvement; climate change information; appropriate use of decision-making techniques; and consideration of barriers to adaptation, funding, technology development, and adaptation research
Process-based approaches: process through which adaptations are developed and implemented in pursuance of a desired outcome or objective	<ul style="list-style-type: none"> • Comparison of adaptation characteristics and steps of development to theoretically and empirically derive characteristics of adaptation success and best practice
Analyzing policies and programmatic approaches: monitoring and comparison of reported adaptation actions and their characteristics	<ul style="list-style-type: none"> • Analysis of characteristics of reported adaptations and comparison across regions, by vulnerability categories, over time, and with respect to adaptation “obligations”
Examining measures of changing vulnerability: measurement of change in vulnerability in relation to adaptation	<ul style="list-style-type: none"> • Monitoring of aggregate vulnerability indexes in relation to adaptation actions • Focus on specific indicators that capture generic determinants of vulnerability (e.g., limited access to education, poverty, health, and inequality) • Examination of specific components of sensitivity and capacity for adaptation to climate change impacts

CFU Climate Funds Update, *TAMD* Tracking Adaptation and Measuring Development