Climate Risks and Solutions: Adaptation Frameworks for Water Resources Planning, Development and Management in South Asia

Background Paper 3

Review of Water and Climate Adaptation Financing and Institutional Frameworks in South Asia

Diana Suhardiman, Sanjiv de Silva, Indika Arulingam, Sashan Rodrigo and Alan Nicol

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About this Report

This is one of three papers commissioned by the World Bank and jointly implemented with the International Water Management Institute (IWMI) as part of the first phase of a two-phase Technical Assistance (TA) project to assess the opportunities for adaptation to climate change in the water sector in seven countries in South Asia (Afghanistan, Bangladesh, Bhutan, India, Nepal, Pakistan and Sri Lanka). The TA – Climate Risks and Solutions: Adaptation Frameworks for Water Resources Planning, Development and Management in South Asia – is funded by the South Asia Water Initiative (SAWI), a partnership of the governments of Australia, Norway and the United Kingdom.

Background Paper 1 describes the scientific understanding of predicted impacts of climate change on water resources and associated risks.

Lacombe, G.; Chinnasamy, P.; Nicol, A. 2019. *Review of climate change science, knowledge and impacts on water resources in South Asia. Background Paper 1*. Colombo, Sri Lanka: International Water Management Institute (IWMI). 73p. (Climate Risks and Solutions: Adaptation Frameworks for Water Resources Planning, Development and Management in South Asia). doi: 10.5337/2019.202

http://www.iwmi.cgiar.org/Publications/Other/PDF/sawi-paper-1.pdf

Background Paper 2 assesses the suitability of the enabling policy frameworks (existing policy, legislation, strategies and plans) for adapting to the impacts of climate change.

Davis, R.; Hirji, R. 2019. *Review of water and climate change policies in South Asia. Background Paper 2*. Colombo, Sri Lanka: International Water Management Institute (IWMI). 120p. (Climate Risks and Solutions: Adaptation Frameworks for Water Resources Planning, Development and Management in South Asia). doi: 10.5337/2019.203

http://www.iwmi.cgiar.org/Publications/Other/PDF/sawi-paper-2.pdf

Background Paper 3 (this paper) assesses the financial, economic, and institutional landscape for adapting to climate change.

Suhardiman, D.; de Silva, S.; Arulingam, I.; Rodrigo, S.; Nicol, A. 2019. *Review of water and climate adaptation financing and institutional frameworks in South Asia. Background Paper 3.* Colombo, Sri Lanka: International Water Management Institute (IWMI). 110p. (Climate Risks and Solutions: Adaptation Frameworks for Water Resources Planning, Development and Management in South Asia). doi: 10.5337/2019.204

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/ water resources development / water demand / water availability / water quality / water management / water supply / water institutions / water scarcity / water governance / international waters / climate change adaptation / flooding / drought / rainfall / economic situation / financing / funding / costs / landscape / decision making / planning / energy resources / food security / food production / hydropower / surface water / groundwater depletion / integrated management / population growth / poverty / climate-smart agriculture / domestic water / cooperation / nongovernmental organizations / government agencies / risk management / irrigation systems / coastal area / stakeholders / South Asia / Sri Lanka / Nepal / Bangladesh / India / Pakistan / Afghanistan / Bhutan /

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Front cover photograph: A woman adjusting a sprinkler in Alwar, Rajasthan, India (*photo:* Shaoyu Liu/IWMI).

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The first phase was implemented under the overall guidance of Dr. Rafik Hirji (formerly Senior Water Resources Specialist, Task Team Leader, World Bank) and Dr. Alan Nicol (Strategic Program Leader - Promoting Sustainable Growth, IWMI), who led the team from IWMI. The background papers were presented and reviewed at the Regional Conference on Risks and Solutions: Adaptation Frameworks for Water Resources Planning, Development and Management in South Asia, which was held in Colombo, Sri Lanka, on July 12-13, 2016. This regional conference was attended by 65 national, regional and international climate change and water resources experts, including over 20 representatives of governments in the region.

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ACRONYMS AND ABBREVIATIONS

ADB	Asian Development Bank
ADP	Annual Development Program
AfDB	African Development Bank
ANDMA	Afghanistan National Disaster Management Authority
BAU	Business-as-usual
BCAS	Bangladesh Centre for Advanced Studies
BCCRF	Bangladesh Climate Change Resilience Fund
BCCSAP	Bangladesh Climate Change Strategy and Action Plan
BCCT	Bangladesh Climate Change Trust
BCCTF	Bangladesh Climate Change Trust Fund
BDT	Bangladeshi Taka
BIDS	Bangladesh Institute of Development Studies
BMDA	Barind Multipurpose Development Agency
BWA	Bhutan Water Authority
BWDB	Bangladesh Water Development Board
CAD	Command Area Development
CARDF	Comprehensive Agriculture and Rural Development Facility
CBO	Community-based Organization
CCAP	Climate Change Action Plan
CCC	Climate Change Cell
CCD	Climate Change Division
CCD	Coast Conservation Department
CCKN	Climate Change Knowledge Network
CCPSC	Climate Change Program Steering Committee
CCS	Climate Change Secretariat
CCU	Climate Change Unit
CDM	Clean Development Mechanism
CDMP	Comprehensive Disaster Management Program
CEA	Central Environmental Authority
CEGIS	Center for Environmental and Geographic Information System
CFF	Climate Fiscal Framework
CFU	Climate Finance Unit
CGE	Computable general equilibrium
CIF	Climate investment fund
COP	Conference of the Parties (UNFCCC)
CPEIR	Climate Public Expenditure and Institutional Review
DANIDA	Danish International Development Agency
DFI	Development finance institutions
DFID	Department for International Development (United Kingdom)
DNA	Designated national authority
DoA&C	Department of Agriculture and Cooperation
DoE	Department of Environment
DoLR	Department of Land Resources
DRR	Disaster risk reduction
DTW	Deep tube well
EBRD	European Bank for Reconstruction and Development
EIA	Economic impact assessment

EIB	European Investment Bank
ETI	Energy, technology, and industry
FAO	Food and Agriculture Organization of the United Nations
FO	Farmer organization
GBM	Ganges-Brahmaputra-Meghna
GCCA	Global Climate Change Alliance
GCF	Green Climate Fund
GDP	Gross domestic product
GED	General Economic Division
GEF	Global Environment Facility
GHG	Greenhouse gas
GIZ	Deutsche Gesellschaft für Internationale Zusammenarbeit
GLOF	Glacial lake outburst flood
GMIS	Gender Management Information System
GoA	Government of Afghanistan
GoB	Government of Bangladesh
GoI	Government of India
GoN	Government of Nepal
GoP	Government of Pakistan
HIC	High-income country
IBFCR	Inclusive Budgeting and Financing for Climate Resilience
ICIMOD	International Centre for Integrated Mountain Development
IDBG	Inter-American Development Bank Group
IFAD	International Fund for Agricultural Development
IMED	Implementation Monitoring and Evaluation Division
INCCA	Indian Network for Climate Change Assessment
INCF	Indian National Climate Fund
IPCC	Intergovernmental Panel on Climate Change
IUCN	International Union for Conservation of Nature
IWMI	International Water Management Institute
IWMP	Integrated Watershed Management Program
IWRM	Integrated water resources management
IWT	Indus Water Treaty
JCS	Joint Country Strategy
JRC	Joint Rivers Commission
KRBM	Koshi River Basin Management
LAPA	Local Adaptation Plans for Action
LDCF	Least Developed Countries Fund
LEAD	Leadership for Environment and Development
LIC	Low-income country
LMIC	Low- and middle-income country
MAIL	Ministry of Agriculture, Irrigation and Livestock
MASL	Mahaweli Authority of Sri Lanka
MBF	Ministry Budget Framework
MDB	Multilateral development bank
MIC	Middle-income country
MoCC	Ministry of Climate Change
MCCICC	Multi-Stakeholder Climate Change Initiatives Coordination Committee
MDG	Millennium Development Goal
MFF	Mangroves for the Future

MoA	Ministry of Agriculture
MoAF	Ministry of Agriculture and Forests
MoAFW	Ministry of Agriculture and Farmers' Welfare
MoCC	Ministry of Climate Change
MoE	Ministry of Energy
MoEn	Ministry of Environment
MoEA	Ministry of External Affairs
MoEF	Ministry of Environment and Forests
MoEFCC	Ministry of Environment, Forest and Climate Change
MoEW	Ministry of Energy and Water
MoF	Ministry of Finance
MoFDM	Ministry of Food and Disaster Management
MoHCA	Ministry of Home and Cultural Affairs
MoI	Ministry of Irrigation
MoIWRM	Ministry of Irrigation and Water Resources Management
MoLGRDC	Ministry of Local Government, Rural Development and Co-operatives
MoMDE	Ministry of Mahaweli Development and Environment
MoNDM	Ministry of National Disaster Management
MoNRE	Ministry of New and Renewable Energy
MoP	Ministry of Power
MoPl	Ministry of Planning
MoRRD	Ministry of Rural Rehabilitation and Development
MoST	Ministry of Science and Technology
MoSTE	Ministry of Science, Technology and Environment
MoUD	Ministry of Urban Development
MoWP	Ministry of Water and Power
MoWR	Ministry of Water Resources
MSTCCC	Multi-Sectoral Technical Committee on Climate Change
MTBF	Medium Term Budget Framework
NABARD	National Bank for Agriculture and Rural Development
NAF	National Adaptation Fund
NAP	National adaptation plan
NAPA	National Adaptation Programme of Action
NAPCC	National Action Plan on Climate Change
NAST	Nepal Academy of Science and Technology
NCCKMC	National Climate Change and Knowledge Management Center
NCCP	National Climate Change Plan
NCCSP	Nepal Climate Change Support Program
NCEF	National Clean Environment Fund
NDB	Non-Development Budget
NDF	National Development Framework
NDMC	National Disaster Management Committee
NEC	National Environment Commission
NECS	National Environment Commission Secretariat
NEMAP	National Environment Management Action Plan
NEPA	National Environment Protection Act
NGO	Nongovernmental organization
NIE	National implementing entity
NICCSA	National Institute for Climate Change Studies and Actions

NPC	National Planning Commission
NPDM	National Plan for Disaster Management
NSAPR	National Strategy for Accelerated Poverty Reduction
NWG	National working group
NWP	National Water Plan
NWRC	National Water Resources Council
NWSDB	National Water Supply and Drainage Board
O&M	Operation and maintenance
ODA	Official development assistance
ODI	Overseas Development Institute
PC	Planning Commission
PCA	Per capita availability
PDMC	Provincial disaster management committee
PECM	Poverty, Environment and Climate Change Mainstreaming
PEPC	Pakistan Environmental Protection Council
PFM	Public Financial Management
PIEDAR	Pakistan Institute for Environment-Development Action Research
PIM	Participatory irrigation management
PMCCC	Prime Minister's Council on Climate Change
PMO	Prime Minister's Office
PPCR	Pilot Program for Climate Resilience
PPP	Public-private partnership
R&D	Research and development
RBO	River basin organization
RCP	Representative Concentration Pathway
RNR	Renewable natural resource
ROR	Rate of return
SAARC	South Asian Association for Regional Cooperation
SACEP	South Asia Co-operative Environment Programme
SAPA	Sector adaptation plan of action
SAPCC	State Action Plans on Climate Change
SASP	South Asian Seas Programme
SAWI	South Asia Water Initiative
SCOPE	Pakistan Environmentalists Association, Society for Conservation and Protection of Environment
SDG	Sustainable Development Goal
SIDS	Small island developing states
SSP	Shared Socioeconomic Pathway
STW	Shallow tube well
UNCBD	United Nations Convention on Biological Diversity
UNCCD	United Nations Convention to Combat Desertification
UNDP	United Nations Development Programme
UNEP	United Nations Environment Programme
UNFCCC	United Nations Framework Convention on Climate Change
UNCDF	United Nations Capital Development Fund
UP	Union Parishad
VDC	Village Development Committee
WACREP	Water and Climate Resilience Program
WAPDA	Water and Power Development Authority
WARPO	Water Resources Planning Organization

WEC	Water and Energy Commission
WECS	Water and Energy Commission Secretariat
WUA	Water Users' Association
WUE	Water-use Efficiency

EXECUTIVE SUMMARY

This paper looks at two particular, yet interlinked, aspects: the current financial flows related to climate adaptation strategies, and the institutional landscapes in place for driving adaptation planning and action on the ground, with a particular focus on the water sector. The paper sees water resources as being central to climate adaptation given that a range of climatic impacts are expressed in quantitative or temporal dimensions of water availability, with strong links to water quality. Thus, it argues that improving water resources management represents a key adaptive strategy for countries.

A structural approach is also adopted to assess the manner in which adaptation planning occurs, including decision making around allocation of finance for adaptation activities. The paper considers how these processes integrate adaptation across sectors, as well as their representativeness in recognizing and addressing the particular needs of vulnerable population groups. While much of the analysis is at country scale, the paper recognizes the importance of regional cooperation given the high incidence of transboundary water resources in South Asia. The report arrives at recommendations that reflect common characteristics across the assessed countries—as well as more country-specific needs—if identified gaps in adaptation financing and planning processes are to be strengthened.

Given that the paper was developed primarily through a desk-based review of existing literature and data, the information presented and the analysis are reflective of this limitation. Therefore, the significant difference in the availability of information across the seven countries must be considered. This is reflected in the paper through the varying levels of detail available for the different countries, which also partly reflects the different levels of complexity between the larger economies, such as India, compared to others, such as Bhutan. Country experiences with adaptation are also different, with Bangladesh, in particular, exhibiting adaptation mechanisms developed over a long history of adapting to several different major natural disaster scenarios. The absence of opportunities to generate primary data has been managed through several iterations of in-country expert review at various stages of development of this paper.

Together with the other two papers in this series, and through a review of existing literature, this paper provides a point of reference for a wide range of actors with the ability to take up its findings. These actors include policy makers and planners at national and subnational levels, donors, nongovernmental organizations (NGOs) and civil society groups.

The paper illustrates the centrality of water in a wide range of key economic sectors, such as food production, energy and industry. In Nepal and Bhutan, for instance, hydropower generation is dominant as the primary economic driver. Irrigation, on the other hand, holds relevance across the board. The importance of surface water and groundwater varies, but the prominence of the latter in some countries (India, Bangladesh) and rapid growth in others (Sri Lanka, Afghanistan) is notable, given its association as a buffer in times of water stress. Although contributing less today to gross domestic product (GDP), agriculture is clearly central to food security and continues to employ half or more of each country's workforce, with the exception of Sri Lanka. In Nepal, Pakistan and Afghanistan, agriculture accounts for 60% or more of the national workforce.

Presenting Integrated Water Resources Management (IWRM) as a key adaptive strategy is crucial in relation to the way water has become a multi-faceted driver of development, and also with regard to its high vulnerability to climate change. As observed in the first paper in this series (Lacombe et al. 2019), major climatic risks are linked to changes in water resource conditions, be it quantitative changes (floods, droughts), other forms of sudden events (storm surges, cyclones), or subtler, incremental impacts (rainfall variation and salinization, including coastal saltwater intrusion). Collectively, these risks make a compelling argument for positioning improved and more integrated water resources management as an explicit and vital adaptation response, which could possibly turn risks into development opportunities.

An important finding of this paper is that this opportunity appears to be not fully internalized by countries. For instance, in addition to large disparities between estimated adaptation costs and available financial flows, discernible financial flows to the water sector are small compared to other sectors, such as agriculture. However, it is recognized that, given the intersection of water with multiple sectors, available data may be missing other financial allocations embedded in these sectors. Nevertheless, the disconnect between water and other sectors appears to continue as the analysis moves from financial allocation to adaptation planning, implementation and monitoring. Of course, such a conclusion applies to different degrees in each country, also recognizing that the current status reflects each country's overall economic and political conditions, and exposure to environmental risks. This is perhaps best demonstrated by Bangladesh, which comes closest to being an exception to this conclusion, given ongoing institutionally embedded efforts to effect greater sectoral integration and institutional continuity between fundraising and fund allocation to critical adaptation needs, and accountability by tracking returns on investments. The country's long history of adapting to a range of major environmental risks is undoubtedly an advantage. See Box ES.1 for key findings.

Box ES.1. Key findings.

Highlighting the centrality of water in the understanding of climate risks, costs and adaptive opportunities

- Water is vital for economic development, including livelihoods and food security.
- Given the high vulnerability of water to climate change, it is extremely important that improved and more integrated water resources management be placed at the center of adaption strategies.
- This centrality of water is recognized in climate and water policies, but is rarely translated in country adaptation responses and priorities.

Assessing the cost of climate change impacts

- Adaptation cost assessments are patchy with fragmented sectoral coverage. This impedes understanding a country's risks, and financing needs and priorities.
- Current cost estimates expressed as a percentage of GDP mask important geographic and demographic differences, which may mean that vulnerable groups as well as key sectors are overlooked or underrepresented.

Adaptation financing

- All countries, with the exception of India and Bangladesh, face a significant financial gap in climate adaptation and are heavily dependent on external funding.
- The smaller economies struggle to navigate a complex and competitive external funding landscape with underdeveloped in-country capacity.
- In-country private sector financing is seemingly a relatively untapped funding source.
- Poor transparency and accountability in climate finance allocation undermines attempts to assess the efficiency and efficacy of adaptation action.

Institutions

- Sectoral fragmentation is a fundamental structural weakness. It disrupts the institutional continuity needed from accessing funds to tracking their investment in adaptation.
- National coordination bodies (such as climate cells) struggle to cope with entrenched sectoral approaches, and lack of capacity to generate cross-sectoral collaboration.

The analysis looks at adaptation financing (treated wherever possible as separate to mitigation financing) and institutional preparedness for planning and action for adaptation as a continuum. The absence of comprehensive cost assessments of climate change impacts, in general, and water resources management, in particular, has important ramifications across the seven countries. Existing assessments are generally sector focused with some sectors not assessed. This impedes understanding a country's financing needs, and risks disadvantaging those sectors without assessments in relation to funding from external sources and allocations from national budgets. Another key weakness is the expression of actual and potential costs in terms of GDP. This risks glossing over the significant geographic and demographic differences in the distribution of these costs. As poor and marginalized groups are more vulnerable to climate shocks, linking cost estimates to specific population groups and locations arises as a critical adjustment necessary across the countries. See Box ES.2 for recommendations.

Box ES.2. Recommendations.

Overall, a more refined and holistic approach to climate adaptation is needed that defines the multi-sectoral linkages of various climate risks (see, for example, Table 1.1 in Davis and Hirji 2019,) and recognizes the various steps, such as securing funds, planning, fund allocation and tracking, as parts of a single, integrated process. Implementing such an approach is likely to require institutional linkages to be built between sectors (horizontal integration) and between central agencies with a mandate for overall planning and coordination, and between regional and local stakeholders (vertical integration).

Assessing the cost of climate change impacts

- Estimates of climate change costs must be disaggregated across sectors. Although such countries have started taking initiatives in this regard (for example, Bhutan with sector adaptation plans of action [SAPA]), further work needs to be done. Noting inter-sectoral linkages can indicate where multiple costs can be avoided or minimized through the same investment.
- Cost estimates should reflect the different vulnerabilities of specific population groups, key sectors and geographical areas for a more spatially and socially nuanced adaptation response.

Adaptation finance

- Investing in IWRM needs to be central to the national adaptation strategy—consistent with the climate and water policies—in view of the multi-sectoral relevance of water, with explicit financing.
- A tracking mechanism around which a "value for money" accountability mechanism can be developed should be considered, e.g., the climate change marker being considered by the Government of Bangladesh (GoB). This would help track the total amount of resources spent on climate-related expenditure against the impact generated.

Institutions

- Adequate staffing and training following a skill gap assessment can improve performance of national adaptation focal agencies toward more effective climate adaptation.
- Just as water resources must be central to the overall adaptation response, adaptation itself must be placed at the center of future development planning.
- Regional approaches for promoting opportunities for greater sharing of knowledge and cooperation (e.g., on flood early warning, cost-effective approaches for dealing with arsenic in water supply, and measures for preventing saltwater intrusion in coastal aquifers), and for mediation (in water-sharing issues) is critical for transboundary cooperation toward more holistic adaptation measures is South Asia.

All countries are faced with having a significant gap in finance for climate adaptation. In countries with larger economies, such as India and Bangladesh, over 80% of identifiable adaptation finance has originated from national budgets, although this trend shows a sharp decline in Bangladesh in recent years. Financing in the other countries shows a marked dependency on external funding. Navigating a dense landscape of different external funds and competition for limited finance among countries require additional and unique in-country institutional capacities. The shift from grants to loans on the part of donors also means that adaptation costs are likely to increase when financed from external funding. An area seemingly relatively untapped is private sector financing. Furthermore, the limited information available on finance flows to the water sector suggests that water resources management is generally not a priority in the context of climate adaptation. Water often falls outside of the top-funded sectors for climate adaptation, with agriculture generally being the top recipient.

The institutional responses to mobilize adaptation involve either the formation of inter-ministerial coordination bodies or assigning the responsibility to tackle climate-related issues to specific sector ministries. Several countries have also established separate climate funds, which, to some extent, delink the tasks of financing with adaptation planning and implementation. These mechanisms, with the exception of those in Bangladesh, also struggle to overcome perennial weaknesses arising from the sectoral fragmentation of the government. There is little evidence that existing climate institutions can overcome entrenched sectoral approaches to development planning. They tend to lack the capacity to generate cross-sectoral collaboration toward the shaping of holistic climate adaptation programs. At the heart of these issues lies the issue of power struggles between agencies vested with climate response coordination and other relevant ministries that are expected to cooperate. In Nepal, for example, both the Ministry of Energy (MoE) and the Ministry of Irrigation (MoI) could proceed with their plans to build hydropower and irrigation dams, respectively, without any consultation with the Climate Change Secretariat (CCS) located under the Ministry of Science, Technology and Environment (MoSTE). The issue is not entirely about mandates, but also reflects the need for investments in developing human capacities, if these coordinating bodies are to be transformed into entities capable of pushing through a coherent and integrated vision for adaptation within the complex political economy of fragmented national institutional landscapes. This fundamental structural weakness is reflected throughout the institutional continuum, from patchy cost assessments of climatic risks to disjointed fund allocation, and an almost complete absence of mechanisms to track adaptation investments against planned outcomes.

Bangladesh is an exception to the above observation, due to the proposed adoption of a climate change marker attached to adaptation (and mitigation) financing. This recommendation, in fact, builds upon markers for poverty reduction and gender that are already in use. It is the closest to making the important transition to climate finance becoming an integral and explicit part of budgetary processes, with clear integration into sector planning and oversight mechanism. This may, in fact, offer a road map for other countries. Another critically important feature of these developments in Bangladesh is that the aforementioned recommended institutional adjustments have arisen from studies commissioned by the Ministry of Finance (MoF) no less. This could be construed as an indication of the degree to which responding to climatic risks has been positioned by the government as a national development priority. This, too, contrasts markedly with the inability already noted of national apex adaptation bodies to make adaptation a unifying and organizing focus.

There are other key findings, however, in which even Bangladesh is not an exception. One such finding is that local communities continue to be positioned as recipients of primarily centrally defined adaptation programs. Many of these groups are those that are already experiencing inequalities, and therefore possess the least adaptive capacities. Despite a few countries introducing regional adaptation plans (such as the Local Adaptation Plans for Action [LAPA] in Nepal), there appears to be a consensus that insufficient effective institutional mechanisms exist to capture and reflect context-specific needs articulated by local stakeholders. In addition to the risk of fostering maladaptation, failure to actively engage local stakeholders leads to the inability to mobilize the significant human capital for adaptation that currently remains mostly untapped.

Institutional disconnects both vertically (across administrative scales) and horizontally (sectoral dissonance) currently undermine deliberative decision making in climate adaptation toward the shaping of holistic adaptation planning, involving all relevant sectors and also including the voices of the poor and marginalized groups. IWRM can serve as a starting point to initiate open discussion on how cross-sectoral interlinkages and coordination can be established as part of an institutional remedy to tackle climate risks. While the current institutional status quo does not always accommodate the envisioned integration, climate change can provide potential entry points for change to move beyond the present institutional traps within the water sector and more broadly.

Finally, the biogeography of South Asia demands cognizance be taken of the critical need for effective regional cooperation. Transboundary impacts can have a major effect on the efficacy of country-level adaptation investments, with the exception of Sri Lanka, given its island nation status. Given the abundance of transboundary rivers in the region, and their origins in glaciers located in several focal countries, water assumes a central position in defining a number of the key transboundary elements linked to climate risks. Its riparian status in multiple major river systems, and its extremely high dependence on transboundary flows for surface water supplies, makes Bangladesh the poster child for greater regional cooperation in this context. However, cooperation across national boundaries, as with sectoral boundaries, is stifled by the diverse economic and political influence of each country in the region. India, arguably the dominant economic and political actor, to a great extent, shapes current transboundary cooperation mechanisms on the sharing of water through a bilateral approach that plays to its dominant position. One option for transcending this approach could be to focus on the issue of glacial lake outburst floods (GLOFs), which may bring a larger number of countries into the dialogue, and place India as both an upper and lower riparian. See Box ES.3 for notes on regional cooperation.

Box ES.3. Regional cooperation is a critical element in adaptation.

With 54 rivers shared between India and Bangladesh alone, a highly interconnected network of rivers and aquifers, with the exception of Sri Lanka, characterizes the South Asian landscape. These shared rivers and aquifers, and the predicted glacial retreat in the Himalayas support the livelihoods of 400 million people across the Indo-Gangetic and Brahmaputra basins in Nepal, India and Bangladesh alone. Links between glaciers and this network of transboundary rivers and aquifers highlight the limitations of adaptive action confined to national boundaries, especially in the case of lower riparian states, and underscore the need for regional cooperation. This is best illustrated by Bangladesh, which not only depends on transboundary flows for 97% of its surface water but is also at risk of regular flooding from unregulated and uncontrolled water flows.

Cooperation among riparian countries, however, is limited, with agreements only for a few specific rivers, many of which predate full recognition of the risks posed by climate change. The focus on water sharing thus appears rather narrow when the need today is for cooperation along a broader front of water management needs and adaptive actions. The existing power asymmetries in economic, political, geographical and country priorities pose a significant challenge to achieving such cooperation. Central to these dynamics is India. Given its economic and political influence, and geographical positioning as a midstream state, India is likely to continue to play a central role in shaping and reshaping governance structures and processes for regional cooperation. While regional political systems such as the South Asian Association for Regional Cooperation (SAARC) and the South Asia Co-operative Environment Programme (SACEP) exist, they have been slow to lead region-wide adaptation initiatives, leaving no clear pathway for scaling existing bilateral approaches to a truly regional platform.

Chapter 1. Introduction

Developmental risks posed by climate change need to be viewed within a complex context of interactions between a host of drivers, including demography, economic development, urbanization and industrialization; availability of technology; and a variegated economic policy landscape. Within this broad perspective, water is central to many climate change impacts, such as floods, droughts, rainfall variation and salinity intrusion, which, together with other impacts such as temperature changes, are expected to have severe consequences for agriculture, health, energy and the environment in South Asia. According to IPCC (2014a), climate change impacts are projected to slow down economic growth, make poverty reduction more difficult and further erode food security. How these impacts will come about, however, is less clear, and this is one of the major findings of IPCC (2014b), which identified that climate change studies that help to understand the impacts are still inadequate in many areas of Asia.

This paper is part of a series of three papers that collectively seek to take stock of current knowledge of climatic risks in seven countries in South Asia (Afghanistan, Bangladesh, Bhutan, India, Nepal, Pakistan and Sri Lanka). This includes assessing their readiness to adapt to these challenges in terms of policy and planning, and the financial and institutional frameworks needed for effective implementation. Such an assessment pays particular attention to climate change risks in water resources management, given the expression of many climatic risks in terms of quantitative and qualitative dimensions of water resources. The existing state of knowledge and information on climate change science and risk is reviewed in Paper 1 (Lacombe et al. 2019). Paper 2 (Davis and Hirji 2019) looks at how this knowledge landscape is incorporated into the policy and planning process in the seven countries. This paper (Paper 3) examines how these policy frameworks and responses are translated into financial and institutional structures, and assesses the strengths and weaknesses of these structures in dealing with climate change and climate risks in the water sector.

This paper draws on an extensive literature review of current financial flows and institutional landscapes related to climate adaptation funding in the context of water resources management in South Asia. A detailed explanation of the information sources used and methodology followed is provided in the Appendix. The paper begins with a brief summary of the major drivers of the economy at both national and regional levels. It emphasizes the economic importance of the main water-related sectors, and provides a summary of climate change impacts on water resources and the economic consequences thereof. It then discusses current trends in financial and institutional frameworks for climate change adaptation. This includes structural factors influencing the targeting of climate finance to key needs, and the strengths and weaknesses that define each country's ability to cope with different climate risks, emphasizing the role that water resources management plays. The conclusion highlights the key findings and lessons to emerge from the study.

Chapter 2. Development, Water Resources and the Economic Implications of Climate Change in South Asia

South Asia has experienced the fastest economic growth rate of any region comprising low- and middle-income countries (LMICs) globally, with an average growth rate of 8% over the past 5 years (World Bank 2016j), which is expected to continue in 2017 and beyond (World Bank 2016k). Most countries in South Asia have benefitted from falling oil prices, a consistent input of remittances and low inflation (World Bank 2016j). India, South Asia's largest economy, was projected to grow at 7.6% in the fiscal year 2016/2017 and at 7.7% in 2017/2018, and comprises approximately 82% of this region's economy (World Bank 2016k). The region has also made important advances in poverty reduction. Further, there have been transitions in the political realm, with some of the countries witnessing major constitutional changes in the past decade. The development contexts of each the country is further elaborated in Table 2.1. Box 2.1 provides a summary of the key findings from this chapter.

Box 2.1. Key findings on water resources and the economic implications of climate change in South Asia.

Water resources have played an integral role in advancing South Asia's development goals. Going into the future, water demand is expected to increase considerably, exceeding supply in many cases.

Even as the contribution of the agriculture sector (the predominant user of water) to gross domestic product (GDP) continues to fall, the sector continues to generate half of all employment and is a key driver of poverty reduction. In mountainous countries such as Nepal and Bhutan, hydropower is expected to, or already is, contributing significantly to GDP growth. With rapid population increase and development in the region, by 2050, India, Pakistan and Afghanistan are expected to experience conditions of water stress with considerable regional disparities in distribution.

The impact of climate change on the spatial and temporal availability of water will have multiple consequences for economies, while its impacts will be unevenly distributed among different sections of society.

South Asia is considered to be one of the regions most vulnerable to climate change: extreme climatic events, including floods, droughts and glacial lake outburst floods (GLOFs), are expected to be further exacerbated as a result of increased climatic variability. In view of the multiple drivers that impact water resources, climate change can be considered a significant additional source of stress on the availability and demand of both surface water and groundwater resources in the region. Given the crosscutting nature of water, this can be expected to have knock-on effects across multiple sectors. Without taking into account extreme climatic events, the cost on the economy could be as high as 8.8% of GDP by 2100 under a business-as-usual (BAU) scenario.

The impacts of climate change are expected to disproportionately impact the most vulnerable sections of society. The poorest, including smallholder farmers, would be hit most severely, especially in countries that are highly dependent on agriculture.

In general, there are limited efforts to assess the impacts of climate change and the costs of adaptation.

The absence of comprehensive cost assessments of climate change impacts, in general, and for water resources management, in particular, is a key issue across the seven countries. Existing assessments are generally sector focused. The lack of information on the water sector could lead to a patchy picture of cost calculation and estimation, and unclear direction on water-related adaptation strategies. Comprehensive financial assessment of climate change impacts should disaggregate financial costs for the water sector specifically, while also linking these to broader development targets and specific population groups, with particular emphasis on gender, poor and marginalized groups.

Water plays a key role in advancing South Asia's development goals. Increasing food and energy security for much of the region is seen as a primary goal in improving the living conditions of the population. The water sector also supports GDP growth in multiple ways, and supports the livelihoods and economic development of millions of people. Natural ecosystems require healthy water systems to sustain them and for the provision of vital ecosystem services. The significance of water-related sectors to economic and social development in each of the countries and key aspects of these sectors that could affect water demand are presented in Table 2.2.

The agriculture sector is the leading user of water, accounting for over 80% of total water withdrawals in South Asia in 2011, except for Sri Lanka where it was 51% (Markandya et al. 2017). While the contribution of agriculture to GDP continues to fall in the region, now accounting for one-fifth of South Asia's GDP, the sector generates half of all employment opportunities. The sector has been instrumental in rural poverty reduction in a region where, with the exception of two countries, over 20% of the population lives in poverty. The management of water resources, therefore, continues to underpin efforts to reduce poverty levels, provide food security and enable economic advancement in South Asia.

The nature of the sector can be expected to change considerably in the coming years. Increasing rural to urban migration is a region-wide phenomenon, and the change in labor force can be expected to have consequences on the type of agriculture that is practiced. Among other changes, in Pakistan, non-crop sectors are becoming important contributors to agricultural GDP, since the yield growth from major crops has fallen in recent years. In economies gaining middle-income status, such as Sri Lanka and Bangladesh, the agriculture sector will be expected to diversify from chiefly rice production to more high-value crop production.

The overall economic growth of South Asia is largely driven by the services sector and private consumption (aggregate demand). The industry sector is projected to expand in some of the countries, with implications for water demand. In India, the manufacturing sector is geared to gain prominence in the next few decades, with a corresponding increase in water demand (Table 2.2). In addition, water resources can also be an important component of the transportation infrastructure required to boost industrial growth and trade. Bangladesh is currently working on developing the river network flowing into its largest port for this purpose.

Countries such as Bhutan and Nepal are focusing on ramping up hydropower generation capacities, while Pakistan has plans to do the same. In Bhutan, hydropower is already the leading contributor to GDP. With energy deficits being a general concern in the region, the increased hydropower generation is expected to meet this need domestically with export to neighboring countries also providing opportunities for significant financial inflows. According to Markandya et al. (2017), in countries such as India and Bangladesh, where the majority of energy is from other sources, the increasing demand for cooling water in thermal power plants is believed to pose a potential source of conflict with other demands on water, especially in India.

The seven countries of South Asia considered in this study (Afghanistan, Bangladesh, Bhutan, India, Nepal, Pakistan and Sri Lanka) are home to 23.7% of the global population, but contain only 4.6% of the global annual renewable water resources, which are unevenly distributed between countries and river basins. Therefore, while water resources will continue to be a vital component of development, rapid population growth in the region coupled with increasing intensity of water use mean that water would increasingly become a scarce resource in many of these countries. Already, 22 of 32 major Indian cities face daily water shortages, while people in Nepal face long queues for drinking water, and Pakistan is facing electricity and water shortages (Surie 2015). By 2050, per capita availability of water will dip below the Falkenmark water stress indicator (Falkenmark et al. 1989) threshold of 1,700 cubic meters (m^3) in India, Pakistan and Afghanistan (Table 2.4). Projected per capita water demand in each of the countries and the projected demand by key sectors is depicted in Tables 2.3 and 2.4.

TABLE 2.1. Snapshot of country development context, South Asia.

Data type	Afghanistan	Bangladesh	Bhutan	India	Nepal	Pakistan	Sri Lanka
Population (millions, 2014)[a]	32.76	159.4	0.776	1,294	28.32	185.5	20.77
Rural population (%, 2017)[b]	75	64	60	66	81	64	82
GDP (USD billions, 2014)[a]	20.62	172.9	1.945	2,039	20.00	244.4	79.36
GDP growth (%, 2015)	1.3	6.5	6.2	8.2	3.25	4.1	4.96
Poverty headcount ratio[c]	35.5 (2017)	14.8 (2016)	1.5 (2017)	21.2 (2011)	15 (2010)	4 (2015)	0.7 (2016)
Key trends in development	• Political uncertainty and limited economic growth • High levels of poverty, especially in rural areas • High levels of unemployment • Rapid urbanization • Infrastructural improvements required	• Steady economic growth and shift from being a low-income country (LIC) to a low- and middle-income country (LMIC) • Advances in poverty reduction • Urbanization is high and continuing • Quality of infrastructure impedes further economic growth	• Continuing rapid economic growth • Transition to a parliamentary democracy • Low and shrinking levels of poverty • Increasing levels of urbanization • High rates of youth unemployment in urban areas • Low private sector participation	• Economic growth highest in South Asia • Despite advances in poverty reduction, sections of society lag • Urban population growth faster than that of rural areas	• Recovering economic growth • Transition to a federal system • Remittances an important contributor to GDP • Steady reduction in poverty • Rapid urbanization • Poor quality of infrastructure is an impediment to growth	• Gradual pace of economic growth • Recent amendment to constitution has devolved key functions to the provinces • Decline in poverty rates; rural stagnation and poverty are major concerns • High level of urbanization	• Strong economic growth, progress toward higher middle-income country (MIC) status • Poverty rates low and reducing further • Rapid levels of urbanization • Aging population will be a concern by 2050

Sources: Compilation from sources including World Bank 2016c, 2016d, 2016e, 2016f, 2016g, 2016h, 2016i.

Notes: [a] Data from World Bank DataBank (http://data.worldbank.org/country).

[b] Data from https://data.worldbank.org/indicator/SP.RUR.TOTL.ZS

[c] International Poverty Line: Poverty headcount ratio at USD 1.90 a day (2011 Purchasing Power Parity) (% of population). Data from World Bank Poverty and Equity Data Portal (http://povertydata.worldbank.org/poverty/region/SAS).

TABLE 2.2. Contribution of water-related sectors to development, and key aspects that could affect water demand, South Asia.

Data type	Afghanistan	Bangladesh	Bhutan	India	Nepal	Pakistan	Sri Lanka
Sector contributions to GDP (%)	Services (53); industry (22); agriculture (21)	Industry (31.27); agriculture (19.29); remittances (11.01)	Hydropower exports (25); tourism (20); agriculture (12)	Services (57); industry (26); agriculture (17)	Services (45); agriculture (35); remittances (29); industry (20)	Services (53.1); agriculture (25.3); industry (20.1)	Services (62.4); manufacturing (28.9); agriculture (8.7)
Contributions to employment (%)	Agriculture (40)	Agriculture (47.5)	Agriculture (62)	Agriculture (over 50)	Agriculture (67)	Agriculture (64)	Agriculture (almost 30)
Key water sectors	• Hydropower meets the greater proportion of electricity generated domestically (55% met by imports) • This share has fluctuated, with the proportional contribution from fossil fuel sources increasing • Serious energy deficits exist • Agriculture is the leading source of GDP growth and employment; largely subsistence based • Existing irrigation systems are damaged or inefficient	• Services and industry (led by the garments sector) are the major contributors to growth • Half of the labor force is employed in agriculture (a large share of the poverty reduction achieved has been among the rural population) • Agriculture sector has grown in productivity, largely due to technological interventions[a] • Low-lying	• Hydropower is main engine of development • Power exports make up 40% of government revenue and this is expected to rise to 60% in 2025 with production expansion • Agriculture largely subsistence based; small-scale and dispersed production • Development of other industries is limited	• While hydropower expansion is part of the plans to expand non-fossil fuel power generation capacity, it is not expected to play a significant role • Serious energy deficits with 20% of the population not having access to electricity • Contribution of agriculture to GDP continues to decline; services sector remains the most significant contributor, while the	• Rapid development of hydropower sector (only a small fraction of economically viable hydropower production developed so far) • Electricity supplied for domestic consumption is inadequate; tremendous potential exists for exports • Agriculture contributes to underpin economic growth and is an important employer; it has	• China–Pakistan Economic Corridor expected to create significant demand for electricity • Electricity generation largely through imported fossil fuels; plans to expand hydropower production • Contribution of agriculture to GDP is decreasing, but is chief employer • Major crops cultivated have shown lowering yield growths;	• Continued transition from a rural, agricultural economy to an urban, services sector-led economy • Economically viable hydropower already developed; future demand to be met by other sources • Greater economic diversification, reduction in percentage employment in agriculture • Self-sufficiency in rice production needed for diversification into high-value crop production

(continued)

TABLE 2.2. Contribution of water-related sectors to development, and key aspects that could affect water demand, South Asia (continued).

Data type	Afghanistan	Bangladesh	Bhutan	India	Nepal	Pakistan	Sri Lanka
		Ganges-Brahmaputra-Meghna Basin, in which 80.5% of the population resides and farms, is extremely susceptible to flooding and other climatic events • Further development of extensive inland waterway networks for transport (as part of the Dhaka-Chittagong corridor)		manufacturing sector is fast growing • Agriculture accounts for 50% of employment, although this number is now declining • Further development of inland waterways (such as the Ganges River) for transport is being looked at	contributed to marked poverty reduction in rural areas • Mountainous terrain and poorly developed infrastructure hamper further growth in the agriculture sector • Labor out-migration is common	non-crop subsectors growing in significance (livestock production is 56% of agricultural GDP); fisheries and forestry continue to expand • Heavily water-stressed nation • Extensive irrigation system is outdated and inefficient • Interprovincial tensions slow down efficient water allocations	
Surface water	Primary water source	Dependent on transboundary flows for 90%	Primary water source	• Pollution is a serious threat • Demand expected to exceed availability by 2025	Primary water source	Primary but rapidly falling	Primary

(continued)

TABLE 2.2. Contribution of water-related sectors to development, and key aspects that could affect water demand, South Asia (continued).

Data type	Afghanistan	Bangladesh	Bhutan	India	Nepal	Pakistan	Sri Lanka
Groundwater	• Secondary water source but growing rapidly	• Provides 85% of irrigation; supports 54% of rice production	• Negligible due to mountain terrain	• Under severe stress, with major impact on energy demand in several states	• Secondary supplier for domestic use and significant for irrigation	• Secondary source, but rapid depletion of groundwater has led to lower stocks	• Source is developing rapidly, although extent of withdrawals is not assessed

Sources: Compilation from sources including IEA 2015; World Bank 2016c, 2016d, 2016e, 2016f, 2016g, 2016h, 2016i; World Development Indicators: Structure of output (http://wdi.worldbank.org/table/4.2); Leao et al. 2018.

Note: [a] "Agriculture growth reduces poverty in Bangladesh," World Bank website, May 17, 2016: http://www.worldbank.org/en/news/feature/2016/05/17/bangladeshs-agriculture-a-poverty-reducer-in-need-of-modernization.

TABLE 2.3. Water demand in South Asia, by agriculture, industry and domestic supply sectors, 2010-2050.

	2010			2030			2050		
	Agriculture	Industry	Domestic	Agriculture	Industry	Domestic	Agriculture	Industry	Domestic
Afghanistan	35.42	0.46	0.34	37.26	1.42	2.07	38.63	3.74	3.27
Bangladesh	43.74	3.36	1.84	43.24	7.46	4.29	43.10	12.39	7.89
Bhutan	0.40	0.01	0.01	0.40	0.07	0.09	0.42	0.11	0.18
India	699.70	41.48	37.35	699.31	103.63	76.15	771.89	131.13	102.04
Nepal	7.24	0.31	0.05	7.74	0.74	0.28	8.24	1.82	0.75
Pakistan	292.25	5.62	4.48	287.53	10.34	7.64	314.85	17.32	6.24
Sri Lanka	8.30	0.51	0.68	7.92	1.49	2.07	7.60	1.59	3.37

Sources: Burek et al. 2016; Wada et al. 2016.

Notes: Projected agricultural demand does not include future socioeconomic change assumptions (which have been included for industrial and domestic use demand).

Water demand (in cubic kilometers per year) for agriculture (scenario – Representative Concentration Pathway [RCP] 6.0), industry (scenario – Shared Socioeconomic Pathway [SSP2]) and domestic use (scenario - SSP2).

TABLE 2.4. Population and total water availability per capita in South Asia, 2010-2100.

Country	2010		2030		2050		2100	
	Population (millions)	PCA (m^3)	Population (millions)	PCA (m^3)	Population (millions)	PCA (m^3)	Population (millions)	PCA (m^3)
Afghanistan	31.4	3,198	51.7	1,975	75.2	1,229	112.7	918
Bangladesh	148.7	10,149	181.1	8,093	195.8	7,559	168.3	9,227
Bhutan	0.7	75,975	1.0	47,236	1.2	33,975	1.3	41,908
India	1,224.6	1,894	1,528.6	1,658	1,733.8	1,345	1,611.1	1,766
Nepal	30.0	7,489	41.3	4,737	50.1	3,566	52.6	4,174
Pakistan	173.6	1,185	239.7	962	292.6	666	326.6	707
Sri Lanka	20.9	3,016	23.4	3,542	24.2	3,314	21.1	3,206

Sources: Burek et al. 2016; Wada et al. 2016.

Notes: Total renewable water resources for each country was considered to be the addition of the runoff within the country and the inflow through river networks. PCA = per capita availability; m^3 = cubic meters.

Population and total water availability per capita for scenarios RCP 6.0/SSP2.

What is clear from Table 2.3 is the progressively increasing demand for water in the industrial and domestic sectors across the region. On the other hand, agricultural water demand is expected to remain relatively static, with the exceptions of India, in particular, and Nepal, while the demand in Sri Lanka is expected to decline. The hidden dimension in the annual figures presented in Tables 2.3 and 2.4 is the seasonality of water availability and demand through the interaction of rainfall patterns, on the one hand, and water use patterns, on the other.

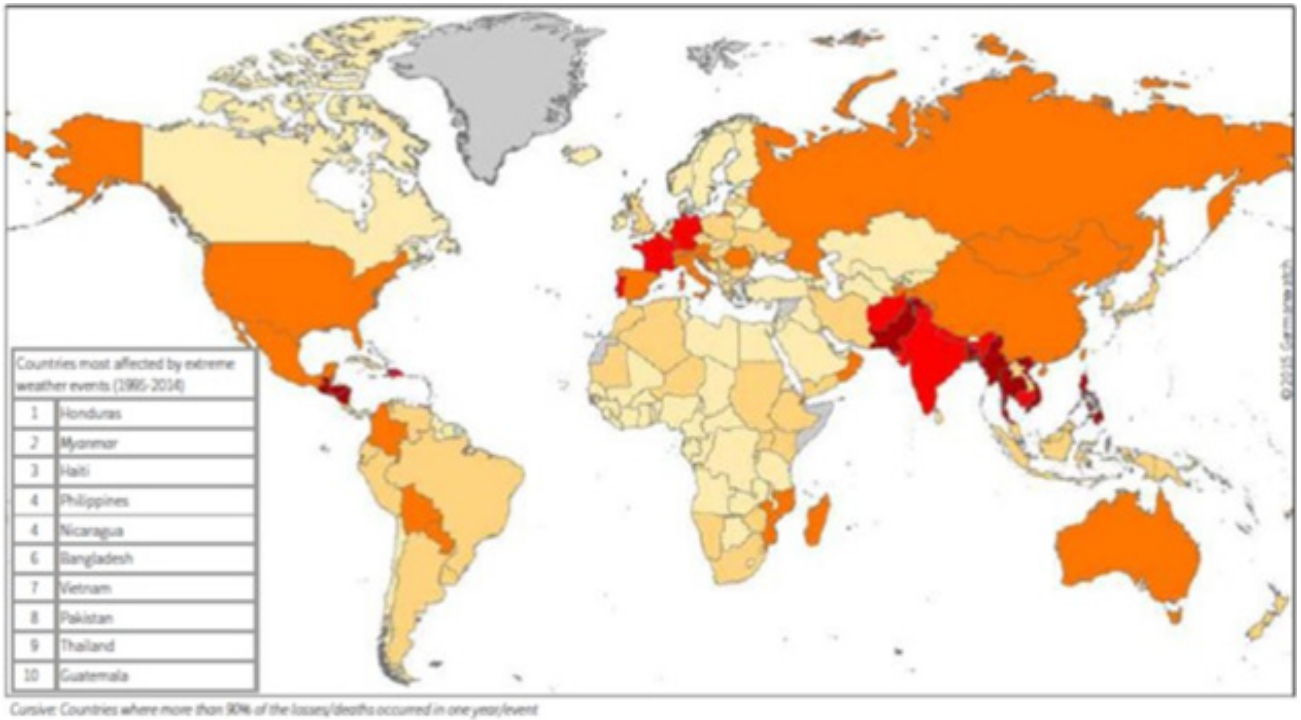
Further, population growth, industrial development, excessive extraction of groundwater and surface water for agriculture, urbanization, environmental pollution, poor domestic water management, increasing variability of rainfall and extreme climatic events have all increased the susceptibility of the region to natural disasters such as floods and droughts (Surie 2015). In addition, the lack of regional treaties and open, transparent data sharing between countries has reduced the region's ability to effectively manage water resources, of which a significant proportion is transboundary in nature.

In view of the multiple drivers that impact water resources, climate change can be considered a significant additional source of stress on water resources availability and demand in the region, with knock-on effects across economies. Figure 2.1 highlights why South Asia is considered one of the most climate vulnerable regions, with virtually all the countries in this region falling within the 20 most vulnerable countries. The climate risk index used in this study is calculated using information on the number of total losses caused by weather events, the number of deaths, the insured damages and the total economic damages. Table 2.5 provides an overview of the major climate risks for each of the seven focal countries in the region, and the sectors likely to be most affected by climate variability.

In relation to climate change adaptation, the role of water is multidimensional in its support to a range of sectors that power growth. The widespread relevance of water also means that its overabundance or absence can have far-reaching developmental consequences. These include floods, GLOFs or droughts. Ensuring that the impacts of climate change on water resources (Lacombe et al. 2019) and their costs are well understood has significant implications for the shaping of adaption responses, and future adaptation strategies and programs.

Ahmed and Suphachalasai (2014) projected the economic costs of climate change at a regional level in South Asia (Table 2.6). They estimate that, without global deviation from a fossil fuel-intensive path, the region could lose an equivalent of 1.8% of its annual GDP by 2050 due to climate change. This would progressively increase to 8.8% by 2100 under a BAU scenario. However, according to the same study, if the global mean temperature rise is below or within 2 °C, the region would lose only an average of 1.3% of its GDP by 2050 and approximately 2.5% by 2100.

FIGURE 2.1. Global climate risk index, 1995-2014.



Source: Kreft et al. 2015.

TABLE 2.5. Major climate risks and sectors potentially affected (South Asian countries).

Risk level	Afghanistan	Bangladesh	Bhutan	India	Nepal	Pakistan	Sri Lanka
High	• Landslide • Drought • Groundwater depletion	• Riverine flood • Groundwater salinization • Storms and cyclones	• GLOF • Flash flood • Landslide	• Drought • Riverine flood • Landslide • Flash flood	• GLOF • Flash flood • Landslide	• Drought • Groundwater depletion • Landslide	• Drought • Storms and cyclones • Groundwater salinization
Medium	• Riverine flood • Erosion or siltation • Flash flood	• Coastal flood • Drought • Groundwater depletion	• Drought • Erosion or siltation • Storms and cyclones	• Storms and cyclones • Groundwater salinization	• Drought • Erosion or siltation	• Flash flood • Groundwater salinization • Erosion or siltation • Coastal flood	• Riverine flood • Groundwater depletion • Flash flood
Low	• GLOF • Storms and cyclones	• Erosion or siltation • Flash flood • Landslide	• Riverine flood • Groundwater depletion	• GLOF • Coastal flood • Erosion or siltation	• Riverine flood • Storms and cyclones • Groundwater depletion	• Storms and cyclones • GLOF • Riverine flood	• Erosion or siltation • Landslide • Coastal flood
Non-existent	• Coastal flood • Groundwater salinization (caused by sea-level rise)	• GLOF	• Coastal flood • Groundwater salinization (caused by sea-level rise)	• NA	• Coastal flood • Groundwater salinization (caused by sea-level rise)	• NA	• GLOF

(Continued)

TABLE 2.5. Major climate risks and sectors potentially affected (South Asian countries) (continued).

Risk level	Afghanistan	Bangladesh	Bhutan	India	Nepal	Pakistan	Sri Lanka
Sectors affected	• Agriculture • Water • Energy • Transport • Health	• Agriculture • Water • Environment • Housing • Transport • Health	• Agriculture • Water • Energy • Forestry • Health	• Agriculture • Water • Forestry • Health • Energy • Environment	• Agriculture • Water • Environment • Health • Energy • Forestry	• Agriculture • Water • Energy • Health • Forestry • Environment	• Agriculture • Water • Forestry • Housing • Health • Transport • Energy

Source: Adapted from Lacombe et al. 2019.

Note: NA = not applicable (all climatic risks covered in this table are present in India and Pakistan).

TABLE 2.6. Projected reductions in GDP (%) due to climate change in South Asian countries, 2050 and 2100.

Region or country	Under a BAU scenario		If mean temperature rise is below 2 °C
	2050	2100	2100
Asia	1.8	8.8	2.5
Afghanistan	Not assessed	Not assessed	Not assessed
Bangladesh	2.0	9.4	2.1
Bhutan	1.4	6.6	1.7
India	1.8	8.7	1.9
Nepal	2.2	9.9	2.4
Pakistan	Not assessed	Not assessed	Not assessed
Sri Lanka	1.2	6.5	1.4

Source: Based on Ahmed and Suphachalasai 2014.

Although the analysis suggests that, by 2050, climate risks could lead to a reduction of less than 10% in real GDP across the seven South Asian countries, the impact on specific sectors may deviate from this projection. Food security, in particular, would have disproportionately severe impacts on human security, not least because the poorest would be hit most acutely, especially in countries that are highly dependent on agriculture. At the same time, the model employed to generate these estimates excludes the impacts of extreme climatic events, such as storms, floods and droughts, which may in fact lead to an underestimation of the cumulative impacts over time.

Insights into climate change impacts and their economic costs in the agriculture sector are provided by Markandya et al. (2017), who concluded that, overall, the demand for water could increase in several major South Asian river basins, many of which are also transboundary. This would exacerbate water scarcity conditions, independently of climate change, given the economic and demographic drivers at play. Consequently, without further investments in irrigation, supply of water for irrigation is expected to drop by as much as 89.5% in some basins. Also notable in terms of transboundary rivers is that these declines in the same basin vary significantly across the riparian countries. In the case of the Ganges for instance, the expected declines for Nepal, India and Bangladesh are 0.8%, 15.7% and 21.3%, respectively, demonstrating the disproportionate distribution of water stress. Similarly, in the Indus, the expected reduction for India is 7.1% compared with 42.7% for Pakistan.

The consequences of increased water scarcity on food production across the regions will be multifaceted. These are expected to include a 10% to 60% increase in the "shadow price" (opportunity cost) of water. In Pakistan, this increase is expected to be 230% to 350% given that crop production is heavily dependent on irrigation, and is likely to face significant water scarcity. Reduced irrigation is expected to also increase net food imports, as countries shift to trading in virtual water as a response strategy. Markandya et al. (2017) estimated net imports to increase by USD 621 million, USD 7 million, USD 4.8 billion, USD 82 million and USD 5.5 billion in Bangladesh, Nepal, Pakistan, Sri Lanka and India, respectively. In India, for example, this would represent a 42% increase from the 2014 figure. While helping to close the food supply deficit, one major cost is likely to be the material impact of balance of payments. In some countries, for example, Sri Lanka, such a strategy may go against current attempts by the government to reduce the balance of payment impact of food exports (de Silva et al. 2018).

Where imports are unable to fully bridge the gap in markets, the prices of major food items, namely crops, meat and livestock products, and processed foods, are expected to increase by 8.5%, 9%, 4%, 21% and 2% in Bangladesh, India, Nepal, Pakistan and Sri Lanka, respectively. Increased water scarcity is likely to mean the structure of irrigation will also change, with rainfed agriculture increasing as irrigation decreases, thereby causing food production to fall and an increased vulnerability to climatic shocks.

The combination of these water scarcity impacts poses serious threats to the food security of South Asia's poor households in particular; and at a macro level, to a decline in the GDP by 2050 of 2.7%, 1.4%, 0.2%, 5.2%, 0.3% and 0.4% in Bangladesh, India, Nepal, Pakistan, Sri Lanka and the rest of South Asia, respectively, compared to the figures in 2011.

When climate change combines with water scarcity, these impacts intensify. The "shadow price" of water doubles in Bangladesh and rises by over 70% in some key basins in India. In Pakistan, it increases by a factor of three to four. Crop outputs are expected to decline a further 1% to 2% in all the countries, except Bangladesh, where the additional decline is expected to be 9% to 14%. GDP losses are much greater: Bangladesh 5.2%, India 1.8%, Nepal 0.8%, Pakistan 5.6%, Sri Lanka 0.6%, and rest of South Asia 0.5%.

Ahmed and Suphachalasai (2014) estimated that to mitigate damage and economic losses under a BAU scenario, the region needs to provide an average climate change adaptation expenditure of 0.48% of regional GDP per year (USD 40 billion) by 2050 and 0.86% of GDP per year (USD 73 billion) by 2100. Regional adaptation costs under the Copenhagen–Cancun scenario[1] are much lower than the costs under the BAU scenario, requiring only an average of 0.36% of GDP per year (USD 31 billion) by 2050 and 0.48% of GDP per year (USD 41 billion) by 2100. Ahmed and Suphachalasai (2014), however, noted that the costs of specific adaptation measures and those in individual sectors are frequently difficult to determine, and may vary widely across the region.

In the water sector, increasing water-use efficiency (WUE) is highlighted by Markandya et al. (2017) as an adaptation with significant potential to closing the gap created by the growing demand for water and the decline in supply due to climate change. This scope exists because current levels of WUE in South Asia are around only 25% to 30% in Bangladesh, 45% in India and 30% in Pakistan, which are all lower than the global average of 50%. Markandya et al. (2017) calculate that food production may increase by about 1% (with a 10% gain in WUE) and by 4% (with a 40% improvement in WUE). A 40% improvement in WUE would reduce the price index of crops by 18.9% in Bangladesh, 12.4% in India, 11.1% in Nepal, 16.6% in Pakistan, 4.5% in Sri Lanka and 17.3% in the rest of South Asia. Underpinning these gains is the increase in irrigated areas, leading to higher levels of food production. After juxtaposing the increasing costs of achieving higher levels of WUE, the same authors concluded that WUE up to 40% can be economically justified in Bangladesh, India and Sri Lanka. In Nepal, after a 20% improvement, the economic gains are smaller than the costs. In Pakistan and the rest of South Asia, an improvement in WUE over 30% may not be economically profitable.

Country Contexts

Afghanistan

Afghanistan contributes 57 billion cubic meters (Bm^3) to major river systems as surface water and 18 Bm^3 as groundwater. Water resources in the country are particularly susceptible to shifts in rainfall, and changes in glaciers and snowmelt. Afghanistan is still primarily an agrarian economy, and water availability or lack thereof is likely to play a significant role in how much economic development takes place. Of the population in the country, 75% (https://data.worldbank.org/indicator/SP.RUR.TOTL.ZS) lives in rural environments, and are heavily dependent on the agriculture and livestock sectors for their livelihoods. To maintain a reliable quantity of water for these sectors, a large portion of the cultivated land is under irrigation, and 98% of the volume of the country's water resources is used for irrigation. However, because Afghanistan is extremely sensitive to drought, and due to the years of civil conflict, water infrastructure is poor. Only 27% of the population has access to improved water sources. Therefore, it is vital that the appropriate infrastructure and proper water management practices are in place to increase access to water.

[1] Assumes implementation of Copenhagen Accord pledges (toward 2020) and the long-term objective of keeping the global mean temperature rise below 2 °C.

Overall, the economy of Afghanistan (measured by GDP) contracted between 2014 and 2015 but is expected to grow by 3.6% in 2017 (World Bank 2016a). The decrease in GDP is due to a combination of factors. These include the departure of foreign troops in 2014, which impacted businesses that catered specifically to foreign soldiers. Other factors include the lack of economic diversification, poor management of resources (including water), and the disconnect between rural communities and the central government with regard to allocation of development projects. The country's GDP comprises three major economic sectors: agriculture (21%), industry (22%) and services (53%) (http://wdi.worldbank.org/table/4.2). Over 40% of the population is employed in the agriculture sector and 55% lives below the poverty line (World Bank 2016a; Leao et al. 2018). Since over half the population earn a living from the agriculture sector, and due to poor water supply delivery, farmers have turned to crops with low water requirement as a means of adjusting to the changing climate and to make ends meet. This change can also be linked to the severe flooding and drought that wreaked havoc on Afghanistan's agriculture sector in 2014. ADB (2014b) estimated that 70% of the losses as a result of GLOFs and flash floods were to crops, livestock, housing and human lives. Agriculture as a sector declined by a projected 5.7% in 2015. This, combined with the sluggish growth in GDP, put upward pressure on the number of people below the poverty line (World Bank 2016a). Indeed, water, energy, transportation, agriculture and health are the sectors most affected by climate change.

Most of the losses from floods and droughts impact nearly 80% of the population, and the reconstruction costs of irrigation infrastructure were also high (ADB 2014b). The Ministry of Energy and Water (MoEW) estimated that the reconstruction costs for large-scale irrigation projects would amount to USD 6.3 million in the Balkh, Jowzjan and Samangan provinces (ADB 2014b). After the floods in 2014, the costs of reconstructing traditional irrigation systems in 15 provinces in the northern region were estimated to reach USD 19 million.

In conclusion, Afghanistan has a wide spectrum of issues to be concerned with besides climate change. Even though the war is officially over, the terrorist threat still remains and the extreme centralization of the central government has alienated the rural population. This is the segment of the population that is most affected by droughts and floods, and is the majority of those that depend on either irrigated or traditional agriculture and livestock systems for their livelihoods. The costs of drought- and flood-related disasters in Afghanistan vary depending on the source. However, it is expected that such costs are likely to increase in the coming years, affecting the country's agrarian economy. However, with better climate management practices, such as improved water storage, resource management and farmers cultivating less water-intensive crops, Afghanistan can see a means of adapting to climate change. Infrastructure development (especially irrigation) should be a priority, since poor infrastructure will be detrimental to the country's resilience toward climate change and will further hinder economic growth.

Bangladesh

Despite the seeming abundance of surface water in Bangladesh, groundwater is the most important water source for the domestic, industrial and agriculture sectors, with 85% of irrigation water sourced from groundwater (Faruque and Ali 2005). The agriculture sector is relevant not only in terms of economic growth but also as a source of food security, nutrition and employment. In fact, nearly 54% of rice production is expected from the dry season *boro* crop (World Bank 2016b), which is mainly irrigated with groundwater. Linked to this dependence on groundwater is the vulnerability of surface water flows. Since 90% of total renewable water resources is derived from the 57 international rivers flowing through Bangladesh (Faruque and Ali 2005), this highlights water uncertainties linked to natural events as well as transboundary political economies. As noted in Lacombe et al. (2019), one major dimension of drought and water shortage in the country is of a hydrological nature, since Bangladesh depends on upstream water use in India and other neighboring countries.

Water is clearly intricately linked with broader development in Bangladesh, which, with nearly 160 million inhabitants (http://data.worldbank.org/country), is among the most densely populated countries in the world. Nevertheless, despite also being one of the countries most affected by climatic stresses,

Bangladesh has maintained an average annual growth rate of about 6% for more than a decade (Gautam et al. 2013). This sustained, accelerated growth has spurred a dramatic decline in poverty incidence from 58.8% in 1991-1992 to 24.8% in 2015 (World Bank 2015a), and this is expected to decrease to 18.6% by the end of the Seventh Five-Year Plan (World Bank 2016b). A significant proportion of poverty reduction has occurred among the country's 70% rural population, and much of this achievement can be attributed to agriculture, since 87% of rural people derive at least part of their incomes from agricultural activities (Gautam et al. 2013). Although the contribution from agriculture to GDP is expected to decline to 15% in 2021, it generates employment for 47.5% of the labor force, and accounts directly and indirectly for about one-fourth of total export earnings. It also provides food security for the growing population (GoB 2013). World Bank (2016b) identified that pro-poor agricultural growth has also stimulated the non-farm economy in Bangladesh, whereby a 10% rise in farm incomes stimulates a 6% rise in non-farm incomes.

Nevertheless, the large national population means that about 46.8 million people still live below the poverty line (GoB 2013), while many who now live above this threshold remain highly vulnerable to economic and natural shocks (Gautam et al. 2013). While the current growth rate bodes well for the country's aspiration to be an MIC by 2021, it needs to raise annual GDP growth to at least 7.5% (Gautam et al. 2013) while maintaining its resilience to multiple shocks, including those linked to climate change. Many of these risks linked to climate change have water at their center. This is partly because 80% of the country is included in the floodplains of the Ganges-Brahmaputra-Meghna (GBM) Basin, with very low elevation and high vulnerability to river flooding. Monsoon rains are expected to intensify while sustained dry spells prior to monsoons are likely to increase surface runoff. The risk of river flooding is expected to further increase due to higher temperatures that result in increased glacier melt, thereby increasing runoff from the neighboring Himalayas into the Ganges and Brahmaputra rivers. According to Huq and Ayers (2008), these changes may also alter the timing of floods, as well as their magnitude, depth, extent and duration. This has implications for the seasonality of the hydrological cycle, and potentially a dramatic change in land use patterns. The same authors noted that coastal flooding may also increase due to sea-level rise and be exacerbated by storm surges. Bangladesh is also prone to drought due to significant variation in rainfall across its landmass, and rainfall variability linked to climate change. Consequently, growth in the agriculture sector (including livestock and fisheries) is characterized by annual fluctuations as a result of environmental shocks, such as floods, droughts and cyclones (Faruque and Ali 2005). Climate change is likely to exacerbate this drought risk, both in terms of intensity and frequency linked to higher mean temperatures and potentially reduced dry season precipitation (Huq and Ayers 2008). Thus, these challenges in water resources management have clear and multiple implications across key sectors driving development in the country, including the vulnerable populations, in particular. A third climatic risk, and one that demonstrates cumulative impacts of multiple climatic risks, is salinity. Increased saltwater intrusion could reduce the availability of freshwater sources, especially during low flow conditions. In the coastal regions, this is linked to sea-level rise resulting in saltwater intrusion into the estuaries and groundwater. The effects are exacerbated by greater evaporation and evapotranspiration of freshwater as temperatures increase, coupled with a greater demand for freshwater in times of water stress. An overall increase in temperature is expected to also be marked by greater temperature extremes during the summer and winter seasons. This pervasiveness of climatic impacts on water resources is recognized by the National Adaptation Programme of Action (NAPA), which highlights water-related impacts of climate change to be among the most critical for Bangladesh. Huq and Ayers (2008) concluded that the projected risks of climate change are expected to reinforce baseline biogeographical, environmental, socioeconomic and demographic stresses already faced by the country.

In an attempt to provide economic values to these risks, Ahmed and Suphachalasai (2014) estimated that, under a moderate climate change scenario, all sectors depending on water resources would suffer and real GDP would fall by 0.78% in 2030. Agriculture is one of the most sensitive sectors to climate change, given its exposure to extreme weather events, such as droughts and floods, as well as saltwater intrusion, and altered rainfall patterns and temperature. These cumulative impacts are expected to overrun the positive impact on the production of natural flood regimes bringing silt and nutrients that increase soil

fertility. Consequently, Ahmed and Suphachalasai (2014) estimated that, under a BAU scenario, due to the reduction in yield, paddy production would fall by 1.6% in 2050 and 5.0% in 2100, causing a negative impact on real GDP by 0.67% in 2050 and 0.93% in 2100. Further reductions to GDP would occur due to impacts on land availability, leading to a fall in real GDP by 0.73% in 2030 and up to 0.93% in 2100 under the BAU scenario. The negative impacts of land quantity shock on the economy would also manifest through an increase in the consumer price index, and a decrease in overall exports and imports. These climatic impacts are likely to also affect the fisheries sector, which contributes about 3.5% to GDP and provides 80% of daily dietary protein. Of particular relevance to the 260 species of fish in Bangladesh will be salinity, since all these species are sensitive to particular saltwater and freshwater conditions (Huq and Ayers 2008). Therefore, in addition to the GDP implications of these climatic impacts, food security and an undermining of livelihood bases represent other major consequences.

The government produced the National Environment Management Action Plan (NEMAP) in 1995, the Bangladesh Climate Change Strategy and Action Plan (BCCSAP) in 2008, NAPA in 2005 (updated in 2009), and the National Plan for Disaster Management (NPDM) in 2010. However, no clear, official, long-term climate change cost projections exist (GoB 2014), except for some independent estimates. For example, modifying food production in marginal areas prone to salinity is expected to cost USD 10 million initially, possibly rising threefold by 2030 (Mainuddin et al. 2011). While climate change is likely to affect all segments of the population, the poor and marginalized groups stand to be mostly affected. This is because unlike the rich and middle-income groups, they lack sufficient resources to invest in climate risk reduction (GoB 2012).

Bhutan

Bhutan is rich in water resources, with total withdrawals in 2008 only being 0.43% of the total annual renewable volume of water.[2] Almost every valley houses a stream for which the source of water is glacial melt or the summer monsoon (or both). The country is highly dependent on this resource, both as an engine for economic growth through hydropower production and for livelihood sustenance through agriculture.

It is estimated that hydropower exports make up 25% of the country's GDP, with an additional 25% if indirect impacts such as construction are also factored in (World Bank 2014). Around 70% of the energy produced is exported to a single buyer, India. While only 5% of Bhutan's hydropower potential is developed at present, this is expected to change due to a plan to generate 10,000 megawatts by 2020, mainly financed by loans and grants from India (at a ratio of 70 to 30). However, the agriculture sector, accounting for only 12% of GDP, remains the leading source of employment with 62% of the population depending on it for their livelihoods (ADB 2014a). The sector is mostly subsistence based, with rice (both irrigated and rainfed) being the main crop produced, although the cultivation of other cash crops is increasing. Irrigation is mainly from river water and monsoon rain, since the groundwater resources that can be developed (and have been developed) are limited due to the mountainous nature of the country. Tourism is a sector that has seen growth in recent times, with revenues making up 20% of non-hydropower exports.

Although Bhutan is sparsely populated, with a population density of 12 persons per square kilometer (km^2), it is experiencing a rapid growth in population. The country's population is overwhelmingly rural, with only 60% (refer Table 2.1) of the population residing in rural areas. However, efforts to modernize the economy have resulted in a high rate of rural to urban migration, with the proportion of the population employed in agriculture shrinking in number. There has been a rapid growth in the country's GDP in the past decade, mainly driven by hydropower development. The country's social and economic well-being is measured by the Gross National Happiness Index. Other measures of development consider Bhutan to be an LIC, with its ranking of 132 out of 188 countries in the Human Development Index.

[2] Data for Bhutan are from the AQUASTAT database of the Food and Agriculture Organization of the United Nations (FAO) (http://www.fao.org/nr/water/aquastat/countries_regions/btn/index.stm - accessed on May 27, 2016).

Ahmed and Suphachalasai (2014) concluded that, under a BAU scenario, the impact of climate change could lead to an annual loss of 1.4% of GDP by 2050, which is expected to increase to 6.6% in the long term. The potential risks posed by climate change are already making Bhutan's hydropower investment less attractive (Meenawat and Sovacool 2011). The country's existing hydropower systems are mainly run of river and therefore highly vulnerable to fluctuations in streamflow, damage caused by flooding and increased sediment loading, which would be intensified by GLOFs. Masutomi et al. (2009) predicted an increase in the productivity of rice cultivation until 2050 (by up to 15.8% depending on the scenario), while Gautam et al. (2013) predicted a decline until 2080 by 12.9%. If the predictions made by Gautam et al. (2013) were to materialize, it would worsen the current level of food insecurity. Since only 8% of the land is cultivable, this not only makes Bhutan a net importer of food at present but also highlights its vulnerability to climate change in terms of long-term food production.

Farmers who depend on subsistence agriculture, including tenants and landless, are the most vulnerable sections of the community (Chettri 2003). Since flood damage to crops and irrigation infrastructure are expected to worsen in the lowlands, farmers will have to move to higher elevations, where the land is steeper, less productive and more dangerous to cultivate. Further, owing to the difficulties involved in pumping water to the highlands, most farms and settlements are close to rivers, making them highly vulnerable to glacial floods (Mirza and Ahmad 2005). On the broader economy, the role of Bhutan's water resources in sustaining current and future socioeconomic development cannot be overstated, making the country extremely vulnerable to the impacts of a changing climate in this sector.

India

India's current water consumption is approximately 581 trillion liters out of an estimated 1,122 trillion liters of utilizable water, with irrigation accounting for as much as 89% of total consumption (KPMG 2010). The same source noted that the demand for water is projected to overtake availability very soon, and that this is already a reality in some regions of the country. Lal (2005) predicted that India is likely to reach a state of water stress before 2025, when per capita availability falls below 1,000 m^3. Demand assessments suggest a 20% increase by 2020, driven primarily by industrial requirements, which are projected to double. Urban demand is expected to also rise rapidly, with 10 million dwellers added to the urban population each year (World Bank 2015b). Pollution of rivers restricts the supply of usable water (Lal 2005). World Bank (2015b) concluded that limited availability of water is already constraining industrial and agricultural performance, whereby the Twelfth Five-Year Plan recognizes water availability as being a key constraint to economic growth.

India's recent growth has been significant, beginning with an agricultural revolution that has taken the country from chronic dependence on grain imports to a net exporter of agricultural produce. Irrigation is one of the key drivers in agricultural development and poverty reduction, with average poverty rates of 25% in irrigated districts compared to 70% in non-irrigated districts (Grey and Sadoff 2007). As noted by Lal (2005), agricultural output is primarily governed by the availability of water, making the agrarian economy sensitive to the status of water resources and the monsoon, in particular. Surface water and groundwater resources also play a vital role in fisheries, livestock production, forestry, energy production and industrial activity. Today, growth is driven by further structural changes in the economy. The services sector accounted for 57% of GDP in 2012-2013, due largely to the information technology subsector, while the industrial sector has consistently contributed around 26% to GDP. In contrast, the agriculture sector now contributes only 17% to GDP, but, as with many other South Asian countries, it provides employment and livelihoods to more than 50% of the labor force (World Bank 2015b).

Most of India's population is vulnerable to the adverse impacts of a changing climate. Despite the country's average annual economic growth rate of 7.6% during the last decade (World Bank 2015b), the poverty headcount ratio was approximately 21.2% of the population (at USD 1.90 a day [2011 Purchasing Power Parity]) in 2011 (http://povertydata.worldbank.org/poverty/country/IND). Moreover, many of India's newly nonpoor, especially in rural areas, remain highly vulnerable to climate shocks that can push them below the poverty line (World Bank 2013). Such vulnerability is driven, for example, by the dependence of around 650 million Indians on

rainfed agriculture for their livelihoods. Also, around 250 million live along a 7,500-kilometer coastline that is at high risk due to sea-level rise and extreme weather events (Garg et al. 2015).

Therefore, the impacts of climate change on the water sector, as detailed in Paper 1 (Lacombe et al. 2019) and summarized in Table 2.5, occur within a context of other drivers of water stress. In addition to rapidly increasing water demand, about 10% of India's total renewable water resources that originate from snowmelt faces an uncertain future. Glacier melt is expected to increase under changed climate conditions (Lal 2005), with both quantitative and temporal repercussions. India is also highly affected by meteorological droughts. While groundwater dominates India's irrigation and provides almost 80% of domestic water (Lal 2005), over-extraction of the resource poses a significant challenge for the country's water resources management (Shah 2008). Furthermore, India is ranked the highest in terms of population exposed to climate risks. These natural factors are compounded by irrational and inefficient use of water resources (KPMG 2010).

Although the exact impacts of changes in water availability could not be identified, several studies confirm that climate change is likely to drive significant economic losses for India. The role of water as a driver across several sectors suggests that climatic impacts on water availability will play a central role. Chaturvedi (2015) estimated that major food crop losses could reach USD 208 billion and USD 366 billion in 2050 and 2100, respectively. Moreover, Garg et al. (2015) estimated that the direct losses associated with extreme weather events were USD 51 billion, of which floods accounted for almost 76%. As the intensity and frequency of extreme weather events are expected to increase under a changing climate, the costs associated with these events are also expected to rise significantly in the future.

A few studies have assessed the quantum of finance required for adaptation and their estimates vary widely. ADB (2014a) estimated that adaptation actions will require India to invest 0.48% of GDP annually. Steinbach et al. (2014) estimated that implementing the National Action Plan on Climate Change (NAPCC) by 2017 would cost USD 38 billion (more than USD 7 billion per year). Another assessment (GoI 2015a) suggested that India would need around USD 206 billion (at 2014-2015 prices) between 2015 and 2030 to implement adaptation actions in agriculture, forestry, fisheries infrastructure, water resources and ecosystems. The same assessment also recognizes that additional investments are likely to be needed for strengthening the resilience and disaster management in sectors such as transport infrastructure (roads, bridges and ports) and buildings. Further investments would be needed to meet future power generation requirements, which Chaturvedi (2015) estimated to be USD 33 billion and USD 123 billion in 2050 and 2100, respectively.

Garg et al. (2015) estimated that, in real terms, the adaptation gap for India could be over USD 1 trillion from 2015 to 2030, and this could increase substantially beyond 2030. There are, however, limited efforts to assess the impacts of climate change on the national economy, and to prioritize climate-related investments within national and sectoral budgets, based on a detailed needs assessment. Although national plans such as the Twelfth Five-Year Plan refer to the impacts of climate change, they do not provide a detailed analysis of the implications climate change is likely to have on the economy. This observation also applies to state-level and sectoral development plans (Steinbach et al. 2014).

Nepal

Nepal has 225 Bm^3 of water available annually, and only 15 Bm^3 have been utilized for economic and social purposes (WECS 2010). Nepal has approximately 1,200 deep tube wells (DTWs) and 150,000 surface tube wells to utilize groundwater reserves. It is estimated that the country uses 1.25 Bm^3 of groundwater for irrigation and 0.297 Bm^3 for domestic purposes (Thapa and Sharma 2004).[3] With groundwater continuing to be used extensively, a proper water management solution is needed to prevent the problem of over-extraction of the resource, since irrigation water demand may increase by 185% in 2025. Since a large portion of Nepal's population derive their livelihoods from the agriculture sector, water management decisions need to be made carefully to avoid significant GDP losses from agriculture.

[3] Mr. Madhav Belbase (member, Nepal National Committee) in personal communication with authors, August 2016.

Nepal remains one of the poorest countries in the world and continues to have setbacks, including the earthquake in 2015, which destroyed a large amount of the country's infrastructure. Fortunately, Nepal had strong macroeconomic fundamentals prior to the earthquake, since factors such as decreasing public debt and increasing remittances assisted with reducing the debt. Most of this economic growth came from remittances, which accounted for 29% of GDP in the fiscal year 2014/2015 (World Bank 2016g). The primary economic sectors of Nepal are agriculture, industry and services, which accounted for 35%, 20% and 45%, respectively, of GDP in 2015. Most of the population lives in rural areas and are employed in the agriculture sector. A poverty reduction of 92% occurred in rural agrarian villages over the past few years, which means that agricultural growth is vital for the reduction of poverty.

Nepal is subjected mostly to GLOFs and landslides, but the country also experiences droughts and floods due to climate variability. There is declining snow cover and increased water demand due to population growth, economic growth and pressure on increased hydropower generation. It is expected that there will be a water deficit due to these factors, which could lead to competition for water in the energy, industry, and agriculture sectors (Mirza and Ahmad 2005). An overarching water policy is needed to avoid competition between the hydropower and agriculture sectors. According to the Economic Impact Assessment (EIA) conducted by the Government of Nepal (GoN), the agriculture and hydropower sectors are the most affected (IDS-Nepal, PAC and GCAP 2014). Both these sectors are affected by many risks, including an increase in the periods of drought, temperature rise, snowmelt and increased runoff. The EIA estimates climate change to have a direct cost to GDP of 1.5% to 2% per year (USD 270 million to USD 360 million per year in 2013 prices), rising to a GDP cost of 5% per year in certain years (IDS-Nepal, PAC and GCAP 2014). Net agricultural losses in the longer term (2070) were estimated to be 0.8% of GDP per year. Water-induced disasters are estimated to cost 0.6% to 1.1% of GDP per year, although Nepal had spent approximately USD 580 million between 2010 and 2011 on mitigating the impacts of such disasters.

Overall, Nepal's cost of adaptation was projected as USD 530 million in 2013 prices (IDS-Nepal, PAC and GCAP 2014). The cost of adaptation for agriculture and irrigation was the highest. Hydropower also had a significant projected adaptation cost of USD 1.1 billion (IDS-Nepal, PAC and GCAP 2014). This is due to risks such as GLOFs on infrastructure, glacial melt rates on river flows, high flows and floods (IDS-Nepal, PAC and GCAP 2014), which may increase sediment transport flowing into the dam storage. The populations affected by climate change would be those that are already experiencing inequalities (women, poor and rural populations), and climate change would magnify these inequalities. To adapt to climate change, Nepal has invested or is investing in infrastructure projects in energy and water that would potentially assist with increasing water storage and hydropower. With water demand for agriculture and hydropower increasing, additional water storage is likely to increase the resilience of Nepal and reduce the competition between these sectors in meeting their respective demands for water.

Pakistan

Pakistan has the world's fourth highest rate of water use. In 2016, the country had a total annual per capita water availability of 1,017 m^3, which is quite close to the scarcity threshold of 1,000 m^3 per capita. As a comparison, water availability per capita in 2009 was 1,500 m^3. It is the world's third highest water-stressed country and has the highest water intensity, which is the amount of water used (in cubic meters) per unit of GDP (Shams 2016). As a result, Pakistan's economy is very water-intensive. As with most South Asian countries, agriculture accounts for a significant portion of Pakistan's GDP (25.3%), with services (53.1%) and industry (20.1%) making up the rest of the economy.[4]

[4] Data on Pakistan: Country report 2015 by Global Finance (https://www.gfmag.com/global-data/country-data/pakistan-gdp-country-report - accessed on May 11, 2016).

Approximately 64% of the country's population lives in rural areas, and derive their livelihoods either directly or indirectly from agriculture-related businesses. The irrigated floodplains along the Indus Basin contribute 90% of the country's crops. Agriculture, which consumes most of the available water, is largely untaxed. Additionally, the majority of Pakistan's farmland is irrigated through canal systems, but is underpriced, and recovers only one quarter of annual operation and maintenance (O&M) costs. Groundwater is also being rapidly depleted since surface water is insufficient to meet demands (Shams 2016). Climate change exacerbates the country's water scarcity issue, and climate change-induced disasters also play a role in contaminating and reducing the available water supplies (Shams 2016).

Pakistan is affected by both floods and droughts, which in turn affect sectors such as agriculture, transportation, communication, irrigation and livestock, and hydropower. On average, the negative impact of floods (both GLOFs and rainfed floods) on Pakistan's economy amounts to approximately USD 6 billion per year (Shah and Lele 2011). It is difficult to estimate the exact impacts on the water sector as an average, because Pakistan has not conducted specific water sector impact assessments. However, flood damage assessments have been conducted and these highlight the economic damage to each sector (World Bank 2010). For the agriculture sector, economic costs due to water variability (changes in snow cover that feed the Indus and Ganges rivers) are expected to affect the country's irrigated crop production (Memon 2014; Mirza and Ahmad 2005), including its key cotton industry.

Pakistan also lacks storage capacity and can hold only 7% of average annual river flows. However, the water needs of the country require a capacity equivalent to at least 40% (Sufi et al. 2011). Integrated water resources management (IWRM) principles can be applied to improve storage capacity as well as improve water management principles (Davis and Hirji 2019).

In conclusion, Pakistan is likely to see increased economic losses from extreme weather events, and competition between the hydropower and agriculture sectors to meet water demand. With extreme weather events having a significant effect on the country's agrarian economy, and the importance of water to several other sectors, Pakistan will have to do more in terms of adapting to climate change for the future. Unfortunately, with the current external and internal security threats facing the country, as well as population growth and industrialization, the economic security of Pakistan has been questionable. In fairness, the country has invested significantly in energy and water storage, even though the budget has not classified it as being related to climate change. Moreover, Pakistan still has one of the stronger economies out of the seven countries analyzed in this paper. This means that it has the resources to meet increasing water demands and avoid water scarcity. In addition, Pakistan can adapt to climate change threats and take advantage of potential benefits, such as increasing the diversity of crops grown and becoming more resilient to climate-induced disasters.

Sri Lanka

In Sri Lanka, irrigation accounts for 88% of total water withdrawals, most of it for rice production.[5] Employing nearly 30% of the total labor force, the agriculture sector is also an important foreign exchange earner (World Bank 2016i). Hydropower is an important contributor to electricity generation in the country, accounting for 58% of the total generation in 2013 and 37% in 2014 (GoSL 2015). The extent to which groundwater contributes to agriculture is unknown, although a significant increase in the number of wells has been observed in the past decade, particularly in the dry zone. Groundwater has been an important mode of poverty alleviation as well as a source of drinking water (IWMI 2005; Panabokke and Perera 2005).

Sri Lanka is classified as an LMIC, experiencing a rapid rate of economic growth at 6.4% (2010-2015) (World Bank 2016i). Other human development indicators and achievement of the millennium development goals (MDGs) are considered to be high. The poverty headcount ratio is approximately

[5] Data on Sri Lanka: FAO's AQUASTAT database (http://www.fao.org/nr/water/aquastat/countries_regions/lka/index.stm - accessed on May 18, 2016).

0.7% of the population (at USD 1.90 a day [2011 Purchasing Power Parity]) (http://povertydata.worldbank.org/poverty/region/SAS). Agriculture, manufacturing and services are the dominant sectors of the economy, and account for 8.7%, 28.9%, and 62.4%, respectively, of GDP in 2015 (World Bank 2016i).

Ahmed and Suphachalasai (2014) concluded that, under a BAU scenario, there would be an annual loss of 1.2% of GDP by 2050 due to the impacts of climate change in Sri Lanka, which is expected to increase to 6.5% in the long term. Studies on the impacts of climate change on agriculture in Sri Lanka predict both increases and decreases in yield, depending on the location of production and timescale. The impact on agricultural income in the country is expected to vary from -20% to +72% depending on the scenario in consideration (Seo et al. 2005). Of the different impacts of climate change, the amount and temporal distribution of precipitation are expected to have the highest impact on rice cultivation (de Silva et al. 2007; Eriyagama et al. 2010). A study by Wijeratne et al. (2007) found that tea (the highest foreign exchange earner) yields are expected to increase at higher elevations and decrease at lower elevations with the combined impacts of climate change. Decreased precipitation in the Central Highlands is also expected to lead to changes in the catchment for the multipurpose Mahaweli Hydro Power Complex, which currently accounts for 59% of the total hydropower capacity. This could also lead to challenges and potential competition in water allocation between the agriculture and hydropower sectors. Eriyagama et al. (2010) noted that the impact of climate change on groundwater resources in Sri Lanka has been the subject of only a limited number of studies.

The contribution of agriculture to the country's GDP has been decreasing steadily. Further, since most feasible large hydropower projects are now developed, provision of electricity in the future is likely to come mostly from other sources. Thus, as the economy diversifies gradually and other sources of electricity generation expand, the contribution of water-related sectors to economic growth may reduce. However, it must be noted that this may not translate to a corresponding decrease in the demand for water, since sectors such as agriculture and industry are expected to continue to use increasingly high amounts of water. For example, as the economy grows, crops that are high value and more water intensive to cultivate may increase in demand. The impact of climate change on the water sector in Sri Lanka is likely to be felt more strongly by those dependent on the agriculture sector for their livelihoods and food security. Geographically, Eriyagama (2010) revealed that five of the 25 districts (Nuwara Eliya, Badulla, Moneragala, Ratnapura and Anuradhapura) are at particular risk. These are areas with historically high climatic extremes, but where a dependency on primary agriculture is high, along with a low level of socioeconomic assets and infrastructure development.

The costs of implementing adaptation measures in each of the nine sectors are defined in the National Adaptation Plan for Climate Change Impacts in Sri Lanka (2015)[6] for the next 10 years and is estimated to be USD 72.3 million. Sectors for which water-related adaptation measures form a significant component of the estimated costs also account for high proportions of the total costs. Overall, water-related adaptation measures amount to 65% of the total cost (or USD 47 million). However, it must be noted that these costs were estimated only from preliminary consultations held with the relevant stakeholders and are thus not complete. Therefore, it can be reasonably concluded that they represent underestimations of the actual costs involved.

[6] See Climate Change Secretariat, Ministry of Mahaweli Development and Environment (http://www.climatechange.lk/NAP/NationalAdaptationPlan_RevisedFinal.26.10.2015.pdf - accessed on August 1, 2018).

Chapter 3. Financial Structures and Mechanisms in Climate Adaptation

Global Overview

Financing for adaptation can come from a variety of sources, including private finance, public finance and development financial institutions, and as a growing trend in recent times from insurance and other risk pooling modalities (Trujillo et al. 2015). This chapter looks at climate financing from major funds focusing on adaptation (Table 3.1). The role of multilateral development banks in financing adaptation is discussed in Chapter 4. It should be noted, therefore, that there would be a certain degree of overlap, as there would also be financial flows between these two sources of adaptation finance. Box 3.1 provides a summary of the key findings from this chapter.

Box 3.1. Key findings on financial structures and mechanisms in climate adaptation.

All countries are challenged with a significant adaptation gap, with no clear bridging mechanisms.

Addressing this adaptation gap is likely to require further capacity within in-country mechanisms to effectively compete for scarce global funding on climate adaptation. This applies even to India and especially Bangladesh, where in-country financing has declined.

The position of improved water resources management in adaptation finance is difficult to assess given the crosscutting nature of water resources with other sectors.

Despite water traditionally being a major development sector, it is not one of the leading recipients of adaptation financing according to limited data on adaptation finance flows. However, this may merely reflect the embedded nature of water resources in several other sectors, whereby adaptation investments linked to water are hidden by being integrated into other sectoral investments. Were this to be the case, such integration should be seen as a desirable characteristic of current adaptation financing.

Disjointed funding mechanisms and underdeveloped structures struggle to match funds to priority adaptation actions.

The institutional architecture for systematically incorporating climate finance into climate adaptation planning is weak, with the exception of Bangladesh, Nepal and India, where the need for a more systematic approach to incorporate climate change considerations into national- and local-level planning has been recognized. This capacity to better target limited climate finance to specific geographies and stakeholder groups seems to be a key need to improve spending effectiveness.

The disconnect between national and local levels in adaptation planning undermines finance targeting and accountability.

Adaptation planning processes for the most part are highly centralized and top-down processes. This risks missing the poor and other especially vulnerable groups when allocating adaptation finance to sectors and geographical areas. Addressing this gap is, therefore, of high priority.

Of the financial flows monitored by Climate Funds Update (http://www.climatefundsupdate.org), the greatest attention has been afforded to climate-resilient infrastructure projects (USD 121 million, or 40% of allocations), with water and sanitation accounting for 46% of this infrastructure-related financing (Nakhooda et al. 2015a). With regard to individual funds, the Pilot Program for Climate Resilience (PPCR) of the World Bank's Climate Investment Funds and the Least Developed Countries Fund (LDCF) are currently the leading providers of adaptation finance. The United Kingdom, Germany and the United States of America are the largest bilateral sources of adaptation finance (Trujillo et al. 2015). Both the United Kingdom and Germany also have national initiatives for global climate financing, namely, the United Kingdom's International Climate Fund and Germany's International Climate Initiative.

Adaptation, however, is underfunded when compared to mitigation, with only 24% of the funding monitored by Climate Funds Update being allocated for adaptation. There is expectation that the Green Climate Fund, which will distribute 50% of its finances for adaptation, will contribute toward the rectification of this imbalance (Trujillo et al. 2015). Major multilateral funding mechanisms focusing on adaptation are shown in Table 3.1.

TABLE 3.1. Major multilateral funding mechanisms focusing on adaptation.

Fund	Description	Funding focus
Multilateral public funds part of the United Nations Framework Convention on Climate Change (UNFCCC) mechanism		
Adaptation Fund	• Instrument of the Kyoto Protocol • Mainly financed from the 2% levy on emission reductions from the Clean Development Mechanism (CDM) • Project approvals in 2014 for adaptation: USD 59 million • Supports subnational and local activity	• Over 50% of funding been directed (by 2013) toward agricultural practices • 25% of funding toward weather monitoring and early warning systems (for flood control)
Global Environment Facility (GEF)	• Longest running climate multilateral fund • During the sixth replenishment of the GEF, USD 1.1 billion will support the climate change focal area (around one-fourth of the total funds pledged to all GEF activities) • Fund the incremental costs that projects are expected to incur to include considerations related to climate change and the environment	• Greater proportion of this funding is for interventions on energy, low carbon technologies, mitigation and renewables
Least Developed Countries Fund (LDCF)	• Administered by the GEF Secretariat • Project approvals in 2014 for adaptation: USD 139 million	• Support LICs to develop and implement national adaptation plans of action
Special Climate Change Fund	• Administered by the GEF Secretariat • Project approvals in 2014 for adaptation: USD 85 million • Fund interventions related to	• Adaptation remains the main area of focus • Assists low-income developing countries (that are

(Continued)

TABLE 3.1. Major multilateral funding mechanisms focusing on adaptation (Continued).

Fund	Description	Funding focus
	adaptation and mitigation	not least developed countries) to develop and implement national adaptation plans
Green Climate Fund (GCF)	• An emerging fund, but one that is expected to be a dominant conduit for international public finance on adaptation • Interim administration by the World Bank • Project approvals in 2014 for adaptation: USD 115 million • Intends to have a 50-50 balance between mitigation and adaptation investments	• 50% of the funding is allocated for mitigation and 50% for adaptation • Of adaptation funding, 50% set aside for LICs, small island developing states (SIDS) and countries in Africa • Adaptation focus: resilient livelihoods, ecosystems and infrastructure, enhanced well-being, and food and water security
Multilateral public funds that are not part of the UNFCCC mechanism		
Pilot Program for Climate Resilience (PPCR)	• One of the four programs by the climate investment funds (CIFs), administered by the World Bank • Project approvals in 2014 for adaptation: USD 71 million	• Works with national governments to mainstream climate resilience into development planning, and operationalize the same
Adaptation for Smallholder Agriculture Program	• Managed by the International Fund for Agricultural Development (IFAD) • Project approvals in 2014 for adaptation: USD 83 million	• Focuses on poor smallholder farmers to improve climate resilience and food security, and reduce greenhouse gas (GHG) emissions
Global Climate Change Alliance Plus (GCCA+)	• Evolved from the GCCA fund set up by the European Union and will run from 2015-2020 • More than EUR 350 million (nearly USD 400 million) is expected to be made available till 2020	• Vulnerable countries, including SIDs and LICs • Mitigation and adaptation • Focus areas for adaptation include climate change mainstreaming and poverty reduction, increasing resilience to climate-related shocks, and sector-based adaptation strategies

Sources: GCCA+ 2012; Nakhooda 2013; Nakhooda et al. 2015a, 2015b; Schalatek et al. 2015; Trujillo and Nakhooda 2013; Trujillo et al. 2014, 2015; Thomson 2015; European Commission 2015.

Financing of Adaptation by the Multilateral Development Banks

In 2015, the multilateral development banks (MDBs), which include the African Development Bank (AfDB), Asian Development Bank (ADB), European Bank for Reconstruction and Development (EBRD), European Investment Bank (EIB), Inter-American Development Bank Group (IDBG) and

the World Bank collectively committed USD 25,096 billion in climate financing to LMICs. This figure includes the MDBs' own resources as well as those channeled by these institutions. In 2014, this amounted to USD 28,345 billion (AfDB, ADB, EBRD, EIB, IDB and World Bank Group 2015, 2016).

In 2015, 80% of this finance was allocated for mitigation-related activities, and 20% for adaptation. In 2014, this breakdown was 82% for mitigation and 18% for adaptation, indicating a slightly higher leaning toward adaptation in 2015 (AfDB, ADB, EBRD, EIB, IDB and World Bank Group 2015, 2016), although adaptation remains clearly underrepresented. An individual breakdown of these numbers for the two large MDBs providing climate financing to the South Asian region is given in Table 3.2. Within the adaptation finance component, the greater proportion of financing (71%) came in the form of investment loans with 6% being allocated for policy-based loan and budget support, and 13% for grants. In terms of a regional breakdown, South Asia drew the largest proportion (29%) followed by Latin America and the Caribbean (21%) and sub-Saharan Africa (19%) (AfDB, ADB, EBRD, EIB, IDB and World Bank Group 2016).

The three sectors that drew in the greatest proportions of financing overall are: water and wastewater systems (27%); energy, transport and other built environment and infrastructure (24%); and crop production and food production (18%). However, it must be noted that there is a wide variation if this breakdown is applied to individual regions. The breakdown for South Asia roughly follows the pattern described previously (AfDB, ADB, EBRD, EIB, IDB and World Bank Group 2016).

TABLE 3.2. Climate financing of the World Bank and Asian Development Bank, 2014 and 2015.

Multilateral development bank	Adaptation finance, 2015 (USD millions)	Mitigation finance, 2015 (USD millions)	Total climate finance, 2015 (USD millions)	Total climate finance as a share of operations, 2015 (%)	Total climate finance as a share of operations, 2014 (%)
Asian Development Bank	356	2,561	2,917	15.3	18
World Bank	3,393	7,329	10,722	17.9	23

Sources: AfDB, ADB, EBRD, EIB, IDB and World Bank Group 2015, 2016.

World Bank's Climate Change Action Plan

The *Climate Change Action Plan* (CCAP) 2016 of the World Bank sets out its strategy to meet the challenges and opportunities brought on by climate change (World Bank, IFC and MIGA 2016). It consists of actions expected to be taken to support countries in this regard, and indicates how the organization will build on its comparative advantage, scale up climate action, integrate climate change across its operations, and work more closely with other stakeholders. In doing so, the World Bank expects to increase the proportion of its financing portfolio that addresses climate change from 21% to 28% by 2020, with total financing (the bank's own resources and other resources) adding up to USD 29 billion per year by 2020.

The need to channel more funding for adaptation activities is an issue requiring urgent resolution. The CCAP too identifies the need to balance the distribution between mitigation and adaptation financing as one of five strategic shifts in future work. Further, considering the amount of resources

needed to generate impact at the scale required, the CCAP recognizes the need to have a closer interaction with national investment plans and policies, and leverage the private sector.

Four top-level priorities are laid out to operationalize the plan: (a) support transformational policies and institutions; (b) leverage resources; (c) scale up climate action; and (d) align internal processes and work with others. The section *Scale up climate action* lists six high impact areas in which the World Bank expects to expand its actions. In this priority, three of the six areas identified (sustainable and resilient cities; climate-smart land use, water, and food security; and leaving no one behind) have a very direct connection to the water sector, thus underscoring the prominence of sustainable water management in the adaptation component of the CCAP (World Bank, IFC and MIGA 2016).

The South Asian region is likely to be vulnerable to the impacts of climate change, through sea-level rise, floods and landslides, and its impact on agriculture. To adapt, the sectors that require the highest financing are disaster risk management in the urban environment, with activities on flood management, coastal management and resilience, and forest management. Climate-smart agriculture and water management are also considered priority areas. Of these, disaster risk management in the urban environment and climate-smart agriculture are considered priority areas for Bangladesh, India and Pakistan; coastal management and resilience for Bangladesh and Sri Lanka; forest management for India; and water management for all four countries.

Until now, the greater proportion of the funding by the World Bank with climate co-benefits target mitigation. Of the seven countries, Bangladesh, India and Pakistan have portfolios with the largest climate co-benefits. However, when analyzing the financial flows from 2011, the gap between financing for mitigation and financing for adaptation has decreased in the years 2015 and 2016.

Country-level Analysis

Afghanistan

The current financial structure in Afghanistan is heavily dependent on foreign aid. The country tracks its foreign aid through the National Budget and Aid Management System. While not divided specifically by crosscutting issues such as climate change, it does provide breakdowns by different economic sectors. Afghanistan receives a greater percentage of grants than loans. The money is spent primarily on infrastructure development, which includes groundwater projects, well monitoring, and mapping of water supply systems and irrigation systems. Yet, the amount of aid dedicated to agriculture and rural development has been declining from USD 251 million in 2012 to USD 193 million in 2013; and the amount dedicated to water has been declining from USD 120 million in 2012 to USD 69 million in 2013.[7] This is in line with wider global aid trends for LDCs (OECD 2014). Since the Government of Afghanistan (GoA) relies on aid, the trends in declining global aid is a red flag in terms of maintaining current projects and programs, and the capacity to finance climate adaptation measures in the long term.

Afghanistan's climate adaptation budget is primarily provided through the financial aid structure, which constitutes the majority of aid being delivered outside of the government budget. For instance, in 2010/2011, approximately 88% (USD 13.8 billion) in aid was received outside of the government budget (known as the external budget), whereas only 12% was received from the core government budget (USD 1.9 billion) (World Bank 2012). The external budget is financed through bilateral donors as well as military contractors. The core budget is broken down into the operating and development budgets. A large portion of the development budget comprises donor-financed programs and projects implemented by the government. Direct climate-related investments usually fall under the purview of the Ministry for Agriculture, Irrigation and Livestock (MAIL) and the Ministry of Energy and Water

[7] For data on Afghanistan's *National Budget and Aid Management* Systems, see the Donor Assistance Database (http://dadafghanistan.gov.af/dad/ - accessed on April 6, 2016).

(MoEW). For example, the agriculture and rural development sector received funds amounting to approximately USD 1.4 billion in grants in 2012 compared with approximately USD 12 million in loans. Similarly, the water sector received approximately USD 363 million in grants[8] compared to USD 28 million in loans. According to Afghanistan's national budget for 2015, the funds allocated for canalization and water supply decreased by 28% from 2014 to 2015, because some projects were discontinued or had funding reduced, such as the access to drinking water project in Samangan (GoA 2015). There was an increase in funds to MoEW. These funds were divided into integrated water resources management (IWRM), irrigation, dam and power projects. This information suggests that there may have been a reprioritization of funds to MoEW, but the reasoning is not stated and is unclear. The aid received by local communities for climate change or water projects is also not documented very well and is hard to track. While aid disbursement is mostly centralized (at the federal level), GoA has emphasized the need for local community input in the allocation of project funding in the National Adaptation Programme of Action (NAPA). Involving local communities, however, is lacking, due to mistrust between the rural communities and GoA. The Ministry of Finance (MoF) introduced a simple gender budgeting system into the National Development Framework (NDF). This requires all ministries to indicate which of their programs are related to gender and serve as a tracking mechanism for gender spending (Strand and Olesen 2005). This tool can be expanded to use with other marginalized groups. However, as of 2004, a report published by the GoA was disappointing in terms of its focus on gender (Strand and Olesen 2005). While the institutional setup may have been promising, implementation of the budgetary system on the ground may not have been conducted correctly. Along with budgetary issues, the term *gender* has been misinterpreted (see Chapter 4). This budgetary tool should be looked at further and perhaps implemented with a better understanding of why it failed in the first place.

Overall, most of Afghanistan's project funding has been dedicated toward development and is not necessarily linked to specific climate change projects. Since Afghanistan already has a database that tracks donor funding, it would be beneficial to add climate-related funding as a filter to better track adaptation funding. Currently, there is a large disconnect between the nationally received funds and those received from local communities. Responding to this disconnect and, to a certain extent, the national government's lack of capacity to distribute funds at a local level, some organizations have channeled aid directly to local communities. There is also a large funding gap between climate adaptation estimates and funding received. While this is true for most countries analyzed in this paper, Afghanistan relies heavily on aid to stimulate its economy in most cases and more than other countries. Therefore, it is necessary to ensure that aid is being allocated correctly to enable the country to become less dependent on foreign aid.

Bangladesh

Sources of Adaptation Finance

Responses to climatic threats in Bangladesh predate the emergence of climate change as an issue (GoB 2012). In fact, the Bangladesh Climate Change Strategy and Action Plan (BCCSAP) in 2008 estimated that government investments alone in addressing climatic impacts have exceeded USD 10 billion over the last 35 years. Government spending dominates identifiable climate spending, including the amount used for adaptation. Available data indicate a growing influence of climate risks across sector fund allocations. Another trend has been a noticeable shift in the direction of both external and internal financial flows from mitigation to adaptation, given national strategies geared toward developing resilience (GoB 2014). In recent years, approximately 97% of spending attributable to climate-sensitive activities has been for adaptation, as classified under the six BCCSAP themes, ranging

[8] For data on Afghanistan's *National Budget and Aid Management Systems,* see the Donor Assistance Database (http://dadafghanistan.gov.af/dad/ - accessed on April 6, 2016).

from infrastructure to social protection (GoB 2012). The structure of external finance for adaptation has also changed, with two-thirds of foreign aid consisting of loans (GoB 2014). This marked shift away from grants has meant that loan funding increased from 58% to 82% of foreign resources between the financial years 2009/2010 and 2011/2012 (GoB 2012). Bilateral and multilateral lending will be supplemented by international funds, such as the still nascent Green Climate Fund (GCF). The GCF is meant to support enhanced action on adaptation, mitigation, technology development and transfer, capacity building and the preparation of national communications by the low-income countries (LICs). According to Baboyan et al. (2014), the GCF is expected to become the main conduit of future international climate finance for Bangladesh[9] and other LICs.[10] There are four mechanisms delivering climate finance in Bangladesh:

- ***Annual Development Program (ADP) of the Government of Bangladesh (GoB).*** This is the primary source of finance for climate activities. Projects are prepared by the Planning Commission (PC) on the basis of detailed proposals and budgets from line ministries. Sectoral allocations are made by the PC after the MoF Finance Division determines the total size of the ADP.
- ***Non-development budget (NDB) of GoB*****:** Prepared by the Finance Division, it mainly finances the recurring costs involved in the functioning of the government, and is intended to be fully financed from domestically generated sources. The relevance for climate change responses lies in the inclusion of elements such as infrastructure maintenance and other standard programs such as crop breeding under various ministries. It is also, importantly, a key funder of the Bangladesh Climate Change Trust Fund (BCCTF).
- ***Bangladesh Climate Change Trust Fund (BCCTF).*** This was established and is fully financed by GoB to support the implementation of BCCSAP via allocations from the NDB. While 66% of the funds can be spent on activities related to climate change,[11] the remaining 34% has to be used for emergencies. The fund is administered by the Ministry of Environment and Forests (MoEF). While annual allocations from 2009 to 2012 remained at BDT 700 million (approximately USD 890,000 at current exchange rates), this has dropped to BDT 100 million for the financial year 2015/2016.[12] The reasons are unclear, although it was always the expectation that GoB would provide initial allocations after which development partners would take over (GoB 2014).
- ***Bangladesh Climate Change Resilience Fund (BCCRF).*** This was set up in 2010 to support the implementation of the BCCSAP, and it primarily targets adaptation. Unlike the BCCTF, this is entirely donor funded.[13] There are funding windows for public sector projects, civil society[14] and research.[15] The Climate Change Unit (CCU) in MoEF coordinates the fund, while the World Bank executes a technical assistance portion. Some uncertainty is apparent regarding future donor contributions to BCCRF, since the fund has yet to achieve the desired momentum, and capacity is needed to disburse funds already committed more quickly (GoB 2012, 2014).

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[9] GoB has nominated MoF, Economic Relations Division, as the national designated agency to interface with the GCF.

[10] The fund also includes a facility to finance the private sector directly or indirectly on adaptation and mitigation activities (Tashmin 2016), which may spur the entry of new actors into adaptation programs.

[11] It is not clear whether these activities cover both adaptation and mitigation measures or are limited to adaptation.

[12] See the Bangladesh Climate Change Trust (BCCT) website (http://www.bcct.gov.bd/index.php/trust-fund - accessed on August 3, 2018).

[13] A total of USD 188.2 million has been contributed principally by the United Kingdom (USD 96.9 million), European Union (USD 37.6 million), Sweden (USD 19.3 million), Switzerland (USD 12.5 million), United States Agency for International Development (USAID) (USD 13 million), AusAID (USD 7.1 million) and Denmark (USD 1.8 million).

[14] Representing 10% of the fund value.

[15] Approximately USD 3.2 million.

Trends in adaptation financing and its distribution

Although around 50% of total development expenditure is resourced by foreign aid (Tashmin 2016), according to GoB (2014), over 80% of climate-related activities are financed from domestic resources estimated at USD 1 billion a year.[16] This domestic finance is sourced mainly from the ADP through its financing of programs with a climate dimension. These accounted for, on average, 60% of GoB spending on climate dimension projects[17] during the period 2010-2014, with the remaining 40% financed from the revenue budget (GoB 2014). This suggests that climate-related responses remain mostly coupled with broader developmental objectives, constituting one of multiple developmental outcomes.

Findings in the Climate Fiscal Framework (CFF) (GoB 2014) indicate a significant shift in the in-country treatment of climate-oriented funding during the period 2009-2014, suggesting the emergence of a greater, broad-based consciousness of the need to address climatic risks. In the financial year 2009/2010, for instance, the number of national budget codes with climate relevance increased significantly from 24 in the original budget to 115 in the revised budget, concentrated mainly in the agriculture and water resources sectors (GoB 2012). Moreover, while in the financial years 2011/2012 and 2012/2013 only 27% of climate spending was executed under activities classified as "strongly" or "significantly" relevant, this percentage almost doubled over the following two fiscal years to 45%. This suggests a considerable gain in the integration of climate issues in public expenditure management and planning processes. The overlap of these developments with the revision of the BCCSAP in 2009 implies that the BCCSAP may have had considerable influence over broader development planning, although water resources is not within the top recipients of climate-sensitive finance.

The CPEIR, CFF and Baboyan et al. (2014) agree that climate dimension allocations are driven by sectoral policies rather than through direct responses to climate strategy and policies. Relevant sector ministries have climate change components and mandates, and receive funds to implement programs through the ADP and NDB. MoEF is mandated to implement projects from the BCCTF and BCCRF (GoB 2012). While this process disconnect emerges as a key gap in fund allocation, the mapping of climate content in government spending (GoB 2012, 2014) does place much of this funding within the six themes of BCCSAP, though with unequal distribution. Most funds have relevance to adaptation-related themes (themes 1-3) and capacity building (theme 6), while mitigation (theme 5) and research and development (R&D) (theme 4) have received only 4% and 8%, respectively. This confirms the focus on adaptation, Bangladesh being a small global emitter of GHGs (Baboyan et al. 2014).

Areas in Which to Strengthen Adaptation Financing and Reforms under Consideration

Despite the spread of climate finance across a broader sectoral landscape, a lack of connectivity among different structures central to harmonized and inclusive adaptation appears to persist. The CPEIR and CFF (GoB 2012, 2014; Khan et al. 2013) note a distinct lack of coordination between the BCCTF and BCCRF, and highlight that the BCCRF and the PPCR circumvent the formal Public Financial Management (PFM) system. Standard project approval guidelines do not apply to projects

[16] A number of other more dispersed and difficult-to-track funding sources operate that may not be fully represented in climate finance analyses, including direct donor funding to nongovernmental organizations (NGOs) and local organizations, as well as private household investments in local adaptation. There is currently no policy in relation to private sector involvement in climate change or any preferred mix of public and private funding or delivery modalities (GoB 2012).

[17] The Climate Public Expenditure and Institutional Review (CPEIR) and the Climate Fiscal Framework (CFF) measure two figures of climate expenditure: (i) climate dimension expenditure: the total expenditure of any program that includes climate elements; and (ii) climate-relevant expenditure: weighted average climate dimension expenditure, adjusted based on the level of relevance to climate change of each program. The latter recognizes that not all climate-related programs are equally relevant to climate change, and therefore uses this method to assess spending according to relevance. Relevance is classified as follows: (i) strongly relevant: 75% and over; (ii) relevant: 50-74%; (iii) somewhat relevant: 25-49%; and (iv) implicitly relevant: 0-24%.

implemented under the BCCTF, which may have originally been necessary in emergency situations. Furthermore, the CPEIR found that, on average, around 45% of planned climate-sensitive expenditure was not referenced in the Ministry Budget Frameworks (MBFs) of all 37 ministries involved in climate spending in the financial year 2011/2012. There is no reference to climate in ministries' key performance frameworks, which remove a significant proportion of the climate-sensitive spending from the performance management architecture and disconnects climate policy at an operational level. The preceding section indicates increasing attempts to reflect climate activities in sectors. However, this appears to occur in an ad hoc manner, and contrary to the principles of harmonization and alignment that seek to link climate policy and priorities with diverse sector policies and planning processes.

Therefore, CPEIR and CFF recommend bringing these activities within the ADP. This would ensure they fall within the regular monitoring framework of the Implementation Monitoring and Evaluation Division (IMED), and strengthen the Medium Term Budget Framework (MTBF), which is the policy implementation framework used by the GoB. This brings the policy planning and budgeting processes together by matching financial resources with intended policy outcomes in a performance, accountability and governance framework that includes performance indicators. The benefits for climate adaptation would include (a) more predictable funding to enable ministries as implementers to plan over 3 years; (b) improved transparency in the allocation and use of resources; (c) explicit ministry ownership of climate programs and achievement of their objectives; and (d) increased emphasis on service delivery by linking budget inputs to desired outcomes in the performance management framework. An important element recommended by the CFF is to introduce a "climate change marker" in the MTBF. This has already been done for gender and poverty to track ministry plans and budgets in terms of explicit objectives, activities and allocations, and reporting against these.

The CFF further recommends inclusion of a brief description of the six thematic areas, and 44 projects and programs of the BCCSAP in the Budget Call Circular 1 guidelines (GoB 2014).[18] Coordination is also needed between the Finance Division of MoF and the PC in funding the ADP, and between the Finance Division and MoEF with respect to the BCCTF and BCCRF. This would also ensure that climate activities are reflected in the budget frameworks of relevant ministries and divisions, subject to government accountability and outcome frameworks, and support a single system for financing climate actions. It would also help to link climate fund management with allocations for operationalizing the National Strategy for Accelerated Poverty Reduction (NSAPR).

The disconnect between planning, allocation and oversight between the central and local governments is another key area that needs attention. While there are no climate change-specific funds available to Union Parishads[19] (UPs), they receive climate-relevant funds from (a) central government, (b) donors, (c) local government's locally generated revenue, (d) household spending, and (e) private funds. In fact, local governments receive the second highest climate allocations compared to other ministries, reaching over USD 3 billion between 2011 and 2014 (Baboyan et al. 2014). While some donor funds use the national system to channel funds to UPs, most donors channel funds directly to NGOs, bypassing government systems. Most often, central government funds are usually allocated to *zilas* (districts) and *upazilas*[20] for further allocation to UPs. However, both government and donor funding mechanisms are characterized by the limited involvement of, or autonomy for, UPs in the planning and budgeting of these funds. Consequently, local planning and budgeting is a linear operational process whereby UPs implement the directives of the central government. This, together with the fact that NGOs operate outside the Joint Country Strategy (JCS) framework, leaves scope for potential overlap and duplication among government development programs. This presents a challenge in tracking climate expenditure and aligning efforts to address climate change in a more integrated manner (GoB 2012).

[18] See Appendix 5 in GoB (2014) for the recommended circular.
[19] Subunits of districts, and the lowest tier of regional administration in Bangladesh.
[20] Subunits of districts, and the second lowest tier of regional administration in Bangladesh, above UPs.

The CFF recommends establishing a climate fiscal cell in the Finance Division to strengthen climate finance coordination and management. The CFF also recommends a set of climate codes designed to (a) track climate change expenditure for policy analysis and reporting, and (b) estimate long-term climate finance needs by identifying potential climate-related public expenditure across government ministries. According to Baboyan et al. (2014), GoB has committed to implementing the CFF recommendations, with support from several development partners, including the United Nations Development Programme (UNDP), United Nations Environment Programme (UNEP), Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) and the UK Department for International Development (DFID), through the Inclusive Budgeting and Financing for Climate Resilience (IBFCR) project.

Bangladesh's engagement in addressing climatic risks—be it a focus on extreme weather events such as floods and cyclones—came well before climate change became a global agenda, which affords it a unique position. It helps explain the considerable progress made both in terms of financing climate adaptation and the significant steps taken to institutionalize its climate response within the formal planning and budgeting mechanism. The recent shift in financing from mitigation to adaptation further suggests a conscious expansion in the scope of Bangladesh's climate response to include the systemic shifts likely to occur under climate change, such as rainfall variation and salinity intrusion. The fact that the agriculture sector is the largest recipient of climate finance is thus no surprise: the plant breeding programs to address salinity intrusion, drought and inundation are examples of investments with direct relationships to water resources. An important point of weakness, however, is the sector-oriented allocation that seemingly does not facilitate the cross-sector coordination that may be needed to address the multidimensional drivers of specific risks. In the water sector, this would also entail highlighting the need for integrated management approaches. Nevertheless, initiatives such as the CPEIR and CFF illustrate the significant in-country motivation and capacity for cycles of review and improvement within the overall financing system. The recent decline in government budgetary allocations for the BCCTF is a concern, especially since national funds have been the mainstay of adaptation efforts thus far, and the expected flow of funds from development partners to the BCCRF has not yet materialized. Why exactly allocations to BCCTF have fallen so significantly is also not clear, but it appears to create a danger of underfunding climate-explicit activities in the future.

Bhutan

In line with the NAPA sector priorities, Bhutan's key adaptation projects are estimated to cost approximately USD 7.5 million. This is equivalent to 7.5% of the total official development assistance (ODA) flow into the country, thus giving the financial feasibility of these projects a high rating (Saito 2013). All of these projects have an association with the water sector, with six focusing on disaster mitigation and management, and three dealing with variations in water availability in various sectors (agriculture, forestry and water supply) (NEC 2006). This further clarifies the significant connections between the water sector and adaptation planning.

Projects that explicitly promote climate adaptation in the water sector have been mainly funded by multilateral sources. This was mainly (86%) in the form of grants. Following the trend seen in the NAPA, disaster prevention and management is the leading objective, followed by increasing food security and mainstreaming adaptation. Direct government spending that explicitly mentions climate change is proportionally small. There are, however, many avenues of spending, especially in the renewable natural resources, energy and urban development, and housing and amenities sectors, which indirectly contribute to adaptation in the water sector. Around 26% of the spending on major activities in the national budget of 2015-2016 is in the renewable natural resources sector (a large proportion on the development of irrigation systems); 32% is in the housing sector (a large proportion on flood protection structures); and 5% on the energy sector (early warning systems). These can be considered as contributing to adaptation in the water sector (Ministry of Finance 2015).

The Bhutan Trust Fund for Environmental Conservation (2016)[21] is an initiative to channel funding from multilateral and bilateral sources toward environmental conservation projects (including climate adaptation) by Bhutanese locals and organizations. It is an endowment fund in which the principal capital is kept intact and its investment income is used as the source of funds.

Efforts to mainstream climate change considerations into financial planning include both governmental and nongovernmental initiatives. A mainstreaming reference group has been set up by the Royal Government of Bhutan. It is tasked with mainstreaming the incorporation of gender, environment, climate change, disaster risk reduction and poverty considerations into governmental planning cycles (Government of Bhutan 2013).

The Performance-based Climate Change Adaptation Grants program by the United Nations Capital Development Fund (UNCDF) aims to mainstream adaptation considerations into the development cycle of local governments (UNCDF 2012). It will do this by providing the additional financing needed for projects to include adaptation considerations. In Bhutan, one-third of environmental spending in the national budget occurs at the local level, indicating that significant fiscal decentralization of environmental spending is occurring already (Bird et al. 2012).

Another initiative to mainstream adaptation considerations into different sectors involves the Sector Adaptation Plan of Action (SAPA). Since the NAPA functioned as an overarching tool, the government needed a more specific plan for the renewable natural resource (RNR) sector, which supports the livelihoods of around 57% of the population. This led to the creation of an RNR SAPA in 2013, with a second version introduced in 2016. The main objectives of the SAPA are to mainstream the risks and vulnerabilities associated with climate change and the actions under the adaptation plan into the plans and programs that come under the sector. It is also expected to mobilize resources for the implementation of related programs. The Policy and Planning Division of the Ministry of Agriculture and Forests (MoAF) is the main institution responsible for operationalizing the SAPA (Government of Bhutan 2016).

Up to now, measures to build adaptive capacity by governmental and NGO sources have placed greater focus on natural disaster mitigation and management. This has been followed by food security, with other sectors such as energy also receiving a certain level of attention. These align strongly with the adaptation needs identified in the NAPA. Taking into account the vulnerability of the country to natural disasters related to GLOFs, it is not surprising that natural disaster mitigation and management has received the highest focus. However, both hydropower and agriculture, two sectors that are important contributors to economic development and livelihood security, are also extremely vulnerable to the impacts of climate change. It is not clear if present and future development of these sectors, and the financing of this development, will account for the need to build adaptive capacity against the projected impacts of climate change.

India

Sources of Adaptation Finance

India's climate actions have so far been largely financed from domestic resources (GoI 2015a), driven by consistent commitments through the annual union budgets toward public spending on climate adaptation. According to Garg et al. (2015), international financing constitutes only about 3.4% of national resource commitments toward climate change, amounting to INR 306 billion (USD 4.7 billion) received under current internationally funded projects.[22] While the overall national budget outlay quadrupled from 2003-2004 to 2014-2015, development- and adaptation-related spending increased by a factor of five. This suggests a steady increase in the percentage of domestic spending on climate action.

[21] See Bhutan Trust Fund for Environmental Conservation website. Available at http://www.bhutantrustfund.bt (accessed on August 6, 2018).

[22] The highest number of projects is supported by ADB (66%) followed by the World Bank (33%) and the Global Environment Facility (GEF) (1%) (Garg et al. 2015).

Trends in Adaptation Financing and Its Distribution

In value terms, public spending on adaptation in 2013-2014 was INR 2,130 billion (USD 32.75 billion), which is 12% of the budget or about 2% of gross domestic product (GDP) (Garg et al. 2015). This is significantly higher than the 1.45% in 2000-2001 and 1.7% in 2006-2007 (Ganguly and Panda 2009). State governments contributed a further INR 3,100 billion (USD 47.6 billion) through their state budgets for similar activities in 2013-2014 (Garg et al. 2015). Further spending on adaptation in the same year took the form of 21 central government schemes directly related to adaptation, amounting to INR 740 billion (USD 11.37 billion), or 0.7% of GDP. Therefore, total spending on adaptation in 2013-2014 was INR 5,970 billion (around USD 91.8 billion).

Garg et al. (2015) identified 30 key ministries to which the Government of India (GoI) is consistently committing resources through the annual union budgets toward public spending on adaptation. About 50% of these funds are consumed by the ministries of Rural Development; Agriculture and Farmers Welfare; and Consumer Affairs, Food and Public Distribution, with only 7% going to the Ministry of Drinking Water and Sanitation.

Current GoI spending on adaptation appears to be significantly lower compared to the cumulative direct and indirect adaptation spending in past years. GoI's budget provision of INR 3.5 billion (USD 52.8 million) for the fiscal years 2015/2016 and 2016/2017 is an order of magnitude lower. Given an estimated requirement of INR 181.5 *crores* for the fiscal year 2017/2018 (GoI 2015b), current allocations only represent a fraction of the financing necessary for addressing climatic risks. Similarly, while INR 1 billion (USD 16 million) was originally allocated for a National Adaptation Fund (NAF) in the 2014-2015 budget, this has been revised to INR 100 million (USD 1.6 million) in the 2015-2016 budget[23] (Sharma et al. 2015).

One reason for this reduction in central allocations may be because the State Action Plans on Climate Change (SAPCC) are developed by each state to capture state-specific needs in the implementation of the National Action Plan on Climate Change (NAPCC). Of the SAPCC activities, 70% to 75% is related to adaptation and the remainder to mitigation, given its focus on sustainable development for the state and protection of the most vulnerable populations. In the face of a changing climate, this represents a significant step to bringing financial allocation decisions closer to the most vulnerable geographies and people. The total finance requirement of SAPCC until 2030 is estimated at INR 10,950 billion (USD 168 billion), about three times the current expenditure, and will clearly require additional financial resources (Garg et al. 2015). In terms of adaptation, agriculture accounts for about 83% of the estimated costs, followed by forests (9.6%) and the water sector trailing with just 4.6%. This figure is surprisingly low considering the centrality of water resources in supporting many productive sectors and the vulnerability of the water sector to climate change.

Overall, existing climate finance volumes are insufficient to meet the USD 38 billion funding necessary to implement the NAPCC, let alone the far greater amount needed for the SAPCC. While there is no comprehensive plan for bridging this gap, GoI has established two dedicated funds at the national level for mobilizing financing: (a) National Clean Environment Fund (NCEF) in 2010, used for financing clean energy within the mitigation domain[24] (GoI 2015a); and (b) National Adaptation Fund (NAF) in 2015. The NAF supports scaling up adaptation interventions in the SAPCC in accordance with the NAPCC, especially in sectors such as agriculture, water and forestry. Spending under the NAF will be in addition to sectoral spending by the respective ministries (GoI 2015a). GoI has also allocated funds to several national missions under the NAPCC. Here, too, the allocation to water is notable for being one of the lowest among the missions, and is in contrast to the USD 129 billion overall investment required to maintain the support of the water sector to economic development

[23] The NAF has been turned into a mission to be managed by the Ministry of Environment, Forest and Climate Change (MoEFCC) instead of the Ministry of Agriculture (MoA).

[24] Includes a carbon tax worth USD 2.7 billion in 2014-2015.

(KPMG 2010). Allocations to the water sector are higher when considering only external adaptation finance, in which water-related actions represent 20% of all such finance, according to Krishnaswamy et al. (2014), covering a topical and geographical range.

Areas in Which Adaptation Financing Needs Strengthening

The funding challenge is exacerbated by a highly fragmented but crowded landscape of international climate finance (Steinbach et al. 2014). This contributes to the difficulty faced by countries such as India in developing an efficient, targeted climate financing plan that can help meet national climate response goals. Delays in disbursement and project implementation are other related barriers to accessing international climate finance. Consequently, while India has attracted significant international funding compared to many other LMICs, these volumes are relatively small compared to the country's future adaptation and mitigation needs. One underlying factor may be the transaction costs and levels of coordination within India's bureaucracy needed to respond to the requirements of each funding source.

With respect to in-country financing, current structural arrangements are described as being "dispersed and fragmentary" by Sharma et al. (2015, 2), allowing for neither efficiency nor accountability. This situation is despite the ostensible existence of several institutional mechanisms, which have been established specifically for climate action coordination (described in Chapter 4). The same authors believe that this stems from a top-down and inflexible approach to planning with centrally sponsored schemes and tied funding. This top-down approach is said to characterize the central government's role as a "donor" in the manner in which it delivers funds to the states and to local governments through predetermined adaptation goals and targets. This leaves little room for devolved decision making and local ownership around adaptation priorities and approaches. It is further claimed that the SAPCC were also prepared without inputs from local governments or communities,[25] and are therefore likely to be tied to achieving predetermined adaptation goals and targets without the flexibility to adapt them to local circumstances. This example suggests that climate governance, including adaptation planning and implementation in India, bypasses the process of devolution[26] that has been central to development efforts in the past two decades (Sharma et al. 2015). Consequently, climate finance appears not to be systematically mainstreamed into national and state budgets, since most development policies and programs view climate outcomes as co-benefits rather than as explicit objectives (Steinbach et al. 2014).

Therefore, from a climate finance readiness standpoint, planning and financial management arrangements are key components of readiness (Steinbach et al. 2014). GoI recognizes that efforts to bridge the funding gap must be based on an approach that combines public, private and international sources of finance, and ensures their efficient utilization (Sharma et al. 2015). Yet, GoI currently has no unified strategy to raise the necessary funds from these various sources and to coordinate the delivery of the NAPCC and the SAPCC priorities.

Creation of the Climate Finance Unit (CFU) at MoF is a step toward addressing this core weakness. However, CFU will need to be strengthened, if it is to support key national nodal agencies in mainstreaming domestic and international action on climate change, particularly on issues related to financing (Steinbach et al. 2014). Linking the MoEFCC, CFU, line ministries and states is likely to be critical, if domestic budget allocations and foreign aid are to be systematically and explicitly allocated and tracked within the NAPCC and the SAPCC priorities. This "blending" of national and international sources is already a primary goal for climate governance mechanisms set up in other LICs, such as the BCCTF (Sharma et al. 2015).

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[25] The process was coordinated by MoEFCC and the state environment departments (Sharma et al. 2015).

[26] The Indian Constitution was amended in 1993 to devolve powers of local governance to Panchayat Raj Institutions (PRIs) in rural areas and urban local bodies in urban areas. Given that climate change impacts are likely to be very localized and need localized responses, local governance and devolved decision making will be critical.

Another dimension in meeting future climate finance challenges is likely to be increasing the hitherto limited engagement with the private sector. This is a key need with respect to climate change decision making and coordinating a national financing strategy that encourages private sector investment in climate-related activities (Steinbach et al. 2014). Current challenges go beyond limited engagement, given the limited capacity of development finance institutions (DFIs) to implement climate-related projects beyond a narrow range of themes, sectors and geographies in India. These constraints inhibit a pipeline of bankable projects that could increase climate-related investment linked to the NAPCC and the SAPCC. Were they to be better linked and able to generate bankable projects, Indian DFIs would need to increase their capacity in meeting international fiduciary standards,[27] and social and environmental safeguards (Steinbach et al. 2014; Varma et al. 2015).

In summary, despite the existence of climate adaptation plans at national and state level, a significant adaptation gap remains for India to tackle. The NAPCC is not backed by a coherent national climate finance strategy and, consequently, it is difficult for GoI to assess exactly how much funding is available. Also, it is not clear who is meant to benefit from national and international financial allocations or whose needs are being prioritized (Sharma et al. 2015; Steinbach et al. 2014). A focus on domestic governance and capacity building arrangements for accessing climate finance, and to ensure more effective, efficient and accountable spending thus emerges as a priority for India. It is unlikely that under current arrangements, the poorest and most vulnerable will be able to either access climate finance or be allowed sufficient flexibility to tailor locally relevant solutions (Sharma et al. 2015). Therefore, an Indian National Climate Fund (INCF) is proposed (Sharma et al. 2015). Such a fund would pool climate finance from national and international sources, and coordinate its disbursement to line agencies, and the state and local levels, through a single mechanism with representation from all relevant sectors and levels (states, districts, *panchayats*), communities and nongovernmental experts.

Nepal

Sources of and Trends in Adaptation Finance

As of 2011, the Government of Nepal's (GoN's) expenditure favored adaptation over mitigation, with 76% of budget allocation going toward adaptation (GoN, NPC, UNDP, UNEP and CDDE 2011). While the government is one of the primary funders of climate adaptation programs (amounting to 44% of total climate funds), current trends also show an increase in donor contributions and a reduction in government support (Sharma 2014). In general, adaptation projects are supported by multilateral organizations and donors, whereas bilateral donors handle both adaptation and mitigation projects. In 2014, 91% of donor funding for Nepal's climate adaptation came from grants (Sharma 2014). This is in contrast to global trends to support climate adaptation through loans. It is unclear if this was a direct policy decision linked to civil societies and media objection to the loans as a violation of the UNFCCC agreements (Regmi and Bhandari 2012). Under the UNFCCC agreements, high-income countries (HICs) agree to assist with funding for climate change programs, since it was agreed that these countries were primarily responsible for climate change due to consumption patterns. While loans constitute financial assistance, it is still money that needs to be paid back, and there has been significant opposition to this concept.

Areas Where Adaptation Financing Needs Strengthening

In 2012, the government introduced budget codes for climate-related projects into the budget planning system, which would enable the relevant ministries to prioritize, allocate and track investments that would reduce the negative impacts of climate change (Sharma 2014). The codes categorized climate change initiatives as highly relevant, relevant or neutral by looking at the percentage of how much

[27] Sound financial management, transparency, independence and professional standards.

funding and other factors (risks) were allocated to climate-related activities per project. Nepal's poor water management practices and lack of transparency with funding allocations at the federal level have led to a level of distrust among some international funders. Therefore, at the federal level, there needs to be an institutional change by the ministries to ensure greater transparency with allocation of funds and better water management practices.

In practice, however, financial planning and allocation for adaptation appears to suffer from a disconnect between a NAPA-driven, top-down approach, on the one hand, and a more bottom-up process envisaged by the Local Adaptation Plans for Action (LAPA) and development plans, on the other. From the 124 projects planned at the local level, only 12 have been implemented (Karanjit et al. 2014). One of the reasons for poor implementation could be because only 11.4% of the total climate budget was in fact allocated to local governments as of the fiscal year 2013/2014 (Karanjit et al. 2014). This is despite the 80% target set for local-level climate financing. Other reasons for the discrepancy between locally implemented and planned projects could be that the formal and actual distribution of funds differed significantly due to transparency issues (Regmi and Bhandari 2012). However, LAPA have proved to be quite beneficial, and are an important institutional framework for tackling climate change issues in rural areas in the future. For further information on LAPA, refer to the "Nepal" section in Chapter 4. The lack of transparency in funding allocations by GoN has hindered the ability to track financing. For example, it is unclear whether the remaining 88.6% of the total climate budget is used at national level and for what type of activities. The currently centralized finance governing structure has resulted in a large disconnect between the local communities and the government. For instance, while local governments include gender equity and social inclusion next to sanitation, disaster risk reduction and climate change considerations, only 1% of the allocated annual budget of local bodies is directed toward gender equity and social inclusion (Karanjit et al. 2014).

The disconnect between the local and national governments regarding priorities of climate change budget allocation is one of the largest hindrances to effective climate change financing in Nepal. For example, while agricultural and irrigation development are considered as top priorities by the local government, both activities are poorly funded (Baral and Chhetri 2014), resulting in increased vulnerability to climate change. Similar to those of other South Asian countries, the gap between the finances required for climate adaptation and funding received is also large. Moreover, despite the NAPA explicitly stating energy, water and public health as priorities for climate adaptation, Nepal lacks any funding directly related to climate adaptation for the respective sectors. See Box 3.2 about decision making in Nepal's hydropower sector.

Pakistan

As of the fiscal year 2013/2014, climate change-related expenses amounted to 6% of the total national budget (USD 1.8 billion) (UNDP 2015). This is an increase of approximately USD 500 million from the fiscal year 2012/2013. Adaptation expenditure focused 30% on water resources, 19% on disaster and risk preparedness, 14% on transportation, and 35% on health and social services. At the federal level, expenditure on mitigation-related climate spending is higher than adaptation spending, while spending on adaptation appears to be higher at the provincial level. The higher expenditure on mitigation at the federal level arises from Pakistan's spending on energy-related projects (55%), whereas funding is more diverse at the local level (UNDP 2015).

Converting climate change projects into budget prioritization agendas remains a challenge, despite the fact that the National Climate Change Plan (NCCP) and implementation framework are in place. In practice, budget allocations for climate adaptation focus on large-scale investment projects such as hydropower (UNDP 2015), with very little focus on other aspects of climate adaptation. Sectoral ministries generally pay little attention to the NCCP and are driven primarily by their own key sector policies, which limits the central positioning of climate adaptation in the MTBF budget ceiling (UNDP 2015). This also compromises any local climate adaptation funding, because funding prioritizes national

over local needs. For the most part, water-related projects are not categorized as climate change-related projects and fall under the development umbrella, and are specifically related to either energy, water or disaster risk reduction (DRR). Pakistan is heavily dependent on dams and canal linings as the primary defense against climate change events. The government argues that more water storage is needed to combat climate change. The dams also increased hydropower output and irrigation capacity.

Box 3.2. Decision making in the hydropower sector in Nepal.

The vulnerability of the hydropower sector in Nepal to climate change, adaptation options and ways to operationalize these options were looked at in a study by Basnyat et al. (2017). The study finds that Nepal's hydropower sector experiences high climatic variability, resulting in economic losses for both the operators of the plant and the economy. Smaller, run-of-river projects are expected to be especially impacted by hydrometeorological variability. However, when compared to the projected long-term variations in temperature and precipitation, climate-induced hazards in the form of sediment, extreme floods and geohazards, such as glacial lake outburst floods (GLOFs), were found to be the bigger threat, leading to faster depreciation and damages to the plants. A shortage of reliable hydrometeorological and sediment data was a major challenge in assessing the vulnerability of the sector.

A key finding of Basnyat et al. (2017) is that while climate change would certainly have an impact on the hydropower sector, it would be overshadowed by the issues and uncertainties in the institutional and regulatory climate. While climate variability, institutional and regulatory issues, and pricing have an impact on the economic sustainability of existing plants, the tariffs received or the discount rate and rate of return (ROR) for plants planned for the next 20 years were more significant concerns. For plants constructed after 20 years, it is expected that the impacts of climate change would become a more important concern.

For current plants, low-regret options—especially nontechnical options and capacity building (such as improved data collection and availability, early warning systems, low-cost structural modifications, sediment management and insurance)—were suggested as adaptation options. For plants planned for the future, climate-smart designs are recommended, which would consider the need to balance between the costs for adaptation incurred at present and the uncertainty regarding the benefits expected in the future. Further, the need for the institutional system around the hydropower sector to prepare for the impacts of climate change is reiterated.

The findings of Basnyat et al. (2017) are reflected in a separate study conducted by Bonzanigo et al. (2015) on the Upper Arun Hydropower Project (UAHP) and Koshi Basin Hydropower Development in Nepal. The study employs the decision tree framework to assess the climate change risks of the prefeasibility 335-megawatt design of the UAHP project and to conduct basin-scale analysis of hydropower investment. The study finds that the currently planned 335-megawatt design of the UAHP is able to withstand a wide range of the climate change impacts considered. In fact, the study suggests that the capacity of the UAHP be further increased to 1,000 megawatts, since this would be the optimal design to take advantage of the increased river flow during the wet season (increased flow is projected as a short-term impact of climate change), while being robust enough for dry-season production. However, with the increased capacity, non-climate factors such as the price of electricity and capital costs would become important in determining the economic performance of the plant. These non-climate factors would become determining factors, if the price of electricity does not increase significantly beyond current rates and if construction costs rose by up to 50% due to delays in implementation. These findings are also seconded by Bonzanigo et al. (2015), who looked at different portfolios for hydropower investment.

Reservoir construction is an integral part of IWRM in Pakistan (Shah and Lele 2011). Construction of dams enables water management in terms of supply, floodwaters and wastewater.

Groundwater is also being used extensively in farming practices to improve crop yields and reduce the amount of withdrawals from surface water sources. While there may not be explicit reference to climate adaptation in the financing of these projects, these have clear adaptive functions in light of restricted surface water resources, whether or not linked to climate change. However, since the private financing of more than 20,000 tube wells in the region has affected the natural ecosystem, by the desertification of lands and drying up of high-value fruit orchards (Qureshi et al. 2010), the future role of groundwater in climate adaptation will need careful reflection and planning.

There is a need to link both national and provincial governments to establish common financial protocols and improve communication mechanisms. Integrating climate adaptation into the budgetary and planning process is also a potential entry point. These linkages and integration are crucial to ensure that climate adaptation expenditure aligns with the priorities of local governments and key stakeholders. IWRM is required at all levels, including improving canal water management, adopting high-efficiency irrigation systems, improving drought forecasting, increasing water shortage and improving regulations. Unfortunately, the costs of these implementations have not been estimated in their entirety. While the Water and Power Development Authority (WAPDA) is conducting assessments on additional water storage, monetary values are currently difficult to ascertain.

Sri Lanka

Sources of and Trends in Adaptation Finance

Existing financial structures for climate adaptation in Sri Lanka take the form of government investments, and bilateral and multilateral grants and loans. Government expenditure explicitly targeting adaptation in the water sector is low, and private sector involvement is notably absent for direct adaptation activities. The projects that directly target adaptation are financed mainly by international funding sources and focus on many different areas. Among the projects studied from 2009 onwards, around USD 88 million (27%) has been disbursed through grants and USD 238 million (73%) through loans. Projects financed by grants can be considered as contributing to "soft" adaptation measures. With projects for which a greater proportion of the funding is through loans, a large segment of the finance is apportioned for infrastructure development.

A major proportion of governmental expenditure that contributes to water-related adaptation[28] can be classified as contributing indirectly to adaptation[29] through allocations for rehabilitation of irrigation schemes, groundwater monitoring, and disaster mitigation and management. A significant fund of USD 434 million was allocated for the development of water storage and distribution systems to provide water for agriculture, hydropower, and domestic and industrial use. Agricultural communities that depend on precipitation or irrigation from minor tanks are at particular risk from climate change. Therefore, the large allocations to develop water storage and distribution facilities could assist in alleviating part of this problem. However, these structures are not necessarily built to consider predicted future impacts of climate change, and hence may not be responsive to these impacts.

Following the trend seen in the National Adaptation Plan (NAP), adaptive capacities in the food security, water resources, coastal and marine, human health and infrastructure, ecosystem and biodiversity sectors are developed through direct adaptation measures. Indirect measures contribute to the human health and infrastructure sectors, and significantly to the water sector. The focus on the water sector has concurrent benefits for food security, and the energy, technology and industry (ETI) sectors. However, adaptive capacities related to enhancing the resilience of agricultural systems or

[28] Identified from the main projects in the national budget allocations for 2016.

[29] Although adaptation is not a main or explicit objective of expenditure, it could be a co-benefit.

ETI systems to extreme weather events and disasters do not appear to attract high levels of funding. Further, the proportions of the adaptive costs attributed to the priority sectors of the NAP are not reflected in the actual financing received by these sectors.

Areas in Which Adaptation Financing Needs Strengthening

The current pattern of financial allocation for climate adaptation does not correspond to the costs estimated in the NAP. Adaptation projects initiated by international donors target a variety of sectors. In contrast, the proportion of government spending that can be considered as contributing to climate adaptation is largely on developing and improving water storage and distribution infrastructure, with disaster prevention and management being the next priority. While this is not surprising, considering current contributions made by the agriculture and hydropower sectors to the country's economic performance, long-term adaptation measures, including sustainable groundwater harnessing (Karunaratne and Pathmarajah 2002), would require knowledge development and generation across sectors and scales.

The Climate Change Secretariat (CCS), under the Ministry of Mahaweli Development and Environment (MoMDE), is the main governmental body coordinating the flow of funding from multilateral and bilateral sources to the relevant governmental entities. The process of monitoring has not yet been systemized, although NAP suggests the formation of climate change cells in the relevant ministries and implementing entities for this purpose. One of the main challenges involved in sourcing financing from the many international climate adaptation funds is a lack of knowledge and experience on how these can be tapped into. The need for institutional and technical capacity to meet the standards required in procedures for requesting finance (for example, proposal writing) is considered a challenge faced by the secretariat in procuring funds.

Current Trends of Existing Financial Structures and Mechanisms

All Countries Are Challenged with a Significant Adaptation Gap with No Clear Bridging Mechanisms

Despite patchy assessments of financial impacts of climate change and adaptation costs, information on current external funding flows and in-country spending makes it clear that a significant financing effort is required if the adaptation plans and priorities are to be fully and effectively implemented. While all the countries depend, to some extent, on external funding, they also exhibit a high dependency, with the exception of Bangladesh and India. While this is not surprising given the much smaller economies of the small countries in the region, it implies that adaptation costs are likely to increase since external funding has shifted from grants to loans. This is especially the case for countries such as Afghanistan and Nepal, where grants currently make up a significant portion of external climate-related financing for both adaptation and mitigation. Even in Bangladesh and India, where adaptation financing has been strongly driven by government spending, significant reductions in government allocations for adaptation in current budgets suggest that this trend may be changing. Addressing this is likely to require further capacity within in-country mechanisms to effectively navigate bilateral, multilateral and private funding, and to compete for scarce global funding for climate adaptation. The role of the private sector in providing credit and insurance facilities should also be looked into and considered as one of the many approaches through which this funding gap could be filled.

The Position of Improved Water Resources Management in Adaptation Finance is Difficult to Assess Given the Crosscutting Nature of Water Resources with Other Sectors

Financing data specifically about adaptation measures in the water sector was hard to locate. Water fails to feature in the top-funded sectors, and lists were generally dominated by agriculture in most of the countries. However, the water sector has strong overlaps with other sectors that do receive funding, such as agriculture. It is, therefore, challenging to make a distinction between investments from adaptation funds and overall sector spending in the water sector. Given the deep hydrological histories, even cultures, of many South Asian countries, and the dominant role water plays in their economies, water is often allocated large amounts of government funding. Therefore, low allocations of adaptation finance to water does not necessarily mean that good water resources management will not contribute to adaptation. In fact, major investments in water infrastructure and associated institutions, many of which predate climate change consciousness, may be nevertheless considered to represent forms of continuous adaptation.

Disjointed Funding Mechanisms and Underdeveloped Structures Struggle to Match Funds to Priority Adaptation Actions

The institutional architecture for incorporating climate finance into climate adaptation planning is still evolving in the region, with the exceptions of Bangladesh, India and Nepal. While some funds are multi-sectoral, others are sector specific. Adaptation measures are driven mainly through indirect funding, in which climate change responses appear to be co-benefits or windfalls of broader sectoral and multi-sectoral development investments. While integration of adaptation financing into sectoral spending is desirable, it is unclear whether the current arrangements represent a systematic approach to doing so. Initiatives driven by other sectoral imperatives, such as the estimated 165,000 deep tube wells (DTWs) in Bangladesh (Winston et al. 2013) to increase food security and meet the growing demand for supplementary irrigation attributed to climate change, may also lead to important externalities. In this case, in addition to concerns over groundwater tables, access to DTWs for some communities and not others (in the Rajshahi District) appears to have intensified the water insecurity of farmers relying on shallow tube wells (STWs) as aquifer levels drop below their reach, especially in the dry season (de Silva and Leder 2016). A more integrated approach to linking climate adaptation with sector spending thus appears to be needed, if sector spending is to effectively address countries' climate risks and adaptation needs.

There is, however, some progress in attempting to identify climate financing and efforts needed in better linking finance with planning in different countries. The clearest examples are the two major evaluations of structural weaknesses in climate finance spending in Bangladesh commissioned by the MoF, which provides detailed means of addressing key weaknesses. Other examples include the Climate Expenditure Report commissioned in Pakistan in 2015 to identify adaptation and mitigation spending as well as the relevant governmental ministries responsible for financing, though there is as yet little movement with respect to institutional adjustments to achieve better finance-planning linkage. One positive example is in Bhutan, where the Mainstreaming Reference Groups aim to more systematically incorporate climate change considerations into national and local planning. Overall, however, the majority of funds generating adaptation capacity in each country cannot be clearly identified, making any assessment of spending on climate finance, including in the water sector, only approximate. It also means that most adaptation results arise out of multipurpose investments not directly related to adaptation.

While risks are expressed in terms of specific climate change impacts, current assessments of climate finance focus on sectors. This poses challenges to attempts to understand the extent to which funding is being directed to address specific risks. The water sector is a good example, since it plays a central role in a range of risks, including flooding, drought, and changes to groundwater quantity

and quality. Improvements in finance tracking mechanisms, therefore, may also need to consider a risk-based approach as opposed to a sectoral approach. In addition, in view of the large gaps between available finance and estimated investments required for effective adaptation, utilizing all available funding sources, especially through engaging the private sector, is essential.

The Disconnect between National and Local Levels in Adaptation Planning Undermines Finance Targeting and Accountability

A majority of climate finance flows and attempts to improve adaptation planning have occurred at a national level, and appear to represent, for the most part, highly centralized and top-down processes, although Nepal and India have introduced subnational planning. A major gap in these approaches is the limited engagement between central and local government with respect to decision making on adaptation planning and financial flows. This center-local disconnect is a key issue, given that it is the poorer and otherwise marginalized segments of country populations that are likely to be worst affected, due to their greater exposure to climate change and shortage of assets to undertake their own adaptation measures. Bringing both local government as well as other representatives of local communities into planning processes, backed by legislation and capacity building, is therefore a priority action. This also recognizes that several functions constitutionally assigned to local government bodies are directly or indirectly related to building adaptive capacity. Additionally, the attempts by some of the countries (India and Nepal) to introduce basin-level planning and management not only brings to light how water sector planning and management could contribute to climate adaptation but also highlights the need to develop adaptation measures specifically for the water sector.

Chapter 4. Institutional Perspectives on Climate Adaptation

Sectoral Fragmentation and Its Implications for Climate Adaptation: Country-level Analysis

This chapter discusses the current institutional frameworks in climate adaptation in each of the seven countries in South Asia selected for this study. This will include assessing how these frameworks correspond to integrated water resources management (IWRM) both theoretically and in its actual implementation, and the implications this has for water resources management. Box 4.1 provides a summary of the key findings from this chapter.

Box 4.1. Key findings on institutional structure mechanisms in climate adaptation

Centralized, top-down management approach does not automatically lead to holistic climate adaptation.

Across the seven countries, institutional frameworks for climate adaptation need to be streamlined with existing government structures across scales, while also allowing space for local authorities and the wider society to be involved in decision-making processes pertaining to water resources management and climate adaptation.

To be meaningful, mainstreaming climate adaptation into national development programs needs to be accompanied with full integration of climate components into planned and ongoing development efforts.

All seven countries (Afghanistan, Bangladesh, Bhutan, India, Nepal, Pakistan and Sri Lanka) mainstream climate adaptation into their respective national development programs. Yet, unless climate components are fully integrated into planned and ongoing development efforts, mainstreaming climate adaptation will continue to be an add-on rather than a holistic program nested in national governments' development planning and program.

Afghanistan

Afghanistan prioritizes climate risks mainly in relation to the agriculture sector and desertification. This is evidenced from the positioning of the Ministry of Agriculture, Irrigation and Livestock (MAIL) as the country's national focal point for climate adaptation, under both the United Nations Convention to Combat Desertification (UNCCD) and United Nations Convention on Biological Diversity (UNCBD). Institutional frameworks for climate adaptation rely on the institutional setup for disaster management, embodied in the National Disaster Management Committee (NDMC) as the apex body. This is chaired by the second vice president with the participation of all the relevant ministries, United Nations representatives, and other relevant stakeholders. The Afghanistan National Disaster Management Authority (ANDMA) is the principal executing body and nodal agency at national level acting as the secretariat for the NDMC. It coordinates all aspects related to disaster mitigation, preparedness and response. At provincial level, Provincial Disaster Management Committees (PDMCs) act as the extended arms of the NDMC. The PDMCs are the vital link between the NDMC, provinces, districts and local levels. Both at the central and provincial levels, ANDMA lacks the capacity (both material and human) to lead prevention, response and operationalization of post-disaster recovery activities. ANDMA has provincial directorates in all 34 provinces of Afghanistan. Yet, the capacity of directorates differs among provinces depending on the availability of staff, level of operational resources, security and terrain. This weak institutional capacity suggests major challenges in tackling flash and riverine floods, a widespread natural hazard in Afghanistan.

Water resources management does not directly feature in Afghanistan's climate adaptation measures. Similarly, the need for IWRM is not always linked to the need to establish holistic institutions on climate adaptation. While water resources management is partly included as a priority area, mainly in the context of irrigation, this is derived largely from its positioning as one of the supporting factors in agricultural production. It is not necessarily linked to water resources management in a broader sense (for example, incorporating flood protection measures as well as issues of groundwater depletion). The central positioning of the agriculture sector in climate adaptation corresponds with drought, landslides and groundwater depletion as major climate risks, as identified in Paper 1 (Lacombe et al. 2019). It is unclear whether the Government of Afghanistan (GoA) also links these risks with the wider context of water resources management, especially in relation to how it might reduce or exacerbate specific climate risks and vice versa.

The Water Sector Policy established in 2004 created the Supreme Council for Water Affairs Management. The council is chaired by the first vice president, and the respective heads of the line ministries are its members (Mahmoodi 2008). While the Supreme Council can (in theory) be regarded as a formal inter-ministerial coordination body in water resources management, there is no clear guideline as to how the council will promote IWRM principles in relation to the defined plans and programs of the different sector ministries. Formally, the Ministry of Energy and Water (MoEW) is in charge of IWRM implementation through the formation of river basin and sub-river basin agencies. It reports to the Supreme Council for Water Affairs (Mahmoodi 2008), though the relationship between MoEW and other sector ministries is not clearly defined.

While water resources management is incorporated into the formal mandates, responsibilities and development plans of different sector ministries, the question remains as to how water resources planning and management are conducted both formally and in practice. For instance, while MoEW will lead the planning process with energy issues, it is unclear as to how the process will include the roles and development plans of other ministries in different aspects of water resources management, including domestic use, health and industry.

In practice, while river basin organizations (RBOs) are envisaged to promote the application of IWRM, such application took place only on a project basis (such as in the Amu Darya River Basin). Little effective implementation of IWRM principles has taken place in practice. This is shown by Afghanistan's mismanagement of groundwater resources (Habib 2014). The contamination of groundwater resources by industry has caused severe health risks, which is due, in part, to poor wastewater management. Although Afghanistan has the Groundwater Development Policy, it is poorly implemented and the lack of enforcement by institutions responsible, primarily MoEW, has caused severe groundwater depletion in some parts of the country (Habib 2014). In addition, while water users' associations (WUAs) have been formed and established in various irrigation systems in the country, it is unclear how WUAs' envisaged role in irrigation system management is linked to the wider context of water resources management, not to mention that many of these WUAs became inactive after their formation.

Nongovernmental organizations (NGOs) in Afghanistan play much the same role as they do in other low-income countries (LICs), working closely with rural communities in capacity development and assisting the government with project implementation. During the war, NGOs had to ally with existing government structures to assist rural villages with water resource issues when the central government could not (GoA 2008). Therefore, NGOs now have a close working relationship with the rural community in Afghanistan. The activities that NGOs carry out include stakeholder participation in water resources management, especially at the field level, and assisting with developing community development councils and WUAs with conservation programs and water usage techniques at a broader level (GoA 2008). NGOs are uniquely positioned in Afghanistan to help with the implementation of IWRM programs, especially in the rural sector. The Rural Water Supply and Sanitation Program is directly implemented by NGOs. The program aims to prevent waterborne diseases by providing potable

water to rural villages. In addition, it assists with capacity building of service delivery, and operation and maintenance (O&M) of water supply and sanitation facilities (GoA 2008). For specific project information, further research is needed on the ground.

Afghanistan and Iran are members of the Helmand River Delta Commission, which measures and divides the river flows between the two countries. Further information on the commission is provided in Chapter 5. Lacking an inter-ministerial coordination body, cross-sectoral collaboration takes place mainly on an ad hoc basis through development programs such as the Comprehensive Agriculture and Rural Development Facility (CARDF), which involves both MAIL and Ministry of Rural Rehabilitation and Development (MoRRD). Consequently, while IWRM is essential, water resources management continues to be directed through sectoral approaches, though not specifically targeted to address the problem of the lack of cross-sectoral coordination. Referring to Afghanistan's major climate risks (including landslides, riverine and flash floods, droughts, groundwater depletion), linking water, agricultural, energy and land agencies would increase the government's capacity to develop more holistic adaptation measures to deal with systemic implications from climate change. In the context of climate adaptation, ANDMA can serve as a potential entry point to harvest more structural and robust inter-ministerial coordination for adaptation formulation and implementation. This process will, however, inevitably require stronger capacity building efforts and significant fine-tuning with MoEW's role in relation to water-specific adaptation measures.

Bangladesh

The Government of Bangladesh took a broader institutional approach in climate adaptation through the incorporation of the water sector as an integral part of the country's adaptation strategies, but without sufficiently emphasizing the need for IWRM or trying to address the current challenges for its implementation. Institutionally, the government established a Climate Change Cell (CCC) in 2004 to build capacity and promote climate-resilient development. The CCC refers to the water sector and ways in which the CCC will be linked to other institutions involved in water resources management. As part of the shift in disaster management practices toward preparedness and risk reduction rather than relief efforts (Tanner et al. 2007), CCC received support from the UK Department for International Development (DFID) through the Comprehensive Disaster Management Program (CDMP). For its day-to-day functioning, CCC is hosted by the Department of Environment (DoE), which acts as the national focal point on climate adaptation, under the Ministry of Environment and Forests (MoEF).

CCC's formal mandate includes preparing technical papers for MoEF to support international negotiations, identifying sectors vulnerable to climate change in Bangladesh, and formulating climate adaptation guidelines and training modules for relevant sector ministries. A Climate Change Knowledge Network (CCKN) was established, which is active in the dissemination of research findings of CCC and other line agencies on climate change issues. Based on the recent community-based adaptation project *Reducing vulnerability to climate change*, CCC is developing a series of guidelines for the emerging community risk assessment processes created under CDMP (Rahman et al. 2010). During its early years, CCC focused on facilitating cross-sectoral coordination among sector ministries through establishing climate focal points in each relevant ministry and providing basic training on climate issues.

Established by the government after Bangladesh signed and ratified the UNFCCC, MoEF (through its technical arms CCC and DoE) is the lead institution for work on climate change. Institutionally, this reflects the government's approach to tackle climate adaptation from a broader development perspective by linking it with environmental aspects and not necessarily focusing specifically on water resources management. While this is very much in line with the high risks associated with riverine and coastal flooding, and storm and cyclone impacts the country frequently faces (see Paper 1: Lacombe et al. [2019]), one could also argue that these risks are strongly linked with water resources management. Nevertheless, the current institutional setup for climate adaptation does not focus specifically on adaptation measures for the water sector. While this lack of specific focus might be linked to the

inability of the National Water Resources Council (NWRC) to effectively implement IWRM, it also poses a risk for furthering the current problem of groundwater salinization and over-extraction.

Bangladesh combined an environmental emphasis with disaster management in its adaptation strategies, which are in line with the major climate risks identified in Paper 1 (Lacombe et al. 2019), especially those pertaining to storms and cyclones, and coastal floods. For example, while MoEF acts as the national focal point for climate adaptation, the Ministry of Food and Disaster Management (MoFDM) also plays an important role in positioning disaster risk reduction as a bottom-up strategy for climate adaptation. As stated in the Corporate Plan 2005-2009 of MoFDM, the mission of the ministry is "to achieve a paradigm shift in national disaster management strategies from conventional response and recovery to a more comprehensive risk reduction culture, and to promote food security as an important factor in ensuring the resilience of the communities to hazards" (MoFDM 2005).

Under CDMP, an existing institutional framework was adapted toward the positioning of climate adaptation as a cross-sectoral issue, which requires inter-ministerial coordination. CDMP demonstrates a process through which a country such as Bangladesh can integrate and address climate-related risks and disasters within a comprehensive management framework. The CDMP framework is built from an assessment of risks at the community level through sector and cross-sectoral analysis. Bangladesh also has many national think tanks and research institutes, which include the Bangladesh Centre for Advanced Studies (BCAS), Center for Environmental and Geographic Information Services (CEGIS), and the Bangladesh Institute of Development Studies (BIDS).

While Bangladesh approaches climate adaptation from a cross-sectoral perspective, it is unclear whether this will enable it to tackle groundwater salinization and depletion effectively. With almost 80% of the total cultivated area irrigated with groundwater (Qureshi et al. 2014) and partially because of ineffective IWRM, Bangladesh faces groundwater over-extraction and water quality issues. The Groundwater Management Ordinance (1985), operationalized by the Ministry of Local Government, Rural Development and Co-operatives (MoLGRDC), and the Bangladesh Water Act (2013) attempt to use licensing to regulate the installation of new wells. However, enforcement and accountability have proven to be difficult in rural areas, and efforts to date to regulate groundwater usage have not borne fruit (even though Bangladesh has a comprehensive institutional structure in water resources management).

The NWRC was established in 1983 as an inter-ministerial coordination body chaired by the prime minister and comprising 47 members. These members include government ministries, water management authorities and academics, as well as representatives from development agencies. The NWRC coordinates water-related policies. Most decisions on national water management are taken by the executive committee of the NWRC, which is chaired by the minister of water resources (the lead government agency for IWRM formulation and implementation). This institutional setup highlights the important leadership of the Ministry of Water Resources (MoWR) in shaping the cross-sectoral coordination between different sector ministries across scales. However, the relationship between MoWR and these sector ministries remains very broadly defined. For example, while the NWRC's main task is to facilitate the coordination of water-related policies, it is unclear how it could ensure such facilitation, especially when MoWR's role in the formulation of such policies is not clearly defined. The Water Resources Planning Organization (WARPO), under MoWR, is responsible for planning both groundwater and surface water development, while the Bangladesh Water Development Board (BWDB) and MoLGRDC are responsible for operationalizing this development. However, it is felt that the mandate of the BWDB does not still have a concrete definition, therefore encumbering its functions.

Water management organizations (WMOs) in Bangladesh are organized into two main groups: those following (i) the Comilla Model, and (ii) other models. The first category consists of the large majority of WMOs, largely due to governmental push to increase irrigation cover. The Comilla Model provides access to credit and other agricultural inputs as well as training to organize two-tiered cooperative systems. The Bangladesh Agricultural Development Corporation and BWDB were

responsible for the development of the Comilla Model for groundwater and surface water irrigation (de Silva 2012). Such participatory management in Bangladesh has, however, been criticized for not succeeding in promoting more inclusive participation in management, and moreover for resulting in the replication of existing institutional structures.

While IWRM has been adopted in the national policies for more than a decade, in practice, sectoral decision making prevails in water resources management. As stated by Rouillard et al. (2014, 520), "Responsibilities and powers for the construction and management of different types of water infrastructure remain fragmented between several ministries and agencies, and achieving policy integration remains challenging because the decisions of coordinating bodies are loosely binding." The NWRC's current lack of power to direct the development plan and activities of sector ministries is rooted in the fact that, while NWRC is assigned with the coordinating role, sectoral development budgets are channeled directly to sector ministries and not through the NWRC. Thus, while hydrological boundaries were considered under the IWRM approach through catchment planning, planning responsibilities are maintained in the NWRC and WARPO, often with little connection with the development plans and activities of sector ministries. An exception to this status quo appears to be the coordination within the water sector as well as with other sectors made possible in the Barind area of northern Bangladesh through the Barind Multipurpose Development Agency (BMDA). With its wide-ranging umbrella of powers covering this drought-prone area, this purpose-specific agency addresses all facets of water management, including augmenting surface water supplies and exploiting groundwater as sources of irrigation and domestic water, while also promoting water savings through crop diversification, new seed varieties and other water-saving technologies (see Box 4.2). Internationally, a Joint Rivers Commission (JRC) was established in 1972, which provided the institutional arena for maintaining a dialogue between Bangladesh and India on Ganges River management. In practice, however, JRC's decisions are non-binding recommendations to be considered for ratification by both governments (Das Gupta et al. 2005). Hence, in times of water scarcity, disputes can continue with respect to water sharing because JRC cannot direct and oblige relevant sector ministries to follow its recommendations (Chowdhury 2010; Rahaman and Varis 2009).

Crucial in the positioning of climate adaptation as a cross-sectoral issue (despite the lack of clear and concrete adaptation strategies for the water sector) is the incorporation of climate issues in the country's national planning strategy. The General Economic Division (GED) of the Planning Commission (PC), under the Ministry of Planning (MoPl), has initiated a process to enhance its institutional capacity to facilitate the incorporation of climate issues in the planning processes. PC is in charge of preparing short- and long-term national plans for the economic and social development of the country, as well as the ADP. The incorporation of climate adaptation into these plans provides a strategic entry point to link climate adaptation with relevant sectoral development plans and activities.

Over the past years, through donor-assisted projects such as the Poverty, Environment and Climate Change Mainstreaming (PECM) project, funded by the United Nations Development Programme (UNDP) and the United Nations Environment Programme (UNEP), climate adaptation has increasingly become significant in terms of national planning. All macro and perspective plans, including the Perspective Plan and the National Sustainable Development Plan, acknowledge BCCSAP and include its climate change strategy. The long-term (50-100 years) holistic Delta Plan 2100 now under development includes adaptation as a critical component in the planning process. All macro and perspective planning, including BCCSAP, have also been incorporated into the Seventh Five-Year Plan (2016-2020).

Box 4.2. Toward Integrated Water Resources Management under the BMDA.

The BMDA was established in January 1992 as a semiautonomous, legal entity under the Ministry of Agriculture (MoA) to develop an integrated approach to address the significant climatic and other biophysical drivers of poverty, and low agricultural production in the Barind Tract. Spread across northern Bangladesh (mainly Rajshahi, Dinajpur, Rangpur and Bogra districts) and India's West Bengal, this drought-prone area is characterized by a dry climate with comparatively high temperatures, low rainfall and limited surface water supplies. These conditions belie the fact that the Barind area constitutes one of the largest irrigated areas in Bangladesh, due to the vast adoption of shallow tube wells (STWs) and, more recently, government investments in deep tube wells (DTWs). Nevertheless, increasing seasonal groundwater abstraction has led to growing concerns over groundwater tables, and the installation of further DTWs has been suspended until the condition of the groundwater resource is better understood.

In addition to farmer investments in groundwater pumping through STWs, the conversion of the Barind area into a major food producer over the past decades has been the goal of the BMDA. To achieve this, unlike most other agencies, it is empowered to take action across sectors within the Barind area, and is a point of sectoral convergence. This is reflected by the composition of its board, which includes representatives from the agriculture sector and the deputy commissioner of the districts covered, and in the broad range of activities it is empowered to undertake. This includes optimizing surface water supplies through renovation or building storage, water transfers between rivers, and pumping from rivers and canals to support irrigation and domestic water supplies. It concurrently develops groundwater resources through electric DTWs, mainly for irrigation but often also linked to domestic water supplies depending on groundwater availability. Domestic water is further supplied through community dug wells, which also support homestead and field vegetable cultivation. Large afforestation attempts to dampen the impacts of climate change and improve soil management, while providing additional sources of food and other forest products to local communities. These measures are supplemented with a range of programs seeking to curtail the demand for irrigation mainly through crop diversification with the introduction of low water-consuming crops, new drought-tolerant crop varieties and the adoption of land management methods such as zero tillage and bunding, linked to farmer training. Water from many DTWs is now conveyed through underground pipes to minimize evaporation losses. Recognizing that these programs can succeed only if markets provide farmers with sufficient incentives, BMDA also develops agro-based industries in the area and constructs roads to improve market access. Efforts to increase the economic returns from water also include the re-excavation of ponds and seasonal wetlands for fish culture and irrigation. Many of these activities are operated with other sector agencies under BMDA's umbrella authority.

The results indicate an increased irrigation coverage, especially in the main *boro* rice season, as well as availability of supplementary irrigation for *aman* rice, particularly during the drought season. Where much of the land was cropped only during the rainy season, a three-crop calendar is now common. This intensification in rice cropping and increased yields due to better access to irrigation have resulted in an additional estimated 5 million metric tons of food grains per year in areas supplied by BMDA-established DTWs. The water saved by using buried pipes to convey groundwater to fields is estimated to have enabled an additional 20,000 metric tons of food grain production annually (BMDA 2015).

Bangladesh is one of the most advanced countries in climate adaptation in South Asia regarding institutional frameworks and arrangements. In the government's strategy to mainstream climate adaptation as an integral part of its development planning and activities, a key element is how it tackles the problem of sectoral fragmentation through centralized funding mechanisms to address climate issues. While CCC provides an entry point for cross-sectoral approaches in climate adaptation, it was the incorporation of climate issues into the national development planning strategy and budget that enabled Bangladesh to implement its climate adaptation strategies without too great a reliance on donor support. Thus, the country's successful attempt to mainstream climate adaptation is not about forming a new inter-ministerial coordination body. Rather, it was achieved through forming the CCC, assigning MoEF as the lead government ministry in climate adaptation, and positioning GED to provide centralized funding mechanisms to support climate adaptation plans and activities. From the perspective of water resources management, Bangladesh's ability to reduce climate risks would be defined by the incorporation of water-related climate adaptation activities into the overall strategy, through further fine-tuning of development plans and programs of MoEF and NWRC. For example, increased climate risks in relation to the steady decline in groundwater recharge is likely to need immediate action to identify effective measures to stop groundwater over-exploitation. This in turn stands to reduce the country's ability to increase food security and reduce poverty, if left unaddressed. Institutionally, this trade-off between regulating groundwater use and adverse impacts on food security highlights the need to develop incentives for different government agencies working on water-related issues to coordinate their efforts.

Bhutan

Following the Earth Summit in Rio de Janeiro, Brazil, in 1992, Bhutan ratified UNFCCC in 1995. The National Environment Commission Secretariat (NECS) became the national focal point for climate change activities in the country. As a technical arm of the National Environment Commission (NEC), the secretariat is responsible for policies, regulations and directives formulated by the NEC and for administering the provisions of the National Environment Protection Act (NEPA). In 2011, the NEC established a Climate Change Unit (CCU) and created a high-level national climate change committee called the Multi-Sectoral Technical Committee on Climate Change (MSTCCC) to serve as a forum to coordinate all climate change-related activities in the country. MSTCCC members are selected from relevant government ministries.

The NEC today has the status of an autonomous, high-level inter-ministerial coordination body representing the highest decision making on all matters related to the protection, conservation and improvement of the natural environment. As the National Focal Agency, NEC is mandated with the responsibility for policies, plans and guidelines for environmental protection, sustainable development and proper utilization of natural resources, including recommendations on ratification of bilateral and multilateral instruments, and regulation of emission limits. While NEC could in theory act as the umbrella institution for IWRM, in practice, the positioning of water resources management in NEC's mandate is far from central and hardly underpinned.

Provisionally, NEC has the mandate to coordinate water-related issues among relevant sectoral ministries and other government agencies. In line with this coordination role, NEC proposed to establish the Bhutan Water Authority (BWA) to implement IWRM. Ideally, the authority would formulate guidelines for sustainable water use among the different stakeholders, including private sector actors. Yet, while the government envisioned the adoption and application of IWRM, this and the proposed plan to form and establish BWA have yet to materialize. The delay is most probably linked to the fact that the establishment of BWA would consequently confuse the role of NEC as the formal coordinating body in water resources management. Moreover, it is unclear as to which government agency or sector ministry would be responsible for BWA formation, since Bhutan does not have a separate ministry focusing on water resources management (apart from water management for agricultural purposes).

In practice, water resources development continues to be directed through sectoral decision-making structures and processes, often overlapping or in parallel with each other. While this lack of cross-sectoral coordination does not seem to matter in terms of the water availability issue, such coordination is imminent in relation to the government's plan to develop hydropower dams and how it might affect the country's vulnerability in relation to glacial lake outburst floods (GLOFs).

Locally, WUAs were formed and established in line with the National Irrigation Policy in the 1980s, which required rural households to maintain the sections of the irrigation canal they used and raise funds for this purpose. In practice, however, the organizational development of WUAs has had mixed results, with many becoming inactive after their formation. In some cases, WUAs become inactive because the government focuses their organizational development mainly on collecting irrigation service fees from farmers and conducting canal maintenance, without linking these functions with improved water service provision to farmers' fields. In other cases, WUAs stop functioning because farmers do not see how they can benefit from it, especially if they do not experience a water scarcity issue.

NEC is the highest decision-making body for environmental management, established under NEPA. It is an inter-ministerial coordination body, chaired by the prime minister, with four to five high officials representing relevant sectoral ministries (for example, minister level or equivalent) nominated by the chair and three representatives from civil society. Internationally, NEC is the national climate focal point for UNFCCC and the designated national authority (DNA) for the Clean Development Mechanism (CDM) of the UNFCCC's Kyoto Protocol.

Other ministries also have water-related climate adaptation mandates. These ministries include the Ministry of Agriculture and Forests (MoAF), the Department of Hydropower and Power Systems and Department of Hydrometeorology Services in the Ministry of Economic Affairs, and the Department of Disaster Management within the Ministry of Home and Cultural Affairs (MoHCA). Theoretically, this diversity of institutions linked to water will enable the government to tackle specific climate risks such as drought and groundwater depletion (see Paper 1: Lacombe et al. [2019]) from a sectoral perspective, especially when related to agricultural development. With regard to climate adaptation for the water sector, this involvement of agencies outside of the water sector will partially fill the current gap in water-specific adaptation measures as well as the current ineffective application of IWRM. While these formal mandates are a good starting point for climate adaptation measures to be effective, they also need to be accompanied by stronger cross-sectoral coordination between the relevant ministries.

Similar to that of Bangladesh, the Bhutan case study clearly illustrates how the government links climate adaptation with environmental management, through the appointment of NEC as the national focal point to direct and coordinate climate-related issues. The difference is that, unlike in Bangladesh, in Bhutan, NEC is in charge of both climate adaptation and water resources management. Institutionally, NEC provides an organizational umbrella to link climate adaptation and water resources management in a more integrated way. This is in line with the central positioning of GLOFs, flash floods and landslides as major climate risks the country is facing (see Paper 1: Lacombe et al. [2019]). Moreover, while the government has positioned NEC as an inter-ministerial coordination body, it has also linked this with project management units for implementation of climate adaptation as part of the development plans, activities and sector ministries. While the linkage has enabled NEC to gain decision-making authority in directing and coordinating climate adaptation responses in the country, NEC's role is also closely linked with the availability of donor funds for climate adaptation (Bisht 2013).

India

The national response to climate change emerged through the Prime Minister's Office (PMO), and manifested in the creation of the Prime Minister's Council on Climate Change (PMCCC) in 2007. PMCCC was to also provide overall guidance on actions related to climate change taken by nodal ministries and other agencies, as well as reviewing the progress and implementation of each of the eight "missions" in

the National Action Plan on Climate Change (NAPCC). Further, under the direction of NAPCC, each of the nodal ministries was required to submit comprehensive mission documents detailing objectives, implementation strategies, timelines, and monitoring and evaluation criteria to PMCCC.

In practice, however, PMCCC's role as the main coordinating entity overseeing all climate policies in India at a central level remains unclear. PMCCC is challenged with overseeing the implementation of adaptation plans within and across the different states. For example, at the state level, there is very little evidence on how the defined adaptation plans have commenced. Despite the central government's continuous efforts to convene nodal states to provide updates on their plans, there are very few examples of coordinated and concerted efforts to implement the plan in any state. While some of the adaptation actions listed in the plans are possibly being implemented, this is likely to be more as a side effect of other preplanned initiatives, such as the modification of an existing irrigation program to increase its coverage.

Nevertheless, reconstitution of PMCCC by the government in 2014 indicates a renewed focus on its functions and the need to revive its coordinating role around issues of climate change. Following the reconstitution, PMCCC was assigned to (a) coordinate national action plans for assessment, adaptation and mitigation of climate change; (b) advise the government on proactive measures that can be taken to deal with climate change challenges; and (c) facilitate inter-ministerial coordination and guide policy formulation in relevant areas. While the MoEFCC would assist the PMO in facilitating the work, the PMCCC could also obtain assistance as required from any relevant government ministry. Prior to the PMCCC reconstitution, MoEFCC acted as the main coordinating entity under the NAPCC, and the nodal ministry is required to liaise and coordinate its proposed and ongoing activities with MoEFCC. Internationally, the PMCCC would act as a high-level decision-making body to provide guidance on climate negotiations. In theory, relevant sectoral ministries would submit their development plans related to climate adaptation to PMCCC. PMCCC would also review and report on these development plans on a regular basis.

PMCCC coordinates national action for assessment, adaptation and mitigation of climate change, but without specific emphasis on how such coordination can address current challenges in IWRM application. India adopted basic principles and approaches for IWRM in 1995 through the creation of the Integrated Watershed Management Program (IWMP). The NWRC, chaired by the prime minister, is formally responsible for inter-ministerial coordination. In practice, however, inter-ministerial coordination is hampered by the council's lack of decision-making power to direct the development plans and activities of sectoral ministries, since sectoral development budgets are channeled directly to each sectoral ministry and not through the council.

While an IWRM approach is implied in India's water resources management policies and guidelines, in practice, sectoral ministries direct sectoral development activities often without much collaboration. For example, while the Ministry of Agriculture and Farmers Welfare (MoAFW) is in charge of agricultural development, its plans and activities to promote agricultural development are not always linked with groundwater over-extraction. Sectoral fragmentation persists in water resources management, but this does not mean that the government does not see the need for cross-sectoral coordination, as evidenced in the 2012 Water Policy. The question is how to create incentives that motivate sectoral ministries toward such coordination in relation to the potential costs and benefits of water resources management and adaptation.

MoWR helps shape water resources management in the country. Two crucial departments—the Department of Land Resources (DoLR) and the Department of Agriculture and Cooperation (DoA&C)—and MoWR have been engaged in implementing schemes and programs for the holistic development of land, drought proofing, irrigation and flood control at a central level. MoWR has also focused on the management and regulation of groundwater sources through its groundwater management and regulation scheme. It carries out groundwater management studies as well as groundwater exploration through geophysical studies.

With regard to river basin management in India, most of the rivers are interstate. States are given authority through the constitution to develop water resources within state boundaries, while the central government has the authority to develop interstate rivers. Current river basin management in India centers largely around infrastructure development and conflict resolution, and has yet to evolve to include more basin-wide integrated approaches to management. At present, river basin organizations (RBOs) are largely top-down in nature with limited stakeholder participation.

Through the River Boards Act 1956, the parliament has the authority to develop interstate river basin boards and authorities, though this initiative has to be collectively requested by the states involved. Until now, no such request has been made, and it is felt that the states perceive such an initiative as a potential loss of power, hence their reluctance. The establishment of entities by the central government to deal with interstate river issues up until now has, therefore, been independent of this Act. However, most interstate water resources have already been tapped into, and most future projects in India are likely to be largely interstate in nature, thereby increasing the necessity for such interstate river basin boards. Internationally, the country played a prominent role in the formulation and signing of the Indus Water Treaty in 1960.

In common with those in Bangladesh and Sri Lanka, participatory irrigation management (PIM) models in India have had a top-down origin. MoWR started fostering farmer participation in 1985 through a centrally sponsored Command Area Development (CAD) program. Since then, MoWR has promoted PIM through a legal model that states have then used to design PIM acts of their own, a practice adopted by 17 states up to now. As in other countries, in India, the PIM model faces challenges, including a lack of resources and support, and an unclear legal and policy environment.

At present, MoEFCC houses both the CCU as well as the National Mission for Green India. The unit comprises members from relevant sectoral ministries, including the Ministry of Finance (MoF), Ministry of New and Renewable Energy (MoNRE), Ministry of Power (MoP), Ministry of Science and Technology (MoST), Ministry of Water Resources (MoWR), Ministry of Urban Development (MoUD), Ministry of Agriculture (MoA), and the Ministry of External Affairs (MoEA) (Dubash and Joseph 2016). While the relevant sector ministries are well represented in the CCU, the envisioned inter-ministerial coordination platform is placed under MoEFCC. This implies MoEFCC's institutional ability to direct and coordinate climate adaptation across sectors is through its access to CCU. However, MoEFCC's ability to control the unit will be influenced by its ability to ensure sector ministries' involvement and commitment, and enable its effective functioning.

India's National Bank for Agriculture and Rural Development (NABARD) has been accredited as a national implementing entity (NIE) for the Adaptation Fund created under the UNFCCC. In its capacity as an NIE, NABARD has generated several feasible projects on climate change adaptation in diverse agro-climatic regions and livelihood sectors, five of which have been submitted as proposals to the Adaptation Fund. Additionally, NABARD is implementing several developmental projects to promote sustainable livelihoods through natural resource management. These include watershed development and sustainable livelihoods for tribal communities, which are helping to build climate change resilience and the adaptive capacities of rural communities.

In 2009, the government also formed the Indian Network for Climate Change Assessment (INCCA) to enhance knowledge about the impacts of climate change at national and subnational levels. INCCA comprises 127 institutions and has been conceptualized as a network-based scientific program designed to (a) assess the drivers and implications of climate change through scientific research; (b) prepare climate change assessments once every 2 years; (c) develop decision support systems; and (d) build capacity toward the management of climate change-related risks and opportunities. Recently, the government has also set up the National Institute for Climate Change Studies and Actions (NICCSA) under its Climate Change Action Program (CCAP) of the MoEF. The NICCSA will conduct analytical studies on scientific, environmental and economic development, and technological issues related to climate change, though direct influence of these studies remains to be seen.

Existing institutional frameworks for climate adaptation in India incorporate both institutional arrangements to ensure cross-sectoral coordination and financial mechanisms for climate adaptation policy implementation. The central government has been quite successful in dealing with sectoral fragmentation in its climate adaptation responses, through centralized budget allocation under NABARD as well as the establishment of an inter-ministerial platform to facilitate coordination (under MoEFCC). Nevertheless, two important questions remain: How can this financial and institutional platform be translated at the state level? How can cross-sectoral mechanisms for climate adaptation help address sectoral fragmentation in the water sector, so that water resources management forms an integral part of the country's adaptation strategies? The latter question is of high importance not only because droughts and groundwater depletion have been identified as major climate risks facing the country (see Paper 1: Lacombe et al. [2019]), but also because irrigation and flood control are key to the government's development strategies to increase agricultural productivity and promote national economic growth.

Nepal

In the context of climate adaptation, Nepal's Climate Change Council is a high-level, inter-ministerial coordination body chaired by the prime minister, with the Ministry of Science, Technology and Environment (MoSTE) functioning as the council secretariat. Formed in 2009, prior to the 15th Conference of the Parties (COP 15), the council's task is to provide high-level policy and strategic oversight, and coordinate financial and technical support to climate-related programs and projects, as well as ensuring that Nepal benefits from climate-related international negotiations and decisions. It comprises 25 members, including 11 ministers and eight technical experts nominated by the government. MoSTE is the designated focal point and lead ministry for implementing the provisions of the UNFCCC; it coordinates the implementation of climate adaptation activities across sectors and donor agencies. Institutionally, this reveals how the Government of Nepal (GoN) positions climate adaptation as a broader issue pertaining to environmental challenges, beyond water resources management alone.

While the current institutional structure shows Nepal's comprehensive approach to climate adaptation, in practice, MoSTE has little presence outside its administrative headquarters in Kathmandu, and has been working on how to increase its organizational capacity so that it can coordinate and implement climate adaptation at a subnational level. The Division of Hydrology and Meteorology under MoSTE collects and disseminates hydrological and meteorological information on water resources, agriculture, energy and other development activities. Yet, it is unclear how this information is conveyed or is being used as a starting point for policy discussion.

MoSTE is equipped with a joint secretary and Climate Change Program Steering Committee (CCPSC), with the latter chaired by the minister and the National Planning Commission (NPC). MoSTE reports directly to the Multi-stakeholder Climate Change Initiatives Coordination Committee (MCCICC) and CCPSC, which then reports to the Climate Change Council. In practice, however, though MoSTE is supposed to coordinate climate adaptation activities in the country through its Climate Change Management Division, different implementing agencies (for example, relevant ministries and NGOs) work mainly with the respective donors.

Formed in 2009, the MCCICC comprises representatives from government agencies, NGOs, private sector actors, academics and international donors. The National Adaptation Programme of Action (NAPA) thematic working group coordinators are also on the MCCICC. Functioning as the MCCICC Secretariat is the Climate Change Management Division under MoSTE. The MCCICC's task is to coordinate climate change activities by providing a venue in which needs are identified and taken into account in the formulation of financing strategies by the government and international donors, as well as in implementing collaborative programs across sectors. In practice, however, MCCICC has not been effective in fulfilling this role as evidenced by its infrequent stakeholder meetings.

The National Climate Change and Knowledge Management Center (NCCKMC) was formed through close collaboration between the Nepal Academy of Science and Technology (NAST) and

MoSTE in 2010. NCCKMC is part of institutional arrangements falling under NAPA and is supported by the Danish International Development Agency (DANIDA), DFID, Global Environment Facility (GEF) and UNDP. Based in NAST, the NCCKMC's mission is to generate and manage climate-related knowledge in Nepal, and provide an institutional platform to coordinate and facilitate knowledge exchange and capacity building to a wide range of stakeholders. NCCKMC faces funding challenges to fulfill its tasks, especially because MoSTE was unable to maintain its initial development investment as envisaged under the NAPA. Next to NCCKMC, various organizations, including national and international NGOs, formed Climate Change Network Nepal. It is a forum that aims to raise awareness on climate change, coordinate and advocate effective action for mitigation and adaptation measures, and establish an information-sharing platform on climate adaptation through community-based networks.

According to the NAPA for Nepal, Local Adaptation Plans for Action (LAPA) were created to assist with tackling climate change issues from the bottom up, and LAPA are meant to be flexible, inclusive and responsive to change. The village development committee (VDC) and the municipality have been characterized as the most suitable units of LAPA. Integration of these units would ensure both a top-down and bottom-up approach for an adaptation plan. Since 2013, the Nepal Climate Change Support Program (NCCSP) has implemented approximately 100 LAPA in 90 VDCs and seven municipalities across 14 districts, mostly in the mid- and far-western regions of Nepal. The steps for LAPA implementation are as follows: (a) climate change sensitization; (b) vulnerability and adaptation assessment; (c) prioritization of adaptation options; (d) LAPA formulation; (e) LAPA integration into the planning process; (f) LAPA implementation; and (g) LAPA progress assessment.

Adaptation actions in LAPA come under six thematic areas: (a) agriculture, livestock and food security; (b) forest management and biodiversity; (c) alternative energy; (d) climate-induced hazards and physical infrastructure; (e) human resource capacity development and livelihoods; and (f) human health. The LAPA process has benefitted more than 500,000 people either directly or indirectly in Nepal. Additionally, it has gained recognition for its success in addressing climate change issues at the village level. The LAPA process is successful because it has a strong participatory approach adopted at the planning and implementation phases. Currently, DFID and the European Union provide financial support, while UNDP provides technical support. For its success, however, the LAPA process still has challenges it needs to overcome. For instance, implementation of programs in the upper hill terrain is quite difficult due to the remoteness, and harsh weather conditions allow only a few months to work. These challenges can be overcome by having a different implementation approach and delivery mechanism, which includes robust monitoring and a quality control mechanism. Another challenge is that LAPA under the current directive have many small activities implemented over scattered areas. This requires a large monitoring effort, and the impact of these implementations is not substantial from a climate change perspective. This challenge can be overcome by intervening on a larger scale, which cuts across geographical boundaries.

It is unclear, however, as to how the established institutional setup in climate adaptation would be able to tackle the problem of sectoral fragmentation, which had continuously impeded IWRM application. Partially driven by the global agenda on IWRM, the National Water Plan (2005) states the importance of IWRM principles and the notion of river basin management to ensure that water resources development is undertaken in an effective and sustainable manner. Initially, the MoWR and the Water and Energy Commission Secretariat (WECS) were identified as the main government institutions responsible for promoting IWRM implementation. In 2009, however, MoWR was split into two ministries: the Ministry of Irrigation (MoI) and the Ministry of Energy (MoE). For this reason, WECS was located under MoWR and later under MoE.

WECS, formed in 1981, is the permanent secretariat of the Water and Energy Commission (WEC), established in 1975 with the objective of "developing the water and energy resources in an integrated and accelerated manner" (ADB 2004, 4). The establishment of WECS was largely driven by the government's objective to be well-equipped in negotiating transboundary water and energy

issues with India, notably through the creation of an integrated and centralized environmental database system for information related to water resources development and management (WECS 2010). In its early days, the role of WECS was envisioned as providing other government ministries with review and technical reports related to the development plans of sectoral ministries, and provision of design guidelines. Following the development of the National Water Plan (NWP), the role of WECS was oriented increasingly toward the formulation of policies and legal frameworks to promote IWRM, and toward cross-sectoral coordination.

There is considerable confusion, however, over what the role and mandate of WECS are, as well as marked disagreement on what they should be. International donor representatives believe that the role of WECS lies in the coordination of water planning. Some sectoral ministries, however, perceive that WECS should solely provide technical expertise to them, while civil society organizations perceive WECS as a government body in charge of IWRM implementation—without actually defining what IWRM implementation entails (Suhardiman et al. 2015). Following NWP's formulation in 2005, WECS developed a draft policy that outlined the institutional frameworks that need to be developed toward the realization of IWRM. However, the policy was never approved because of MoE's objection. The policy was drafted notably to give legal backup to WECS to review and approve development plans and activities of sectoral ministries.

Following this major setback, WECS has been unable to fulfill its role in promoting cross-sector coordination, as outlined in the NWP. Lacking the legal backup to ensure sectoral ministries' compliance with the principles of IWRM (for example, sharing its development plan and activities with WECS and other sectoral ministries), WECS continues to struggle to find an institutional niche where it can add value for sector ministries.

WUAs have been formed on water-related projects and aligned with the national irrigation policy. While WUA representatives have been involved in the overall consultation and discussion process of the national irrigation policy, WUA members' accountability to farmers needs to be addressed to ensure greater inclusion (Howarth et al. 2004).

In 2008, the government was in charge of taking stock of all groundwater resources, and for making the necessary policy and institutional arrangements for the sustainable use of this resource. As of 2011, however, groundwater is still a relatively unregulated resource and, therefore, in need of proper management and utilization (Kansakar 2011). A draft Act on Groundwater Regulation has been prepared and sent to parliament for approval. According to the draft, a regulatory body called the Groundwater Board will be established to regulate, manage and provide licenses to different users. If IWRM principles were implemented, WUAs would be the organizations at the local level responsible for proper management of water resources in river basins. GoN is still the primary manager of water at the national level, and should therefore be included in any discussions on large-scale IWRM projects.

The national and international NGO sectors in Nepal play a major role in building capacities of rural and urban populations to tackle climate change problems. They conduct research, assist the national government with policy-making decisions on the environment, and provide an avenue for work that the national government or the private sector wouldn't have the resources to provide. A significant number of NGOs in Nepal are dedicated to environmental education. However, organizations such as the Nepal Wetlands Society and the Local Initiatives for Biodiversity, Research and Development are oriented toward accessing resources to better respond to climate change impacts. NGOs are also involved with implementing LAPA. As defined in the LAPA process, NGOs are vital for coordination of stakeholders, field research and education of community members. Through analysis, this includes everything from working to implement IWRM principles in villages to disaster risk reduction (DRR) and prevention of GLOFs. Unfortunately, specific information on local-level NGOs and project implementation needs to be investigated further on the ground, since the information is not readily available. It is recommended that working with NGOs in Nepal is moved forward with climate change adaptation priorities.

Integrated river basin management programs have been initiated in Nepal mainly through NGOs with government support. The Koshi River Basin is one of the three largest river basins in Nepal and includes seven major rivers. Additionally, the Koshi River is one of the major contributors to the Ganges River and thus has regional significance. With an IWRM approach in mind, the Koshi River Basin Management (KRBM) program was initiated as part of the National Water Plan for Nepal in 2005 (ICIMOD 2016a). The KRBM program attempts to improve the regional coordination management of the river basin. The International Centre for Integrated Mountain Development (ICIMOD), the Australian government, ADAPT-Nepal and GoN are the main supporters of the KRBM program. There are other organizations also involved. A focal issue is gender and inequality, and their links to drivers of change and integrated river basin management. Additionally, the program looks to employ incentive-based mechanisms to improve water-use efficiency and productivity. ICIMOD seems to be taking the lead role in gender-related programs in the Koshi Basin. ICIMOD has focused on better roles of marginalized farmers and women in irrigation, sustainable intensification of stable crops, training for women farmers, and low-cost livelihood technologies (ICIMOD 2016b). Furthermore, in a conference organized by ICIMOD, the Department of Agriculture, and the Department of Irrigation (the coordinator of the Koshi River Basin) stated the need for having more gender equity discussions on topics focusing on empowerment (decision making, economic), and capacity development in new agricultural technologies (ICIMOD 2016b). For specific implementation of gender-related water programs, specific in-country fieldwork needs to be conducted.

The Nepal case study illustrates the government's main strategy to form a (new) inter-ministerial coordination platform as an institutional means to address the problem of sectoral fragmentation, both with regard to water resources management and climate adaptation. This institutional framing corresponds very well to the major climate risks facing the country (such as GLOFs, flash floods, landslides and droughts). These risks suggest the need for an integrated approach to climate adaptation. In practice, however, current institutional arrangements and linkages for both water resources management and climate adaptation remain scattered due to powerful sectoral ministerial resistance to accepting the role of WECS as a regulating body, as well as a lack of sufficient funding and organizational capacity to implement climate adaptation programs through MoSTE. Nepal has established the required institutional setup for a holistic and integrated approach to water resources management and climate adaptation. Yet, the question remains as to how to make such structures work in strengthening the country's adaptation capacity, in general, and with regard to the water sector, in particular. Central in ensuring effective functioning of IWRM is the role of incentives for various sector ministries to get involved in the proposed coordination efforts.

Pakistan

The Cabinet Committee on Climate Change was formulated in 1995 to provide a policy coordination forum for climate change. This was later changed to the Prime Minister's Council on Climate Change (PMCCC) in 2004. This also aimed to establish a high-level inter-ministerial linkage and proved to be extremely effective in initiating the country's entry into the global carbon market, but less on water-related climate adaptation. The PMCCC is chaired by the prime minister, with several ministers as its members, including the minister for the Ministry of Environment (MoEn) and the deputy chairman of the Planning Commission. An important direction given by PMCCC in the wake of major climate change concerns is the need to focus on water and food security issues, though the institutional setup and mechanisms to do this were never clearly outlined. In recent years, however, the PMCCC has been inactive due to unreliable funding for the implementation of climate adaptation programs and lack of staffing capacity. There is considerable merit in reactivating and utilizing the PMCCC to provide a forum for integrating climate change into mainstream policy making.

In 2011, when the MoEn was devolved to the provincial authorities, responsibility for climate change was handed over to the Ministry of Planning, Development and Reform. In October 2011, four new ministries

were set up to absorb the departments that were leftover from the devolution, including the Ministry of National Disaster Management (MoNDM). This was renamed the Ministry of Climate Change (MoCC) in April 2012, elevating the issue to cabinet level. MoCC has the mandate to coordinate climate change issues with relevant agencies and institutions. The National Climate Change Plan (NCCP) Committee was established to ensure effective implementation of the climate policy and oversee progress in this regard.

MoCC was downgraded to a Climate Change Division (CCD) in 2013 working under the Prime Minister's Office. The CCD is the main federal institution responsible for planning activities and formulating policies associated with environmental protection, pollution and resource conservation. It is responsible for implementing the Pakistan Environmental Protection Act, coordinating the activities of other federal ministries, and acting as the secretariat for the Pakistan Environmental Protection Council (PEPC). It also deals with agreements reached with other countries and international organizations in the field of environment. In addition, the Pakistan Environmental Protection Agency comes under its administrative control. CCD, under the Prime Minister's Office, leads federal climate change actions and hosts the CDM cell. It also leads efforts to address climate challenges with relevant federal ministries, such as Water and Power, National Food Security and Research, Science and Technology, and Planning and Development. The CCD also works with agencies such as the Water and Power Development Authority (WAPDA), Pakistan Agricultural Research Council, and the National Institute of Oceanography. In 2015, the CCD regained its status as a ministry.

The Ministry of Water and Power (MoWP) plays a lead role in water resources management in Pakistan, but it is unclear how this role is linked to the country's climate adaptation program. It is responsible for the national distribution of water and management of multipurpose reservoirs on the Indus River and its tributaries. At present, Pakistan does not have a water resources policy, though one is being developed. Like India, Pakistan signed the Indus Water Treaty in 1960, which stipulates basic rules in water distribution and sharing between the two countries. At the local level, the government has formed and established WUAs to increase farmers' involvement in irrigation system management. In practice, however, WUA organizational development has mixed results, with some WUAs becoming inactive after its formation, and others functioning merely on an ad hoc basis when they have to resolve water conflicts between farmers during periods of water scarcity.

NGOs in Pakistan are doing a significant amount of work when it comes to water and climate change. The role of national and international NGOs in the country is to sometimes assist the national government in the implementation of climate adaptation projects, but also to assist with field research and on-the-ground implementation through their own organizations. There are over 15 NGOs that are specifically dedicated to environmental protection. Some of these organizations include, but are not limited to, the Pakistan Environmentalists Association, Society for Conservation and Protection of Environment (SCOPE), the Pakistan Institute for Environment-Development Action Research (PIEDAR), and the Leadership for Environment and Development (LEAD).

Currently, LEAD Pakistan is working on climate change, environmental management and social capital development projects. A notable climate change project is working on the Design and Development of Water Sector LAPA through the British High Commission. Although further information on this project is unavailable, this is very similar to what Nepal has done with its LAPA. PIEDAR has worked on projects to increase irrigation efficiency and protect local water bodies. However, as of recently, there have been no notable projects recorded. To gain a better understanding of Pakistan's vibrant NGO sector, further research needs to be conducted on the ground to identify what is being implemented. Since these NGOs work closely with the government and provide valuable information to anyone wanting to work in Pakistan on climate change and water management, it is vital that these NGOs are included in any stakeholder discussion. Pakistan is a member of the Indus Water Commission along with India. It is critical to note that there are a number of opportunities in developing the Indus Basin Water Treaty with regard to gender equality, knowledge, technology, and the capacities of the respective in-country institutions to better address the needs of their own country and the basin itself. The Indus Water Commission and the Indus Water Treaty (IWT) are discussed further in Chapter 5.

Pakistan has also developed an online gender database to address goal 5 of the United Nations Sustainable Development Goals (SDGs). The Government of Punjab has set up an online Gender Management Information System (GMIS) to keep track of project implementation for addressing gender issues. GMIS has six thematic areas: health, governance, education, economic participation and opportunities, demographics, legal rights and violence against women (Ahmed 2016). The database is supposed to assist decision makers and planners in preparing gender-responsive budgets and urban planning, and addressing other fields related to status and issues of gender, particularly women. The database revealed a clear lack of participation by women in the workforce, particularly in decision-making roles (Ahmed 2016). In addition, the projects that were supposed to be implemented with a specific focus on the advancement of livelihoods for women had either not been implemented or had been poorly implemented. The institutions and support systems to assist women either lack the capacity to do so or are redundant (Ahmed 2016). While the database was not meant to address the water sector specifically, it should be noted that it does track gender through a number of other sectors, and the water sector is at least indirectly associated with most of these sectors. Specifically addressing environmental issues related to gender might be challenging. However, if gender empowerment is to be addressed in the water sector then taking a holistic approach across multiple sectors might prove more beneficial than a singular sector view. The lack of participation by women in decision-making roles, for instance, affects decisions made by WUAs and is skewed to a more male-dominated approach. This would show that the issue of gender is not a technical water problem, but perhaps an institutional or cultural problem that needs to be addressed at a different level.

Current institutional frameworks for climate adaptation in Pakistan show how the government aims to tackle the problem of sector fragmentation through the positioning of its climate change institutional platform at cabinet level under the Prime Minister's Office. However, such measures must reference how earlier attempts to establish such platforms for IWRM have not been effective in terms of its application. While such positioning could theoretically ensure cross-sectoral coordination for climate adaptation programs, in practice, implementation of such programs is often directed by relevant sectoral ministries and depends largely on how donors channel climate adaptation funds. While the organizational transformation of MoNDM into MoCC reveals the close linkage between climate adaptation and disaster management in the institutional framing of Pakistan's climate adaptation, the question remains as to how water resources management can be positioned as an integral part of the country's adaptation strategies. Since drought, groundwater depletion and salinization are among key climate risks facing the country (see Paper 1: Lacombe [2019]), institutional strengthening should focus on developing measures for water allocation and prioritization across the different sectors, as well as linking surface water and groundwater planning and management.

Sri Lanka

Within the context of climate adaptation, Sri Lanka has a Climate Change Secretariat (CCS), which was established in 2008 under the Ministry of Mahaweli Development and Environment (MoMDE). The secretariat provides a platform to address climate change issues at the national level, both in terms of information sharing and facilitating policy actions, and to serve as an overarching institutional mechanism on climate change responses. Internationally, it liaises with the UNFCCC Secretariat.

In line with the National Climate Change Adaptation Plan of Sri Lanka, the CCS is the responsible government agency to coordinate climate adaptation in the country. This is a huge task, especially since cross-sectoral coordination is severely lacking for the water-related sectors alone. Ideally, a national working group (NWG) would be set up to support CCS in the implementation of climate adaptation programs across the different sectors. As envisioned in the National Climate Change Adaptation Plan, NWG would function as a consortium of national government ministries, research institutes (such as the Department of Meteorology, Disaster Management Centre, National Science Foundation), and NGO representatives coordinated by CCS staff members. In practice, however, NWG was not established until now.

Other nongovernmental actors such as NGOs and universities are key players in incorporating climate change considerations into water resources management in Sri Lanka. An example of this is the Water and Climate Resilience Programme (WACREP) by the Sri Lanka Water Partnership. The program aims to promote technology options and best practices while strengthening capacities among different levels of water managers and users, including farmer organizations (FOs) and other community-based organizations.

Water governance in Sri Lanka is still largely based on management systems put in place during British colonial rule and determined by administrative- and land-based boundaries. At present, there are nearly 51 Acts and over 40 agencies involved in governing and managing the water resources of the country, many of which are restricted to certain functions or subsectors. As a result, there is heavy duplication, fragmentation and overlap in the institutional setup in Sri Lanka's water sector.

Lacking an inter-ministerial coordination body and institutional arrangements to facilitate cross-sectoral collaboration, water resources development decisions are taken by each sectoral ministry, often without any connection with each other, although coordinated at the national planning and budget allocation level. Up to now, attempts to put in place an overarching water policy or Act have been unsuccessful, in part due to a lack of political backing. Besides, while Sri Lanka is equipped with a government ministry in charge of water resources management (Ministry of Irrigation and Water Resources Management [MoIWRM]), the ministry's strong focus on irrigation tends to narrow the scope and boundary of water resources management into water planning and development predominantly for the agriculture sector, in addition to water supply for domestic use. A continued emphasis on developing irrigation systems means that irrigation institutions enjoy a position of privilege in the current system.

The Water Resources Board was established with the objective of advising the MoIWRM on different aspects of water resources management in the country, including the design of integrated management plans, prioritization of objectives in the case of river basin and trans-river basin projects, and the coordination of different government entities working in the sector. However, recently, the focus of the board appears to have shifted from encompassing the entire water sector to mainly that related to groundwater research, monitoring and development. Despite its role in groundwater management, however, the board does not seem to be involved in working on linkages between groundwater and surface water.

Currently, the state is in charge of interprovincial rivers and irrigation schemes, while the management of the same within the nine provinces has been devolved to the provincial councils. Other aspects of the water sector that come under the purview of the provincial councils include health, water supply and sanitation, and environmental protection. In practice, however, the devolution of these functions has not been fully realized, with both the central government and the provincial councils being involved in the provision of these services. For example, the Department of Agrarian Development under the Ministry of Agriculture (MoA) still plays an important role in the management of minor irrigation systems.

In Sri Lanka, the O&M of irrigation schemes is jointly undertaken with FOs under the Participatory Irrigation System Management program. FOs that are registered with the Department of Agrarian Development are considered legal entities. While such PIM has faced several challenges, a study by Samad and Vermillion (1999) found that, in cases where management was transferred to FOs and these irrigation structures were rehabilitated by the government, significant increases in yield were observed.

Under existing institutional frameworks, the Mahaweli Authority of Sri Lanka (MASL) under MoMDE, the Central Environmental Authority (CEA), and the Coast Conservation Department (CCD) could potentially play an important role in climate adaptation in the water sector. MASL is an RBO responsible for the Mahaweli Development Scheme, which seeks to develop the Mahaweli River Basin to meet the country's irrigation and hydropower needs. MASL as a model for a developing RBO is discussed in Box 4.3. In addition, MoIWRM is responsible for the management of all water resources in the country, with the main focus on the development and management of large- and medium-

scale irrigation systems, in which the Irrigation Management Division is in charge of overall system management. Here, climate adaptation programs and activities are strongly rooted in the construction and rehabilitation of physical irrigation infrastructure to improve storage capacity.

Box 4.3. MASL as an example of an evolving RBO.

MASL was established under the Mahaweli Authority of Sri Lanka Act No. 23 of 1979 to implement the Mahaweli River Development Scheme.[a] It was envisaged that the authority would develop the Mahaweli River Basin as well as other associated river basins to meet the country's irrigation and hydropower needs. The Mahaweli River Basin encompasses roughly one-fifth of Sri Lanka's land area. At present, the area covered by the scheme includes 39% of the country and 60% of the total irrigable area.[b] Thus, MASL manages a significant proportion of the country's land and water resources.

Within its areas of operation, MASL is vested with umbrella powers. It is responsible for the construction and operation of infrastructure for the purpose of irrigation and agriculture, and for the construction of hydropower plants. MASL is also responsible for the settlement and resettlement of communities and socioeconomic development in the basin. The Mahaweli Authority of Sri Lanka Act also provides MASL with the broader function of watershed management of the area. MASL is authorized to raise finances for its work through activities such as acquiring shares in other organizations and other forms of investments.[a]

The Mahaweli Development project has been and continues to be a major area of focus for the allocation of public finance in the water sector. In the national budgets of the year 2015/2016, 29% of the total allocation to the different ministries in the water sector has been to the MoMDE, of which 83% is to MASL.[c] The President of Sri Lanka is the minister of MoMDE, which illustrates the project's political importance.

The Water Management Secretariat of MASL coordinates the allocation of water between sectors through meetings held weekly and at the beginning of each cultivation season. Representatives from the Irrigation Department, Ceylon Electricity Board, National Water Supply and Drainage Board (NWSDB), and MASL decide on how much water is allocated to the sectors.

The Bulk Water Allocation Model tested in the 1990s by MASL has yielded positive results regarding water allocation on the other end of the supply chain. Under this model, the amount of water issued to a user through a distributary canal is fixed at the beginning of the cultivation season. Thus, a particular user would have a legal right over this quantity of water, providing an incentive for using it efficiently, thus contributing to water management. It is felt that this could help overcome some of the challenges faced by PIM, which suffers from a lack of ownership of responsibilities for the maintenance of irrigation systems by WUAs (Aheeyar et al. 2012).

Thus, MASL is an example of a basin-level planning institution, which has the potential to evolve into a working example of IWRM. A future challenge is ensuring that the political and financial significance given to the project and MASL, which has been a key driver of its success, is balanced by an approach in which decision making is truly participatory, involving institutions and communities at all levels.

Notes:

[a] For information on the *Mahaweli Authority of Sri Lanka Act*, visit the website of the Mahaweli Authority of Sri Lanka (http://mahaweli.gov.lk/en/pdf/Act&Gazettes/Mahaweli%20ACT.pdf).

[b] For information on the *Master Plan*, visit the website of the Mahaweli Authority of Sri Lanka (http://mahaweli.gov.lk/en/mp.html).

[c] For information on *Budget Estimates 2016, Volume 3*, visit the website of the Government of Sri Lanka, Department of National Budget, Ministry of Finance (http://www.treasury.gov.lk/documents/10181/161077/bdgtestmates2016E-vol3.pdf/70ac63a4-6255-409c-bdff-3a5c9e78fd60).

While the Sri Lankan government has attempted to facilitate cross-sectoral coordination and collaboration for climate adaptation through the formation of CCS, current institutional frameworks and arrangements on climate adaptation remain on the periphery since sectoral decision-making structures and mechanisms prevail. CCS's lack of capacity, in terms of budget and staffing, is also an issue. The formation of CCS does not automatically result in the establishment of an inter-ministerial, coordination platform for climate adaptation. In contrast, sectoral ministries continue to operate almost in parallel to each other, because they often do not see how they would benefit from cross-sectoral coordination, not to mention potential implications of such coordination in terms of sector ministries' budget allocations. While some ministries play some role in climate adaptation, this has happened mainly through donor-funded project activities, with little cross-sectoral interlinkages and connections. The government approaches climate adaptation in the water sector mainly through irrigation infrastructure development and rehabilitation to increase water storage capacity as a means of ensuring food security. Since droughts, and groundwater salinization and depletion are major climate risks for the country, a more central positioning of the water sector in climate adaptation strategies is required. Institutionally, efforts to strengthen cross-sectoral coordination can begin through the promotion of direct collaboration (for example, through joint programs and projects) between relevant sectoral ministries. At a country level, and for the water sector specifically, climate adaptation highlights the need for IWRM, since holistic adaptation measures would require integrated water resources planning and management across the different sectors. The next subsection discusses the current institutional frameworks in water resources management in each of the seven countries in South Asia selected for this study, how this corresponds to IWRM both theoretically and in its actual implementation, and the implications this has for approaches to climate adaptation.

Current Trends of Existing Institutional Frameworks

Centralized Approach Does Not Automatically Lead to Holistic Climate Adaptation

Across the seven countries, institutional frameworks for climate adaptation follow a centralized approach, with one or more government agencies charged with leading, preparing and formulating climate adaptation programs at the national level. This is most evident in India, where the national response around climate change emerged through the Prime Minister's Office, with the creation of PMCCC in 2007. Similarly, GoN formed the Climate Change Council in 2009 as the national coordinating body to ensure effective implementation of climate adaptation policies. Though Nepal has also formulated its LAPA, which involves a bottom-up approach to climate adaptation planning, in practice, adaptation planning through NAPA continues to dominate LAPA (Nagoda 2015). It must be noted that Pakistan too has begun to take initiatives with regard to employing LAPAs. In Bhutan, the NEC, an inter-ministerial body chaired by the prime minister, is in charge of formulating climate adaptation programs. In Bangladesh, MoEF is leading the country's climate adaptation program, collaborating with other ministries and international financial institutions, through its CCC. The same can be said with regard to Sri Lanka and Afghanistan through their positioning of CCS under MoMDE and the CEA under the Ministry of Mahaweli Development and Environment, respectively, as lead government agencies. Finally, the Government of Pakistan (GoP) has renamed the former Ministry of National Disaster Management (MoNDM) to the Ministry of Climate Change (MoCC), and made the latter the leading government agency in climate adaptation.

Driven by global climate policy discussions, national governments have appointed relevant sectoral ministries (for example, MoSTE in Nepal, MoEF in Bangladesh) or formed new inter-ministerial bodies to lead program implementation as an ad hoc response (Dubash and Joseph 2016) to institutionalization. In practice, while the institutional structures for climate adaptation are in place, more needs to be done to improve the overall performance and institutional effectiveness of these bodies, both at ministerial

and inter-ministerial levels. Most of the countries have established their respective institutional set up for climate adaptation (e.g., either through an inter-ministerial, decision-making platform or sector ministry leadership, or a combination of both). However, how such setups would address the existing challenges of cross-sectoral integration and collaboration (for example, overlapping roles and areas of responsibility between the different sector ministries and the established inter-ministerial bodies) remains unclear. Similarly, while the establishment of this institutional setup is a good start to tackle climate adaptation, in many countries, it remains unclear as to how such a setup could ensure effective implementation of climate adaptation programs on the ground. For example, in Sri Lanka, Bhutan, Pakistan and Afghanistan, the leading government agencies on climate adaptation have hardly any capacity (in terms of staffing and budget) to monitor program implementation on the ground. In India, state governments directed the formulation of their State Action Plans on Climate Change (SAPCC) almost entirely toward the NAPCC. This left little space for discussion on how these plans could be best implemented within the current institutional structure, not to mention that formulation and implementation of climate adaptation programs continue to be directed by centralized funding mechanisms (both from donors and the government's budget). This brings to light not only the need to increase the overall capacity and performance of government agencies across sectors and scales, and especially those linked to climate adaptation (such as monitoring and evaluation), but also, to a certain extent, the need for budgetary reform on how funding for climate adaptation can be channeled most effectively.

Institutionally, a centralized approach to climate adaptation does not automatically result in strong institutional rooting or accommodate the inclusion of local coping strategies or immediate entry points to scale up these strategies as an integral part of the country's climate adaptation programs. In Nepal, the government established MCCICC in 2009, followed by the formation of the NCCKMC under NAST in 2010. While MCCICC's membership includes international NGOs, academics, private sector actors and international financial institutions, next to representatives from relevant government ministries, it remains a nationally centered institution with very little connection to local communities. Similarly, while NCCKMC works toward a knowledge platform, which can be very useful for climate adaptation across scales, it is unclear how local communities, especially those who would be most affected by climate variability, such as women and the poorest, could access such a platform (Nagoda 2015). Refer to Paper 2 (Davis and Hirji 2019) on the importance of local action to support climate change adaptation. Local communities, NGOs and research organizations must be an integral part of the institutional landscape in climate adaptation. Across the seven countries, WUAs can be used as a starting point for better understanding of institutional arrangements of farmers' adaptation strategies. For instance, understanding when WUAs and farmers decide to change the water delivery schedule to deal with climate variability is a pertinent part of the larger design and development of climate adaptation programs. In addition, the establishment of BCAS, CEGIS and BIDS in Bangladesh could potentially contribute to the provision of scientific information on climate adaptation. At present, WUAs and FOs are rarely consulted when formulating adaptation strategies.

Furthermore, while water resources management is implied in the overall institutional frameworks for climate adaptation, institutional measures for adaptation are not always directly linked with the need for IWRM. For example, while Pakistan positions MoCC as the leading agency for climate adaptation, it is unclear whether this institutional measure will integrate water resources management sufficiently in the country's climate adaptation. Similarly, Bangladesh and Bhutan have taken a more integrated institutional approach toward climate adaptation, driven by a strong emphasis on environmental aspects of climate change. However, the question remains as to whether such integration will also adequately incorporate water bodies (such as NWRC) in climate adaptation.

Institutional Challenges of, and Opportunities for, Mainstreaming Climate Adaptation into National Development Programs

All seven countries mainstream climate adaptation into their respective national development programs (see Paper 2 [Davis and Hirji 2019] on policy mainstreaming in climate adaptation). In Bangladesh, Bhutan, India, Nepal, Pakistan and Sri Lanka, climate adaptation programs form an integral part of development objectives to enhance food security and reduce poverty, involving the relevant sectors (water, agriculture, forest, health, transport). Climate adaptation programs are also closely linked with risk prevention and disaster management in Bangladesh, Bhutan, Pakistan and Sri Lanka as well as with environmental issues (problems of desertification, in particular) in Afghanistan.

Strategies to mainstream climate adaptation are partly rooted in the dependency of governments to external funding agencies for support in financing climate adaptation programs (OECD 2009; Sharma 2011). Lacking any financial resources to implement these programs is an overarching problem. Five of the seven countries' governments (with the exception of Bangladesh and India, which have put significant internal revenues into climate adaptation) have "incorporated" climate adaptation as part of their national development strategies in poverty reduction through activities such as improved health systems, water and sanitation, agricultural development, and housing and infrastructure.

While mainstreaming climate adaptation into national development programs can be viewed as a first step in seriously tackling climate issues (Agrawala 2004; Ayers et al. 2014), we argue that unless climate components are fully integrated into planned and ongoing development efforts, mainstreaming climate adaptation will continue to be an add-on rather than a holistic program nested in national governments' development planning and program. Key element to support such integration is climate-oriented capacity building efforts, both institutionally and programmatically. For example, in Sri Lanka, Bhutan, Pakistan and Afghanistan, the absence of a strong climate adaptation program is not only due to the lack of funding but also related to very low institutional capacity to implement such programs across scales, with most government staff involved having little knowledge on climate adaptation issues and approaches.

Chapter 5. The Need for Regional Cooperation

The importance of regional cooperation and coordination is reflected in the transboundary nature of many countries' water resources that are expected to be impacted by climate change. The predicted glacial retreat in the Himalayas would affect water availability for agriculture, domestic use, hydropower and industry, on which some 400 million people across the Indo-Gangetic and Brahmaputra basins in Nepal, India and Bangladesh depend (Mirza and Ahmad 2005). In fact, World Bank (2009) recognized that the most severe climate threats (such as glacier retreat and sea-level rise) transcend national boundaries, and lists cooperation on international rivers and river basins as a priority for the region.

Along with other climatic impacts that undermine water availability, climate change could intensify existing tensions and create new conflicts over the sharing of transboundary rivers. This could arise both within a country (as in the case of the Sindh and Punjab provinces in Pakistan over the Indus; as well as between states in India) and between countries. The fact that 97% of Bangladesh's freshwater flows come through India is indicative of the limits posed by transboundary factors on the adaptive space available to individual countries. Bangladesh and India have 54 transnational rivers, but agreements exist only for a few specific rivers—for example, a 30-year old treaty over the Ganges. Even in situations where water-sharing agreements exist, as in the case of the Indus Waters Treaty, potential future reductions in water flow could lead to the need for renegotiated terms of allocations (Mirza and Ahmad 2005). Five treaties currently exist between the South Asian nations: the Indus Waters Treaty between India and Pakistan (1960); the treaties between India and Nepal on the Kosi (1954), Gandaki (1959) and Mahakali (1996) rivers; and the Ganges Water Sharing treaty between India and Bangladesh (1996) (Prasai and Surie 2015).

While regional cooperation is critical for climate adaptation, efforts to promote regional adaptation will have to consider existing asymmetries in economic and political power, geography, resource endowments, skills, institutional capacities and country priorities. Central to these dynamics is India, which is likely to play a key role in future regional cooperation for climate adaptation, especially with regard to the water and energy sectors. In addition to its economic and political influence, India's geographical positioning—a midstream state in many ways—provides it with a central role with respect to lower and upper riparian countries. With several major rivers flowing through its territory, how India controls flows in response to increasing national demands for energy and food for its growing population and economic ambitions will have major consequences for other states (Bhaduri and Barbier 2008). To date, India has taken a bilateral approach to developing formal cooperation, a feature in its treaties with Pakistan (Indus Waters Treaty 1960), Bangladesh (India Bangladesh Water Sharing Treaty 1996) and Nepal (Mahakali River Treaty 1996) (Ranjan 2015).

Within this context, the South Asian Association for Regional Cooperation (SAARC) has initiated many regional cooperation agreements, some directly on climate change and others on related topics such as the environment and disaster management. Of these, the Dhaka Declaration and SAARC Action Plan on Climate Change (2008), and the Thimphu Statement on Climate Change (SAARC 2010) are considered to be important milestones in the association's response to climate change. SAARC has established several regional centers that provide an institutional framework within SAARC to address climate-related risks and vulnerabilities. This includes the Disaster Management Center, the Meteorological Research Center, the Coastal Zone Management Center, and the Forestry Center. These promote cooperation in monitoring, data generation and sharing, better preparedness, capacity building, and ultimately identifying and developing priorities for action to be taken by member countries (Das and Bandyopadhyay 2015). This framework thereby provides the technical capacity and cross-country links for implementing the Dhaka Declaration and the SAARC Action Plan on Climate Change (2009-2011), which focuses on seven thematic areas of cooperation: adaptation, mitigation, technology transfer, finance and investment, education and awareness, management of impacts and risks, and capacity building for international negotiations.

The Thimphu Statement on Climate Change recognizes that South Asia is expected to be heavily impacted by climate change, thus necessitating a regional response. It focuses on four initiatives that correspond to key drivers of climate vulnerability in South Asia. Two of these are an Intergovernmental Monsoon Initiative and an Intergovernmental Mountain Initiative on mountain ecosystems, particularly glaciers. By assigning implementation of these initiatives to one of the regional centers, the statement identifies institutional leads to take these initiatives forward. As such, this arrangement provides a sensible mechanism to drive action on the ground.

Despite these significant planning efforts for building regional response to climate change, the reality remains that neither the SAARC Action Plan on Climate Change nor the Thimphu Declaration have resulted in change on the ground (Majaw 2012; Thapa 2013). The Thimphu Statement does not go far enough in providing direction, for example, to the implementing centers on what it specifically wants them to achieve. It stops short of defining specific targets the initiatives are to achieve (Thapa 2013). Furthermore, articulation of the initiatives and lead institutions are not backed by a financing strategy, nor is it understood how the centers will liaise with national governments and other in-country stakeholders on whom they depend on for implementation. In fact, while the Thimphu Declaration entrusts implementation to the centers, SAARC's authority to enforce compliance by its member states remains limited to encouraging them to act (Thapa 2013). This limitation is embedded in the SAARC Charter, which requires collective agreement from all member states. There is also no compulsion on member states to ensure their national laws and programs articulate the vision embodied in SAARC statements (Thapa 2013).

These fundamental structural issues within SAARC appear to be compounded by diverse national prerogatives shaping countries' willingness to subordinate its positions in the overall climate politics. India, for instance, no longer identifies with the agenda of the low-income countries (LICs). This has also made it difficult for SAARC to present a unified position in multilateral negotiations (Thapa 2013), thereby explaining why the association has played a relatively small role in climate change policy making in the region (Majaw 2012). A remedy suggested by Thapa (2013) is for SAARC statements and plans to display greater flexibility to accommodate differences among its members, with consensus on obligations based around a base standard and ensure that all member states at least meet that standard (Thapa 2013).

Similar to SAARC, the South Asia Co-operative Environment Programme (SACEP) was formed in 1982 with the aim of developing regional cooperation among South Asian nations that would build national capacity to manage issues related to the environment (http://www.sacep.org/). SACEP includes all the countries mentioned in this report. SACEP's activities include working on institutional strengthening for conservation of biodiversity, capacity building, environmental information and assessment, and education and awareness. With the United Nations Environment Programme (UNEP), SACEP works toward the improvement of the legal and institutional framework to address environmental issues in the region (http://www.sacep.org/). SACEP works with the South Asian Seas Programme (SASP) to protect marine and coastal environments in its member countries. While there is no specific focus on water or integrated water resources management (IWRM), the activities that SACEP encompasses will no doubt include legal and institutional issues concerning regional water problems. Therefore, SACEP should be seen as a partner to assist with regional cooperation in climate change activities.

However, while there is agreement on the need to respond to climate change at a regional scale, there is as yet no settlement on how these agreements are to be financed. Considering the financing gap faced by all the countries in implementing national plans of action, funding from other sources would be required for these initiatives to be successfully implemented. Consequently, while there are other region-wide initiatives that contribute to adaptation, including the South Asia Water Initiative (SAWI) by the World Bank, and Mangroves for the Future (MFF) by the United Nations Development Programme (UNDP) and the International Union for Conservation of Nature (IUCN),

formal government-driven arrangements remain at a nascent stage with no clear pathway for scaling existing bilateral approaches to a truly regional platform.

An important distinction in this cooperation appears to be a framing of adaptation (and mitigation) in terms of flooding, as opposed to water scarcity expected in many shared river basins. It is proposed that the dynamics of cooperation over water scarcity are quite different, requiring upstream riparians to forgo a percentage of growth in favor of growth in downstream riparians. The previous discussion on the prevalence of bilateral approaches to water sharing in river basins suggests that the approach to dealing with too much and too little water are quite opposite, in which the former is marked by regional collaboration, while the latter by bilateral negotiations. Das and Bandyopadhyay (2015) thus believed it is crucial that SAARC focuses more explicitly on the intraregional differences that exist between its member states, with the resolution of political tensions between India and Pakistan, in particular, an essential prerequisite.

One way forward suggested by Das and Bandyopadhyay (2015) is to focus on broader economic cooperation, drawing lessons from the success of European economic integration that helped diffuse the political tensions prevalent in Europe prior to integration. This is a view shared by World Bank (2009), which sees increased economic cooperation as a potential catalyst for resolving political and social differences, and for reducing a number of underlying causes of vulnerability to climate change, especially for the poor, by increasing growth, reducing inequality and increasing energy trade.

Chapter 6. Key Findings and Recommendations

The findings in this chapter bring out a common theme highlighting the mainly structural nature of existing challenges faced by financial mechanisms and institutional frameworks in promoting integrated responses to climatic risks, which demand the opposite to current sectoral institutional structures and culture (Box 6.1). The concept of integrated water resources management (IWRM) has, for some time, more integrated approaches within the water sector, quite independently of climate adaptation thinking. The persisting gap between policies that adopt IWRM (see Paper 2 [Davis and Hirji 2019]) and institutional disconnects that impede it in practice demonstrates the difficulties in building integrated and deliberative responses to developmental challenges in practice.

Box 6.1. Adaptation finance and institutions.

Adaptation finance

- All countries are challenged with a significant adaptation funding gap, with no clear bridging mechanisms.
- Strategies to mainstream climate adaptation are partly rooted in the dependency of governments to external funding agencies for support in financing adaptation programs.
    - Strengthening in-country capacity is needed to navigate a dense landscape of different external funds in a competitive funding environment.
- Whether an emphasis is placed on improved water resources management as a priority area for adaptation finance is difficult to assess based on this desk study alone.
    - While integration of water resources management into other sectors for explicit climate adaptation is important, existing data suggest much of this integration is not captured in national systems.
- Disjointed funding mechanisms and underdeveloped structures struggle to match funds to priority adaptation actions.
    - The majority of funds generating adaptation capacity in each country cannot be clearly identified, making any assessment of spending on climate finance, including in the water sector, only approximate.
    - The water sector falls outside of the top-funded sectors for climate adaptation.
    - Most adaptation results arise out of multipurpose investments not directly related to adaptation. The extent to which these results are intended (planned for) is not clear. Such planning would indicate a desirable integration of adaptation across sectors.
- The disconnect between national and local levels in adaptation planning undermines finance targeting and accountability, potentially further marginalizing the more vulnerable groups and sectors.
- An area seemingly relatively untapped is in-country private sector financing specifically for adaptation.

(continued)

Box 6.1. Adaptation finance and institutions. (Continued)

Institutions

- A centralized approach to adaptation planning does not automatically lead to holistic climate adaptation.
- Sectoral fragmentation is present among all countries.
  - Fundamental structural weaknesses are reflected throughout the institutional continuum, from patchy cost assessments of climatic risks to disjointed fund allocation, and an almost complete absence of mechanisms to track adaptation investments.
  - Although national coordinating entities for adaptation exist in nearly all countries, most struggle to drive a cooperative and comprehensive approach to adaptation.
  - Making national coordinating entities more effective will require a re-imagining of their roles, structure and composition that provides a more challenging and empowering mandate.
  - Entrenched sectoral competition is nevertheless likely to pose major challenges to the performance of re-imagined national coordinating bodies.
- While the institutional structures for climate adaptation are in place, more needs to be done to improve the overall performance and institutional effectiveness of these bodies, both at ministerial and inter-ministerial levels.
- In addition to greater cross-sectoral cooperation, more emphasis is needed on giving local stakeholders, including local government and marginalized communities, a more explicit voice in centralized planning processes.
- Policy makers need to strengthen the role of local communities, nongovernmental organizations (NGOs) and research organizations as an integral part of the institutional landscape in climate adaptation as well as, to a certain extent, the need for budgetary reform on how funding for climate adaptation can be channeled most effectively.

Finding 1: Water resources are a fundamental driver of economic development and other aspects of well-being across the region. The high vulnerability of water resources to climate change creates a strong argument for improved and more IWRM as an explicit adaptation response.

As demonstrated in Chapter 2 (as well as in Table 2.2), water is among several common themes characterizing the development context across the region. Its impact as an enabling resource across several key sectors, such as agriculture, energy production and industry, is clear, with a variation in this mix from one country to another. In Nepal and Bhutan, for instance, hydropower generation is the primary economic driver, and it is the sector that has also powered development in Sri Lanka until recent diversification of energy sources. Despite differing contributions in economic terms, agriculture remains fundamental in terms of food security, nutrition and employment, given the majority of rural populations in all the countries. Here, too, water is key, with surface water or groundwater being prominent in different countries. In many countries, such as Sri Lanka, Bangladesh, and India, groundwater is an important driver of rural poverty reduction and food security. Pakistan's position as the largest cotton exporter in the world means that this element of agriculture alone plays a significant role in the rural as well as national economy.

This central role played by water can become a major risk, given the many climate change impacts expressed as quantitative or temporal dimensions of water availability: several types of flooding, drought, salinity and storm surges, with direct and indirect impacts on surface water and groundwater. These, in turn, stand to undermine major economic and other key developmental systems. However, the extent to which water is prioritized in funding allocations is unclear. Identifiable fund allocations for water have been small in many countries. However, the crosscutting nature of the resources most likely means significant investments remain hidden in other sectoral investments, such as agriculture in Bangladesh, and irrigation and hydropower infrastructure in Bhutan, Nepal, India and Sri Lanka.

Recommendations

Water resources and its integrated management should become a primary entry point to adaptation planning at country and subnational levels, and for donors and other international adaptation financiers. Improving IWRM should be seen as a primary adaptation in itself, recognizing the potential to merge risk management with generating multifaceted developmental benefits.

Better coordination is needed between institutions that work on demand-side management and those that work on the supply side. This is especially challenging since demand-side management may involve sectors that may not have an evident link to the management of water resources, but still influence water extraction and usage. For instance, economic policies such as subsidies that aim to improve performance in the food production and energy sectors can have undesirable consequences for the water sector. These consequences might include inefficient water use through the cultivation of crops that consume a lot of water or the employment of inefficient irrigation techniques. For example, energy subsidies that aim to promote greater levels of irrigation to increase food security can lead to the over-extraction of groundwater and then to a decrease in the water table. Subsidies to stimulate increased biofuel production as a solution to greenhouse gas (GHG) mitigation can lead to the cultivation of water-intensive crops in regions that are already water stressed, thereby increasing levels of water scarcity. A more holistic view of the system is needed for institutions to better understand the linkages between supply- and demand-side planning, and the trade-offs that arise. At a conceptual level, the water-energy-food-environment nexus framework is an approach that can be adopted to provide such a perspective.

Finding 2: Current knowledge of financial implications of climate risks, and existing institutional structures and capacities appear to be insufficient for understanding the climate risks, adaptation priorities and financing needs for specific geographies and populations.

As seen from Chapter 2, current calculations of costs induced through climate change appear to exist for some sectors but not others in each country. This suggests the absence of a concerted effort to produce a comprehensive assessment of costs associated with the full range of climatic risks. Many existing cost estimates are expressed as a percentage of gross domestic product (GDP), and do not automatically disaggregate the unequal distribution of these costs between specific population groups and geographies. This macroeconomic orientation suggests that such analyses are not underpinned by a more integrated framework that also places value on where in the landscape and populations these costs are likely to arise. This includes disaggregating costs for the water sector among wider estimates of costs due to climate change impacts. This is partly the result of the specific nature of the water sector, intersecting as it does with all forms of human activity. It is also because typical projects on climate change adaptation cut across multiple sectors, making it difficult to isolate components related specifically to water (and related financing). Some countries, such as Pakistan and Nepal, have conducted flood-related cost assessments in terms of risk, though there are many other factors that are not assessed. These include groundwater depletion and salinization, which also emerge as important water-related risks (see Table 2.5 in Chapter 2).

The overarching reason for the absence of a more geographically and demographically nuanced appreciation of costs and adaptation needs associated with climate risks, appears to be the disjointed and scattered financial mechanisms across economic sectors and administrative levels, which result in incomplete cost estimates of specific and cumulative climate risks and associated adaptation costs. This causes uncoordinated fund channeling for climate adaptation across the different sectors and levels. It also impedes the ability to track allocations and spending, and to hold funding recipients accountable for their adaptation goals. Innovations in Bangladesh, such as the proposed climate change marker, may offer a road map for other countries in terms of mainstreaming climate funds. It is the closest to making the important transition to climate finance becoming an integral and explicit part of budgetary processes. If the most recent recommendations for structural reforms to existing mechanisms are implemented, they will likely establish a comprehensive oversight mechanism that can enable the government to track the impacts of climate finance spending. This could create an environment of greater accountability on climate expenditure and provide support to stronger learning on future adaptation priorities. The possibility that further reforms may involve the use of a climate adaptation marker—an existing innovation for tracking and accounting for spending on poverty reduction and gender—is of particular interest in terms of potential replication in other countries included in this study. Notably, the World Bank appears to recognize the importance of such a marker of "coding methodology" in its financing operations to enable more accurate tracking and accounting of adaptation co-benefits (World Bank, IFC and MIGA 2016).

Recommendations

- Expand the costing of climatic risks from their impacts on GDP to a range of social indicators that also reflect the unequal distribution of impacts across different parts of a country and groups of people, focusing especially on women and the poorer segments of populations. Adaptation must be fundamentally sensitive to the vulnerabilities of people (and their natural environments), and thus regional vulnerability maps linked to demographic data can help articulate this human dimension in parallel with assessments in economic terms.
- To expand the understanding of climatic risks from economic to socioeconomic, the costs of specific and cumulative climatic risks should capture variations across different parts of each country. This can better inform the climate financing required and identify geographical hot spots where adaptation spending is most needed.
- To address the adaptation funding gaps faced by all the countries, and given the external aid dependency of especially the smaller economies—and the crowded space in international climate finance—capacity building within the national climate cells or similar institutions must specifically create and retain specialists in fund raising.
- In addition to looking externally for funds, greater effort and skills are necessary to explore in-country sources of finance, especially through engagement with the private sector. Approaches could include public-private partnerships (PPPs) and incentives for adaptation in broader national and subregional fiscal budgets and policy development.

The emergence of index-based insurance schemes is an innovative approach to developing effective safety nets for low-income, flood-prone communities. Whereas traditionally, flood-risk management has focused on engineered responses, such as dams and flood walls, with compensation often an ad hoc response after the flood event, the insurance schemes systematically secure funds for compensation before a flood. Such measures typically involve organizations and experts from central and state government bodies, private insurance firms, community-based organizations and NGOs. One example is the ongoing *Remote sensing innovations for index-based flood insurance* project, implemented by the International Water Management Institute (IWMI) and with the involvement of government agencies, development banks, insurance agencies, local NGOs, and farmers in India and Bangladesh (http://ibfi.iwmi.org/).

IWMI estimates that, if the solutions proposed by the project are scaled up, by 2025, INR 10 billion in flood insurance can be delivered to approximately 1 million farmers through strong PPP business models. Another advantage of these models, according to their proponents (for example, Patankar and Sarkar [2015]), is that they can accommodate the poorer farmer classes with even less than 1 hectare of land, whereas traditional insurance works best for smaller numbers of larger farm units and high-value crops.

Most of the large farming populations in the seven countries meet a key criterion for the workability of these schemes. However, a number of other criteria may require institutional, policy and infrastructure investments before such schemes become feasible. These include enabling policy frameworks; ideally openness toward and experience with PPP approaches; banking networks for rapid and cost-effective distribution; a sufficient network of weather stations with historical data; and the long-term commitment from reinsurers (Patankar and Sarkar 2015).

Finding 3: Despite coordinating institutions for adaptation being in place, the lack of connective tissue critical for effective cross-sectoral coordination remains an important practical gap for more sectorally integrated adaptation responses.

Climate adaptation, in general, and those related to water resources management, in particular, require complex and widespread institutional action and coordinated efforts at different scales. As such, inter-ministerial coordination and cross-sectoral collaboration are essential for the formulation of holistic adaptation programs and their effective implementation (Adger et al. 2005; Thomas and Twyman 2005; Urwin and Jordan 2008). This speaks to the greater levels of responsiveness needed in the face of multiple and cumulative climate risks, and to recognize differentiated needs across geographies and human communities in a manner that supports better bottom-up information flows on needs, results and impact. Bringing countries' response capabilities up to such a level is important, given that adaptation involves iterative learning over time, which depends on feedback loops. The current status, however, seems to be characterized by a business-as-usual (BAU) approach that plays into embedded political economies and sectoral egoism (Goldstein and Keohane 1993). The challenge of bureaucratic competition as institutional traps in climate adaptation and their implications for adaptation programs across scales is well documented (de Oliveira 2009; Koch et al. 2007; Lebel et al. 2011).

There is little evidence that existing climate institutions can overcome entrenched sectoral approaches to development planning.

Across the seven countries, institutional frameworks for climate adaptation have been designed through either the formation of inter-ministerial bodies or sectoral leadership or a combination. While there is no silver bullet on the type of institutional frameworks for climate adaptation, these frameworks are based on two interrelated assumptions: (a) cross-sectoral collaboration will take place in climate adaptation efforts, despite challenges of IWRM application in the water sector; and (b) existing institutional frameworks have the capacity (in terms of budget, staffing and knowledge) to implement holistic climate adaptation programs on the ground, and thus support cross-sectoral collaboration. In practice, however, the application of climate adaptation is hindered by various factors, ranging from overlapping tasks and responsibilities to sectoral competition in terms of mandates and budget allocation. At the heart of these issues lies the practical disparities in influence between agencies vested with climate response coordination and other sectors that are expected to cooperate. In India, this is most apparent in how the role of the Prime Minister's Council on Climate Change (PMCCC) remains unclear with regard to inter-ministerial coordination, while the authority of the Ministry of Environment, Forest and Climate Change (MoEFCC) to effect the necessary cooperation has been questioned by Sharma et al. (2015). In Nepal, both the Ministry of Energy (MoE) and the Ministry of Irrigation (MoI) could proceed with their plans to build hydropower and irrigation dams, respectively, without any consultation with the Climate

Change Secretariat (CCS) located under the Ministry of Science, Technology and Environment (MoSTE). This is because they do not need any approval from the secretariat to proceed with the plans. In Sri Lanka, the formation of the CCS does not automatically result in the establishment of an inter-ministerial coordination platform, since the CCS operates on the periphery and sectoral ministries continue to drive sector development. In Afghanistan, Pakistan and Bhutan, lack of inter-ministerial coordination is often exacerbated by the lack of government capacity to implement adaptation programs on the ground.

Most climate coordinating agencies, therefore, appear to be principally conduits for securing external funding.

While funding mechanisms for climate adaptation (through both internal central government revenues and external donor funds) could act as initial or temporary institutional "glue" to facilitate inter-ministerial coordination, there is a need to go beyond simply a financing approach. In Bhutan, the National Economic Commission's (NEC's) functioning is limited to developing climate adaptation program activities and allocating donor funds for climate adaptation across relevant sectoral ministries. While doing this, it lacks an institutional mechanism to ensure effective inter-ministerial relationships and joint efforts in the development and implementation of projects. Similarly, in Bangladesh, the Ministry of Environment and Forests (MoEF) and the Ministry of Finance (MoF) are in charge of the allocation of climate adaptation funds to other relevant sectoral ministries. At the same time, they have very little influence to ensure inter-ministerial coordination through the different projects. In India, centralized fund disbursement from the center to different states does not seem to encourage cross-sectoral collaboration, given the predominantly sectoral approach in the National Action Plan on Climate Change (NAPCC) and State Action Plans on Climate Change (SAPCC) formulation processes.

Another key challenge in developing appropriate climate adaptation measures is the gap between knowledge generation and knowledge adoption in policy decisions. For example, while there is an extensive network of systems for agrometeorological and hydrometeorological data collection involving three governmental departments in Sri Lanka, access to the data collected and dissemination of this information is noninstitutionalized (Aheeyar 2012). Additionally, these data are not always linked to each other. Table 6.1 provides an overview of the typology of institutional approaches in climate adaptation as well as their strengths and weaknesses.

While one approach to address the politics of sectoral coordination is discussed later in this chapter, a less complex and thus more attainable future objective should be investments in developing human capacities. This is critical if national climate coordinating bodies are to be transformed from administrative to strategic entities capable of pushing through a coherent and integrated vision for adaptation. This report and other analyses can provide the basis for developing performance criteria against which to conduct a comprehensive needs assessment that will provide a structure to training and other capacity development investments.

Establishing cooperation networks by leveraging climate funding can help overcome sectoral political economies.

The crucial role of networks in shaping alliance formation in climate adaptation has been noted widely (Ostrom 2010; Thynne 2008). The Government of Bangladesh (GoB) stands out as a role model. Despite the absence of any formal inter-ministerial, decision-making body to coordinate climate adaptation, GoB has developed an extensive adaptation program with significant involvement from relevant sector ministries and other government agencies. The ability of Bangladesh to continue to improve its adaptation strategies and programs is linked to several factors. First, and most critically, GoB positioned climate adaptation as a national development priority, while focusing on establishing policy networks with international donors. This helps overcome the lack of formal coordination mechanisms, mainly through the provision of funds as key incentives for sector ministries to be involved in climate adaptation programs.

TABLE 6.1. Typology of institutional approaches in climate adaptation.

Type of institutional framework	Strengths	Weaknesses	Study countries
Cross-sectoral collaboration through the establishment of an inter-ministerial coordinating body	• Theoretically, it provides the institutional setup for holistic program development, planning and implementation • In theory, it can address climate adaptation more effectively (e.g., less overlapping between various government agencies)	• Often unable to overcome the problem of sectoral fragmentation • Malfunctioning due to lack of a decision-making authority to direct and enforce sectoral ministries' conduct	Afghanistan, Bhutan
Combined inter-ministerial coordinating body with sectoral leadership	• Facilitate the formation of networks for cross-sectoral collaboration • Facilitate the development of adaptive institutional frameworks, based on how relevant bodies perceive and negotiate their roles and interface	• Requires a lot of fine-tuning (across scales) to form solid, strategic alliances between relevant bodies • Requires clear division of tasks and responsibilities	Bangladesh, India, Nepal, Pakistan
Sectoral leadership	• Direct access to decision-making authority to plan, direct and implement climate adaptation	• Sectoral approach to climate adaptation may not be sufficient to address widespread, cross-sectoral implications of climate change	Sri Lanka
Government revenue and project fund as main financial source	• Continuous channeling of funds could increase the program's sustainability	• Requires more time and effort for fine-tuning in terms of financial mechanisms selected, division of tasks, activities selected, etc. • Requires strong commitment from both the government and international donors • Unclear prioritization of climate adaptation measures, since they are often implied in the government's national development programs	Bangladesh, India

(Continued)

TABLE 6.1. Typology of institutional approaches in climate adaptation. (Continued)

Type of institutional framework	Strengths	Weaknesses	Study countries
Project fund as main financial source	• Direct implementation of climate adaptation activities through various government agencies and NGOs • Effective implementation of climate adaptation through the project management unit	• Dependency on aid often results in the program's unsustainability (ends after funds are fully allocated) • Parallel projects may not be effective to address cross-sectoral implications of climate change	Afghanistan, Bhutan, Nepal, Sri Lanka

Note: NGO = nongovernmental organization.

Second, the way the Department of Environment under MoEF, as the lead agency for climate adaptation, has formed strategic alliances (partly through funding agreements) with government agencies and other actors as a means of facilitating cross-sectoral collaboration helps tackle the problem of bureaucratic competition. Here, since cross-sectoral collaboration is harnessed at departmental level, instead of ministerial level, it presents much less threats at the institutional level. Third, GoB's ability to advance its climate adaptation programs cannot be viewed apart from how the government allocated sufficient funds from its central budget to fund climate adaptation programs, while combining this with donor funding. Unlike other project-oriented programs with external donor funds, MoF also supported the Bangladesh Climate Change Strategy and Action Plan (BCCSAP) through its non-development budget to cover regular expenses, such as salaries, wages and training for programs delivering climate-responsive activities. Similarly, the Planning Commission of Bangladesh financed plans related to infrastructure development for climate adaptation purposes (Alam et al. 2011).

With the exception of Bangladesh, collective action from government agencies to institutionally strengthen climate adaptation approaches across sectors appears to be relatively weak. Although Sri Lanka, Nepal, Bhutan and Pakistan have coordination bodies, they seem to lack the right networks, strategic alliances and access to significant funds for climate adaptation. These newly formed bodies sometimes cease to function and may simply exist on paper, or provide mainly administrative rather than strategic functions. The National Climate Change Plan Committee in Pakistan, which meets biannually to report to PMCCC, is an example.

Recommendations

- Adaptation finance must be understood as a continuum from securing funds to their strategic allocation and performance monitoring. Investments are needed to build connectivity in institutions, and planning and accountability processes that ensure national and subnational budget allocation mechanisms, which make possible targeted and accountable adaptation spending. To this end, the climate change marker in fiscal reporting being considered by GoB may provide one mechanism for other countries to adapt and adopt. Lessons from the already operational markers for poverty and gender in Bangladesh could be instructive.

- The targeting of adaptation finance can be improved by strengthening center-periphery lines of communication on adaptation priorities as well as local knowledge and capacities to adapt. This process can help strengthen institutional capacities of countries to ensure adaptation is not only effective but also accountable to especially the most vulnerable, and as such should also contribute to strengthening good governance in the countries. These efforts would link closely to the more geographically and demographically nuanced mapping of climatic risks.
- Addressing institutional fragmentation is likely to require major strengthening of the climate cell or similar bodies. This may involve strengthening their legal mandate and powers for convening, coordinating and improving the caliber of staffing and capacity building. These changes must elevate these key entities from being administrative to strategic agents of change.

Finding 4: Current institutional frameworks do not promote deliberative decision making capable of achieving informed, inclusive and accountable climate adaptation.

Deliberative decision making in relation to climate adaptation (Ayers 2011; Huq and Khan 2006) and IWRM implementation, in particular, can strengthen current approaches by including a greater set of voices in the building of consensus around what actions to take. This includes the voices of the poorest and most marginalized groups who are frequently the most vulnerable to climate change impacts. At a broad scale, this includes the majority of the country populations who still depend on agriculture for employment and food security. At a finer scale, examples include small-scale farmers across the region, especially in countries such as Bhutan, with limited arable land due to its biogeography, and Bangladesh, due to its population density. Other groups include those in coastal areas that are vulnerable to storm surges and salinity intrusion, which impact food production and drinking water availability. Many of these groups already experience inequalities and therefore possess the least adaptive capacities. Currently, ongoing policy discussions on climate adaptation, in general, and IWRM, in particular, fail significantly to put local communities and marginalized groups into the overall shaping of adaptation strategies. Central to the challenge of adaptation—and the ability of societies to adapt—is the notion of collective action (Adger 2003, 387).

The role of local communities and informal institutional arrangements in transforming coping strategies to sustainable adaptive capacity has been raised in recent discussions on climate adaptation (Berman et al. 2012) across the seven countries. However, local communities continue to be positioned as recipients of (nationally defined) adaptation programs rather than as actors capable of articulating context-specific needs and shaping their own adaption measures. Examples of local communities across the seven countries using local strategies to cope with climate variability are numerous (Birkenholtz 2014; Chhetri and Easterling 2010; Chhetri et al. 2012; Rotberg 2013), and demonstrate the significant human capital that currently remains mostly untapped by adaptation decision making and planning.

Therefore, government agencies' development strategies must be linked to climate adaptation through the formulation and implementation of adaptation measures in the water sector—institutionally and financially—with local communities' strategies to cope with climate change. Climate-smart villages, in which researchers documented local villagers' adaptation strategies in agricultural development and water use, can be considered as a starting point to build this linkage. To be effective, current institutional frameworks need to be oriented toward adaptive institution building, enabling existing institutions to react and respond more rapidly and flexibly to emerging climate trends and development demands. While the inclusion of the respective ministries in charge of local government in central decision-making bodies is noted, what is lacking is an explicit mechanism to reflect adaptation needs from the ground upward. This would enable planning, allocation and tracking of climate funding to support

priority needs more effectively and efficiently, and to ensure accountability in the conversion of funds into results. These center-local linkages are key not only for identifying context-specific adaptation strategies but also for highlighting the centrality of water resources management in climate adaptation.

Recommendations

- Strengthen the development process of subnational adaptation plans in countries in which these already exist, and consider introducing the same in other countries. Such processes should make use of broader decentralization procedures and associated institutions.
- More studies are necessary of existing experiences of decentralized adaptation planning and implementation, such as the Local Adaptation Plans for Action (LAPA) plans in Nepal. Resulting lessons will provide important knowledge both for improving these processes, and guidance for countries planning to follow suit.
- Decentralized planning must be closely linked to the more nuanced assessments of climatic risk. These assessments, and associated maps and databases should form points of departure for regional planning.
- To ensure coordination between the center and regions, regional plans and key focal entities must be granted equal space within centralized adaptation planning bodies. This move should also assist in coordinating fund allocation that may need to pull together sectoral and geographical priorities.
- More emphasis on decentralized planning may also help navigate the political economies arising from institutional fragmentation, by decentralizing planning and bringing a more diverse range of actors including NGOs and community-based organizations (CBOs) into the process.

Finding 5: Given the strong transboundary nature of climatic risks, serious efforts are needed to promote greater regional cooperation.

According to Chapter 5, it is clear that the biogeography of South Asia makes effective regional cooperation an inescapable necessity. As such, minimizing transboundary impacts can have a major impact on the efficacy of country-level adaptation investments, with the exception of Sri Lanka, given its island nation status. Water assumes a central position in defining a number of the key transboundary elements in climate risks, in light of the major significance of transboundary rivers in the region, and their origins in glaciers located in several focal countries. What is apparent is a distribution in the points of leverage across most countries depending on where transboundary rivers originate and flow through. In this geographical perspective, it could be argued that Bangladesh is particularly disadvantaged, given its riparian status and extremely high dependence on transboundary flows for surface water supplies. Another critical source of differentiation arises from the diverse economic and political influence of each country. India can be seen as the dominant economic and political actor shaping current transboundary cooperation mechanisms, especially with respect to the sharing of water in transboundary rivers. One option for transcending a distinctly bilateral flavor to existing transboundary treaties could be to focus on the glacial lake outburst flood (GLOF) issue, which may bring a larger number of countries into the dialogue. Such broader threats would also be more appropriate issues to highlight within well-established broader cooperation frameworks, such as the South Asian Association for Regional Cooperation (SAARC).

Chapter 7. Conclusions

Across the seven countries, respective governments have created institutions to deal with climate change issues, either through forming inter-ministerial coordinating bodies or by assigning the responsibility to tackle climate-related issues to specific sector ministries, but without strong emphasis on developing adaptation measures for the water sector specifically. These mechanisms, with the exception of Bangladesh, appear to operate at a somewhat superficial scale, and struggle to overcome perennial weaknesses of a sectionalized bureaucracy in transforming from administrative to strategic entities. Several factors influence this impasse, including the choice of lead agency and its positioning within the political economy shaping interagency collaboration, and the human capacities with which these agencies are endowed. Bangladesh, a country with a long pedigree of responding to environmental and climatic stresses, offers one avenue for mediating political economies, although investments in human capacities will also be necessary. The need for ensuring sector planning and investments to optimize contributions to the national adaptation effort, singly and through cooperation, is highlighted by the significant gap between incomplete assessments of adaptation costs and levels of mobilized finances from international, government and private sources. While this report has focused on climatic risks, it is necessary to note here that another advantage of better coordination in planning could be the ability to take advantage of any opportunities presented by climatic changes.

Such a view meshes well with the logic of integrated water resources management (IWRM), which, if effectively implemented, offers significant contributions to a country's overall adaptive response, given its centrality across multiple development sectors (as argued in Paper 2 [Davis and Hirji 2019]). Discernible financial data, however, suggest that this point has not been internalized in all the countries, given the small financial flows to the water sector compared to others such as agriculture. However, given the water sector's enabling role across other sectors (such as agriculture and energy), available data may be missing other allocations embedded in other sectors. More broadly, this analysis argues that placing adaptation as a central element of development, rather than as an add-on, is critical. An example of such an approach already exists in Bangladesh's approach of broad sensitization and network development.

With no clear bridging mechanism to address the funding gap in the short term, making the most of scarce resources becomes critical. This then means ensuring that scarce funding is well targeted to key adaptation needs, which in turn needs to be defined not only in terms of macroeconomic impacts but also in terms of broader human needs among highly heterogeneous populations. This connects to other findings on the structural dimensions underpinning planning processes. Some relate to the gaps that disrupt the continuum from accessing climate finance to its allocation to meet specific adaptation objectives, perhaps also in specific locations, to accountability against these objectives. Given that more attention is generally placed on the acquisition of climate finance mainly from external sources, this analysis has strived to highlight the importance of structural continuity that sees funding acquisition as only the beginning of this continuum. Each country appears to be characterized by vertical gaps in information flows and decision-making pathways, in addition to lateral institutional disconnects. These effectively deprive both local government and their constituents of agency in defining adaptation priorities and modalities, despite well-developed devolution processes in a number of countries. As such, adaptation seems to remain centrally driven and quite technocratic.

Finally, much attention and effort has been placed on generating international finance for adaptation, and the articulation of risks and response strategies, such as the National Adaptation Programme of Action (NAPA), and similar documents and coordinating bodies at the country level. However, this report makes clear the need to look more deeply into the actual mechanisms that need to bring together finance and technical planning—as well as central government agencies and local stakeholders—if the efforts to raise and effectively utilize funds in support of adaptation are to be fruitful.

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APPENDIX. DETAILS OF THE STUDY METHODOLOGY AND INFORMATION SOURCES.

Current trends in financial flows and structures, and institutional frameworks are key building blocks in identifying how to increase a country's capacity to cope with climate risks. Information on international funding was obtained from an online database maintained by Heinrich Böll Stiftung and the Overseas Development Institute (ODI)[30] as well as from other sources. The regional study by Ahmed and Suphachalasai (2014) on the costs of climate change and estimated costs of adaptation, as well as a range of other recent studies, either fill gaps or illustrate variation between different cases. It is, however, also understood that this and other sources cited in this paper are based partly or wholly on figures provided by governments and may not always be wholly representative.

Ahmed and Suphachalasai (2014) have been an important source of information on the projected economic impacts of climate change in the countries studied. The study is based on a modeling process that involves regional climate modeling, physical impact assessment, and economic assessment (using the integrated assessment model and the computable general equilibrium [CGE] model). The emission scenarios considered were those emerging from the Fourth Assessment Report of the Intergovernmental Panel on Climate Change (IPCC) and other developments arising from the United Nations Framework Convention on Climate Change (UNFCCC) negotiations. The sectors analyzed were (a) agriculture, (b) coastal and marine, (c) energy, (d) forests and other land ecosystems, (e) human health, and (f) water resources. For the section on economic impacts, a limitation of the study is that regional estimates are predominately based on the results for India. Further, the model does not take into consideration extreme events as well as certain other impacts that could arise as a result of climate change. Therefore, the estimates are expected to be on the conservative side (Ahmed and Suphachalasai 2014).

The challenge of cross-country comparisons is important to note. Different methodologies underlie the various estimates and calculations, and these are rarely based on similar groupings of risks or adaptation priorities. Where existing studies on the economic costs of climate change (estimated), costs of adaptation, and international and governmental financing were not available, reference was made to primary data sources (e.g., governmental budgets, governmental databases that track donor funding, and national adaptation plans [NAPs]). In the case of some governmental budgets, only the spending on major activities were looked at. As a result, these may not be entirely reflective of the actual costs and levels of spending.

Deriving mainly from a broad literature review, the paper has not been able to incorporate local-level financial mechanisms and institutional arrangements for climate adaptation, since these are rarely documented in the literature. Other key constraints stem from the fact that, in each country, investments in water resources development and management can be embedded across sectors, which makes it difficult to separate out data and values specific to water. For instance, while water resources management in Afghanistan falls under the Infrastructure and Natural Resources Pillar, this does not limit spending on water-related projects in other sectors such as agriculture and rural development. This is also the case in Sri Lanka and Bhutan, where water resources management is spread across several ministries and sectors to which finances are allocated, each with varying levels of involvement with the water sector.

How a country classifies the "water resources sector" is also important. Pakistan has a separate classification for water and sanitation, but still has projects such as solar pumping that assist farmers with improved energy capacity to pump water from groundwater wells. Additionally, Nepal has water components related to agriculture without classifying the funding as related to water, though it also classifies some hydropower projects as being related to the water sector. Afghanistan classifies

[30] See Climate Funds Update's website (http://www.climatefundsupdate.org/).

water-related irrigation under the infrastructure sector. Therefore, tracking funding specific to the water sector is challenging, since water spans the energy, agriculture, infrastructure and disaster risk reduction (DRR) sectors. The approach has been to reflect water-specific data when available, but to base much of the analysis on wider data on climate adaptation.

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