

Challenges of Mainstreaming Climate Change Adaptation in Bangladesh

By

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**Submitted in fulfillment of the requirement for
the degree of Master of Public Policy**

University of Tasmania, Australia

July 2012.

Declaration

This thesis contains no material which has been accepted for a degree or diploma by the University or any other institution, except by way of background information and duly acknowledged in the thesis, and to the best of the Candidate's knowledge and belief no material previously published or written by another person except where due acknowledgement is made in the text of the thesis. This thesis may be made available for loan and limited copying in accordance with the *Copyright Act 1968*.



15 July, 2012

Date.....

Acknowledgements

First of all I would like to express my deep gratitude to my supervisor Professor Kate Crowley for her guidance and encouragement which made this study possible.

I also appreciate the kind cooperation of my course coordinator Dr. Hannah Murphy who has been supporting me throughout the course.

My heartiest gratitude to Mr Chris Dillon, the Scholarship Officer of the University of Tasmania, for his sincere support not only in academic affairs but also for my family.

I am really thankful to all the Tasmanian friends without whose support and love it would have been impossible to carry on my study in this foreign land with two children. I am also thankful to my husband and other family members who encouraged me from overseas.

Finally, I am grateful to my two children – 7 year old Ahnaf and 3 year old Namirah who have been deprived of appropriate attention from me, and patient enough to allow me to sit before the computer for hours.

Abstract

Adaptation is a policy instrument for facing the challenges posed by climate change.

Government pursues adaptation in different ways aside from simply creating awareness about climate change and its effects. It makes rules for changing behaviour and practices which include National Action Plans, building codes, standardisations and so forth; provides loans to the affected communities, facilitates insurances, takes measures to correct market imperfections and grants financial incentives or discourages a specific behaviour through taxation; and strengthens institutional capacity, develops skills, supplies emergency relief and arranges rehabilitation, as well as constructing physical infrastructures, and repairing and maintaining the existing ones.

These initiatives require additional resources and efforts which the developing countries, the most vulnerable to climate change, are unable to afford. For this reason, government needs to mainstream adaptation into their development planning and programs including the Poverty Reduction Strategy Papers (PRSPs) and the Millennium Development Goals (MDGs).

Mainstreaming involves a number of challenges, most of which are related to policy instruments, such as lack of awareness and knowledge sharing, resource shortages, organisational inefficiencies, and ineffective regulations. Bangladesh being a developing country and climatically the most vulnerable, has undertaken various policy measures for adaptation and its mainstreaming. This study has made an effort to identify the challenges associated with the adaptation mainstreaming endeavours in Bangladesh. Also, it ultimately offers a number of suggestions for overcoming these obstacles.

Abbreviations

APF	Adaptation Policy Framework
BARSIC	Bangladesh Resource Centre for Indigenous Knowledge
BCAS	Bangladesh Centre for Advanced Studies
BCCAP	Bangladesh Climate Change Action Plan
BCCRF	Bangladesh Climate Change Resilience Fund
CCC	Climate Change Cell
CDM	Comprehensive Disaster Management
CFIC	Community Flood Information System
CIDA	Canadian International Development Agency
CLP	Char Livelihood Programme
COP	Conference of Parties
DFID	Department for International Development
DoE	Department of Environment
DoF	Department of Forest
FAO	Food and Agricultural Organisation
GDP	Gross Domestic Product
GEF	Global Environment Facility
GLCA	Global Leadership for Climate Action
GoB	Government of Bangladesh
IASC	Inter Agency Standing Committee
IPCC	Intergovernmental Panel on Climate Change
LDC	Least Developed Country
LDCF	Least Developed Countries Fund
MDG	Millennium Development Goal
MoEF	Ministry of Environment and Forest
MoFDM	Ministry of Food and Disaster Management
MoI	Ministry of Information

MoL	Ministry of Land
NAPA	National Adaptation Policy Action
NGO	Non-Government Organisation
ODA	Official Development Assistance
OECD	Organization of Economic Cooperation and Development
PDMP	Participatory Disaster Management Programme
PPP	Public Private Partnership
PRSP	Poverty Reduction Strategy Paper
SID	Small Island State
UNDP	United Nations Development Program
UNEP	United Nations Environment program
UNFCCC	United Nations Framework Convention on Climate Change
UNO	United Nations Organisation
USA	United States of America
USAID	United States Agency for International Development
WB	World Bank
WHO	World Health Organisation

Char refers small island in the river

\$ refers the US dollar

‘Taka’ refers Bangladeshi currency

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Chapter 1

1.1. Introduction

The global climate has been changing significantly and damage to the climate is still ongoing (Pittock 2009). The physical and social processes of climate change have a momentum that will continue for a long time (Leary et al. 2008). Even if the emissions stop today, some degree of change will occur in the global climate and climate changes amplify weather related hazards (Huq et al. 2003). Since the beginning of the politicisation of climate change, global concern has been with mitigation. However, mitigation cannot reverse the impacts of past and current emissions or of unavoidable future emissions (Chambwera and Stage 2010). Therefore, Artur and Hilhorst (2010) argue that along with mitigation, adaptation is necessary.

In the last few years the scientific community has increasingly realised the importance of adaptation; especially for the developing countries where climate change will affect different sectors (Huq et al. 2003; the World Bank 2010). Climate change threatens the process of sustainable development, and it may increase poverty and create barriers for achieving the Millennium Development Goals (MDGs) (UNFCCC 2007; Burton, Diringer and Smith 2006; Griebenow and Kishore 2009, Leary et al. 2008). For example, in Honduras, gross domestic product (GDP) fell because of Hurricane Mitch in 1998 (Burton, Diringer and Smith 2006). During the 1970s global total losses from natural disasters was around US\$83 billion. This increased to a total of around \$440 billion during the 1990s, and a significant portion of the GDP of the developing countries decreased because of natural calamities (Stern 2007). Likewise, in Sub-Saharan Africa and Central and South Asia, rainfall variability and warming reduced agricultural production and subsequently slowed the growth and increased poverty (Giddens 2009; Davis, Oswald and Mitchell 2009; World Bank 2010). Referring to Carter et al., Stern (2007, p. 106) notes that in North-Eastern Ethiopia, during the period between 1998-2000, each household had \$266 in drought-induced losses of crops and livestock. In India in 2002, GDP decreased by 3 percent because of a 19 percent drop in seasonal rainfall (Callinor et al., cited in Stern 2007)

However, Halsnaes and Verhagen (2007, p. 666) argue that poverty is the main focus in the developing countries, and that 'the issue of climate change is overshadowed by poverty

elimination, food and water security, health, natural resources management, energy access, transportation needs, and local air pollution'. Artur and Hilhorts (2010) support this argument by citing an example from Mozambique where the main concerns for the government are poverty elimination, employment generation and infrastructure development though, climatically, it is one of the most vulnerable countries in the world. Nevertheless, incorporation of adaptation measures into sustainable development strategies is an effectual way to respond to the impacts of climate change (UNFCCC 2007). Therefore, Leary et al. (2008), and Chambwera and Stage (2010) argue that adaptation should be treated as an integral part of a country's development process rather than as a separate issue.

Adger et al. (2007) note that public policy may play a crucial role in facilitating adaptation to climate change in different ways, namely, increasing adaptive capacity and resilience of the people and infrastructure, and providing necessary information to public and private organisations for undertaking investment decisions. Climate change is a new issue in the area of public policy. Therefore, governments are trying to address this issue with the policy instruments at hand and are also formulating suitable new policies. The National Adaptation Policy Action (NAPA) is the main policy instrument for climate change adaptation which was provided to the parties of the United Nations Framework Convention on Climate Change (UNFCCC) in 2001 for developing a framework for mainstreaming adaptation (GLCA 2009; Morris et al. 2010). The Poverty Reduction Strategy Paper (PRSP), and planning and programs for achieving MDGs are considered to be other policy instruments in this area (Mitchell, Tanner and Wilkinson 2006). However, the process of mainstreaming involves a number of challenges.

Among the developing countries, Bangladesh is the most vulnerable to climate change (Urry 2011). From 1990 to 2009, Bangladesh was one of the countries most affected by extreme weather events where 7,849 people died, and in economic terms, total losses amounted to \$2,068 million, which was 1.67 percent of the GDP, and the number of climatic hazards reached 259 (Harmeling 2011). The climate change projection for Bangladesh is that its temperature will rise by 1.3 degrees by 2030 and 2.6 degrees by 2070, and that sea-level will rise by 3 feet which will affect 17 percent of the total cultivable land, with 35 million people dislocated by losing their farms and homesteads (Mazumder 2010; Displacement Solutions 2010). In order to face the threats posed by climate change, Bangladesh has prepared the NAPA and with limited financial capability it is making efforts to integrate it into the PRSP, the MDGs and other developmental plans and programs (Ahmad 2011). However, the mainstreaming process in Bangladesh will involve considerable challenges.

1.2. Aim of the study: To identify the challenges of mainstreaming climate change adaptation in Bangladesh.

1.3. Objectives of the study

- a) Discuss climate change effects, and adaptation as a policy instrument
- b) Discuss mainstreaming and associated challenges
- c) Adaptation and its mainstreaming, and challenges of mainstreaming adaptation in Bangladesh
- d) Recommendations under the framework of policy instruments

1.4. Importance of the study

Adaptation is one of the two main instruments of combating climate change. Being unable to undertake separate programs for adaptation, the developing nations have to mainstream the adaptation initiatives, yet, mainstreaming faces obstacles and government can apply various instruments to overcome them. This study makes an effort to identify the policy instruments for climate change adaptation and the problems associated with mainstreaming adaptation, and also provide recommendations under the framework of four policy instruments namely information based, regulation based, treasury based and organisation based policy instruments. This may provide a guideline for policy makers to correct the policy measures for climate change adaptation. Further, this study finds that there is insufficient literature on climate change adaptation under the policy instrument framework. Therefore, there is scope for future studies on adaptation which consider the fundamental policy instruments available to government such as information-based, regulatory, financial and organisation-based.

1.5. Methodology

This study is based on secondary sources such as books, journals, web resources, comments, newspapers, and national and international documents on climate change adaptation. The main sources of literature are documents and articles prepared by the United Nations Development Program (UNDP), Organisation of Economic Cooperation and Development (OECD), United Nations Environment Program (UNEP), UNFCCC, Intergovernmental Panel on Climate Change (IPCC), the government of Bangladesh and the Stern Review. Bangladesh has been selected as a case in this study for three reasons. Firstly, it is the most vulnerable country to climate change; secondly, it is a developing country with limited financial, institutional and human resources;

and thirdly, Bangladesh has been trying to mainstream adaptation under the framework of the UNFCCC.

1.6. Overview of climate change impacts

Although, the exact picture of the impacts of climate change is uncertain, the risks are high (Biermann and Boas 2010). Robbins (2004) maintains that degradation of the whole environment, including soil erosion, deforestation, desertification, biodiversity loss, water pollution, as well as atmospheric and climate changes have been noticed by ecologists and they believe that any recovery will take a long period of time (Robbins 2004). Climate change will also affect sources of food, health, infrastructures, industry, settlement and society (Halsnaes and Laursen 2009; Leary et al. 2008; Chambwera and Stage 2010). According to Adger and Bernet, (cited in Edwards and Wiseman 2011, p. 196) the global mean temperature is projected to increase by 2 degrees or more and in case of failure to reduce global emissions drastically, the global mean temperature may cross 4 degrees and in that case, the future impact on this earth is unpredictable. It is also predicted that climate change may raise the sea level by three feet which may extensively flood some parts of the United States of America (USA) and cause even more extreme problems for the Netherlands, Egypt, Bangladesh, China, small island states (SIDs) and low-lying coastal areas (Cochran and Malone 2005; Burton, Diringier and Smith 2006).

Climate change will affect different sectors. The agricultural sector is projected to be the most affected area as new plant-diseases, pests, changes in plant flowering dates and bird migrations may affect the crops (Burton, Diringier and Smith 2006). Intrusion of saline water, drought and flood may damage crops and cause shortages of food and fodder, reduce fisheries and grassy animals (Halsnaes and Laursen 2009; Carter 2001). Human health is also under threat because of climate change. The World Health Organisation (cited in Urry 2011, p. 6) states that each year 150,000 deaths are caused by climate change which he calls 'climate genocide'. Finnigan (2010) points out that, per year, 5 million incidences of diseases occur because of climate change. Moreover, changes in plant life may worsen aeroallergens (Morris et al. 2010). Differences in demographic and socio-economic profiles affect the level of vulnerability. Children and the aged are the most vulnerable (Davoudi, Crawford and Mehmood 2009). Finally, referring to the Global Humanitarian Forum, Finnigan (2010) observes that by 2050, desertification, water scarcity, floods and storms may displace up to 150 million people. Migration to cities or other countries will be the only option (Pittock 2009). However, these displacements may instigate violent disturbances, group conflicts and even humanitarian disasters (Reeves and Jouzel 2010; Neumann 2005; and Davis, Oswald and Mitchell 2009).

1.6.1. Impacts on the developing world

The impact of climate change will differ in different regions. Nations with higher incomes, and better health and education, will be more easily able to cope with challenges posed by climate change (Stern 2007; Shukla et al. 2003). On the other hand, developing countries are more vulnerable to climate change because of higher exposure to climate, climate sensitive economies, poor socio-economic conditions, ineffective and corrupt government, dependence on low-value tropical crops, unplanned and overcrowded cities, weak infrastructure and limited institutional capacity (Giddens 2009; Stern 2007). Mozambique is an example of a country which is significantly exposed to climate change, where the average temperature has increased by 1.6 degrees Celsius, the rainy season starts later, and the dry season lasts longer than before due to climate change (Artur and Hilhorst 2010). Further, agriculture and fishing are the main food producing sectors, and along with tourism, the main income generators, as well as less access to technology, credit and the international market make the economies sensitive to climate change and reduce adaptive capacity in these countries (Burton, Diringier and Smith 2006; Richardson et. al 2009; Berg and Burger 2010). The higher growth rate of population will also create extra pressure on natural resources and pushes millions of people to live in illegally built houses in slums in the cheaper marginal and hazard-prone lands (Davis, Oswald and Mitchell 2009; the Commission for Africa – cited in Stern 2007).

Regarding the climate change threat to human health, Stern (2007) observes that 96 per cent of disaster related deaths occur in developing countries and if no change occurs in malaria control, then a 2 degree rise in temperature will cause 40 to 60 million people in Africa to be exposed to malaria, and the number will rise to 70 to 80 million if the temperature increase reaches 3 to 4 degrees. Stern (2007) argues that the problems of rapid population growth, poverty, political, ethnic or religious tensions, and national and cross border conflicts are intensified when natural hazards are added to them. Referring to the University for Peace for Africa Programme, Stern (2007) has identified the decade long drought in the Northern Darfur state in Sudan, along with other factors, as being behind the current conflict there. The dispute between Senegal and Mauritania originated from sharing the water of the Senegal River. In that conflict, Mauritanian forces killed hundreds of Senegalese, and 75,000 Senegalese and 150,000 Mauritians were repatriated by 1989. Weather events in 2000 that affected approximately 3 million people in Bangladesh resulted in migration and violence as tribal people in North India clashed with emigrating Bangladeshis (Stern 2007).

1.7. Chapter outline

In order to obtain the aim and objectives of this study, this essay is divided into five chapters. This first chapter introduces the topic, describes the aims, objectives, importance and methodology of the study. It also provides an overview of the impacts of climate change in general and in the context of the developing countries. Chapter 2 will first highlight the types of policy instruments, then discuss instruments for climate change, and elaborate on the idea of adaptation. Chapter 3 will explain the issue of mainstreaming and its challenges. Chapter 4 will delineate the Bangladesh case as one of the most vulnerable countries to climate change and also outline the action taken by the Bangladesh government for mainstreaming adaptation, and the challenges of mainstreaming. The final chapter will make an effort to provide a number of recommendations under the framework of conventional policy instruments and conclude the discussion.

Chapter 2

Policy Instruments and Adaptation

This chapter will first highlight four types of policy instruments in general and then discuss those for climate change. Thereafter, it will discuss adaptation as a policy instrument for climate change.

2.1. Policy instruments

Policy instruments give effect to policy and act as mechanisms to achieve the objectives and goals of the governments (Hague and Harrop 2010; Fankhauser et al. 2008). Policy instruments are used to control and coordinate both government and non-government actors (Bahr 2010). Christopher Hood (cited in Howlett, Ramesh and Pearl 2009, p. 115) developed the 'NATO' model to classify the policy instruments. According to Hood, 'NATO' stands for 'nodality' or information, 'authority', 'treasure', and 'organisation'.

Howlett, Ramesh and Pearl (2009) describe these four types of policy instruments in detail. Firstly, information-based instruments are used to bring change in the behavior of the public towards a desired objective. They include public information and campaigns, benchmarking and performance indicators, and commissions and enquiries. The second is authority or regulatory instruments such as rules, standards, permits, prohibitions, laws, executives and orders, used to direct the target population to carry out or refrain from performing certain activities (Keyes – cited in Howlett, Ramesh and Pearl 2009, p. 119; Howlett and Ramesh 1995). Thirdly, treasury-based or financial policy instruments are used to discourage, encourage and promote desired behavior of the public through imposition of tax, providing subsidies, grants, loans and tax incentives, and establishing advocacy, and interest groups and think tanks.

Fourthly, when government itself performs the tasks of delivering goods and services directly through government employees, funded from the public treasury, then it is treated as an organization-based instrument (Leman, cited in Howlett, Ramesh and Pearl 2009, p. 126). This includes direct provision, public enterprise; quasi-autonomous non-government organisations (Quangos); public-private partnership (PPP); family, community and voluntary organisations; market creation; and government re-organisation. Non-government actors play a role in

governance through networking under the government and intergovernmental settings (Althaus, Bridgman, and Davis 2007).

According to Howlett, Ramesh and Pearl (2009), an appropriate policy instrument or a combination of instruments is used to address a policy problem. Application of policy instruments must follow a sequence, for instance, information campaigns are necessary for direct regulation of behaviour (Salamon, cited in Hague and Harrop 2010, p. 376). Also, policy instruments should be supported by adequate power and resources (Althaus, Bridgman, and Davis 2007). The limitation of policy instruments is that simple application of an instrument cannot solve a 'wicked problem' (Althaus, Bridgman, and Davis 2007: p. 54). The problem of climate change is a 'wicked problem' and defying solution is its nature (Crowley 2009, p. 1).

2.2. Policy instruments for climate change

There are two main instruments for managing climate change: one is mitigation and another is adaptation. Mitigation means limiting the emissions of greenhouse gases such as carbon dioxide and methane (Ayers, Alam and Huq 2010). This is considered the responsibility of the industrialised world which is responsible for the majority of the emissions. On the other hand, adaptation is a spontaneous or intended response to changed conditions of the environment resulting from climate change, in order to keep the adverse effects minimal and maximise future opportunities (Pittock 2009; Fankhauser et al. 2008). Regarding the difference between adaptation and mitigation, Artur and Hilhorst (2010) argue that mitigation deals with the causes of climate change while adaptation deals with the consequence. Climate change, being a policy problem, has the virtue that in theory it can be solved by policy instruments although thus far this has not been the case (Bahr 2010). This paper, however, will focus on adaptation.

2.3. Policy instruments and adaptation

Formulation and implementation of an appropriate policy framework will encourage and facilitate individuals, communities and businesses to undertake fruitful adaptation (Stern 2007). Climate change adaptation is a new policy issue and the governance mechanisms and policy instruments for it are still in the process of development (Peltonen, Juhola and Schuster 2011). According to the GEF (2009), lack of technical knowledge on this issue among the policy makers and implementers is the main barrier for developing and actualising adaptation planning. There is also a general tendency in the public to maintain the status quo and resist adaptation (Ruhl 2009). Besides this, adaptation measures across multiple levels demand policy coherence and integration, and there is ambiguity about the responsibility, level and extent of adaptation

(Peltonen, Juhola and Schuster 2011). Therefore, Morris et al. (2010) express concern about the insufficiency of research in the area of public policy in finding out the best possible way of adapting to climate change whilst Stern (2007) suggests adopting entirely new policies targeted at adaptation to climate change (Stern 2007). Nevertheless, efforts are in progress to utilise general policy instruments for implementing adaptation measures.

2.3.1. Information-based instruments for adaptation

Reliable information on different aspects of climate change such as probable timing, extent and impacts of climate change, knowledge of drought and flood resistant crops and new crop cultivating methods enable people from different sections of the society to adapt autonomously (Stern 2007). Local farmers may be unaware of the crop varieties that are less vulnerable to flooding and salinity because of lack of information and knowledge, and even the policy makers may fail to recognise the effects of climate change or the success of their projects for the same reason (Koudstaal et al. 1999; Ospina and Heeks 2012). Stern (2007) cites an example from Tanzania's National Action Plan for Climate Change which put emphasis on raising awareness during the first two years of implementation. In Uganda, drama, songs and radio broadcasts are used to raise awareness about causes and effects of climate change (Ospina and Heeks 2012). In Australia, public campaigns play a significant role in water conservation and fire prevention (Pittock 2009). However, information-based instruments are questioned regarding credibility (Prelims 2010). The effectiveness of these instruments may vary by socio-economic status, the quality of information, the way they are presented and public interpretation of messages (Howlett, Ramesh and Pearl 2009).

2.3.2. Regulatory instruments for adaptation

A regulatory framework is essential for supporting and implementing adaptation policies and programs (FAO 2007). Along with other measures, Australia uses regulatory measures for protecting the environment and natural resources (Pittock 2009). Regulatory instruments for climate change adaptation include definition of no-settlement zones, land use regulations, national planning frameworks, land use planning, performance standards, and building codes (Geyer et al. 2011; Stern 2007). However, lack of resources creates barriers to enforcing regulatory measures. Roberts, Parrotta and Wreford (2009) argue that in the protected areas of forests, inappropriate policy and inadequate means create obstacles that prevent forest clearing. According to Stern (2007), weak regulatory practices and poor enforcement, lack of technical capacity, and unclear property rights may reduce the effectiveness of this instrument (Stern

2007). Moreover, compulsory instruments involve inefficiency, which adds costs to clients by excluding the market and retards creativity and expansion (Stewart 1999).

2.3.3. Treasury-based instruments for adaptation

Financial instruments such as loans, guarantees, insurance for sharing risks and so forth are also used for adaptation (Geyer et al. 2011). In order to fill the gap of regulatory enforcement, financial measures can be added to this, for instance, the ‘protector receives’ principle where the protectors of a common resource are rewarded. Australia and New Zealand use tax incentives for expanded forestation (Roberts, Parrotta and Wreford 2009). Market-based instruments include subsidies for forestation of degraded land, construction of dykes, water supply, irrigation, desalination, tax reduction and price support; taxes for raising funds, and tradable quotas of entities to achieve adaptation units (Roberts, Parrotta and Wreford 2009). Australia also uses a variety of price signals under market-based instruments in an aim to encourage conservation of bio-diversity, decrease salinity and manage natural resources (Crowley 2004). However, lack of resources is the main limitation for pursuing financial instruments, for example, poor people have limited ability to be covered by insurance (Prelims 2010; Stern 2007). The effectiveness of this instrument depends upon government’s financial resources and ability to raise and disburse funds (Howlett, Ramesh and Pearl 2009).

2.3.4. Organisation-based instruments for adaptation

Organisations assist government to act directly, using their own forces rather than any hired agency (Prelims 2010). Organisation-based instruments for climate change include service concessions, research for drought tolerant seeds, and flood barrier operations through Public Private Partnership (PPP) (Geyer et al. 2011). Moreover, by promoting development, governments can enable individuals and communities to respond to climate change, and through better access to education and reproductive health, people can avail themselves of the opportunities from climate change and reduce pressure on available resources (Stern 2007). However, effectiveness of the operation of government organisations and agencies may be affected by limited resources and unskilled staff (Prelims 2010). Furthermore, program delivery by government agencies is inflexible, time consuming, may serve political purpose, inefficient as they are not cost conscious, and involves inter- and intra- agency conflicts within the government (Bovens et al, cited in Howlett, Ramesh and Pearl 2009, p. 127).

The instruments for adaptation discussed above are formulated and implemented at the domestic level. Since climate change is a global problem, international communities have developed a few policy instruments for adaptation. These are discussed below.

2.4. The global policy context for adaptation and international policy instruments

Stavins (1997) defines international adaptation efforts as a patchwork of multilateral and bilateral initiatives which focus on developing countries' capabilities for adaptation. Paavola and Adger (cited in Jerneck and Olsson 2010) describe the two aspects of adaptation from an international perspective. Firstly, adaptation is considered to be the legal obligation of the developed countries to pay for adaptation in the poor countries because of more emissions by the former. Secondly, adaptation is believed to be a moral obligation of the less vulnerable to the more vulnerable. Additionally, since the argument for international funding for adaptation is based on a 'polluters pay principle' this funding is an addition to current aid commitments and it is recognised in Climate Convention Article-4 of the United Nations (Ayers, Alam and Huq 2010). Above all, climate change hits the developing countries severely and they have the least capacity to cope, therefore, adaptation measures have been directed at the developing countries in the interventional context (Artur and Hilhorst 2010; Marshal 2007; Giddens 2009).

Historically adaptation did not receive much attention from the international community before the 1992 Rio Conference and the Kyoto Protocol in 1997 (Artur and Hilhorst 2010). Adaptation gained importance in 2005 in the Conference of Parties-2 (COP-2) in Nairobi, again in 2007 in the Bali Road Map and Action Plan, followed by Copenhagen COP 15 in 2009 (Davoudi, Crawford and Mehmood 2009). The Global Environment Facility (GEF) is the outcome of international negotiations with the UNFCCC and the Kyoto Protocol. The GEF administers international funds that are used for international policy instruments such as the Adaptation Policy Framework (APF) which intends to mainstream adaptation by engaging all stakeholders at all stages (Mitchell, Tanner and Wilkinson 2006).

The NAPA, the main policy instrument for mainstreaming of climate change adaptation, is a process which identifies, communicates and addresses the most urgent and immediate adaptation needs, and prioritises these requirements (the Government of Nepal 2010). Development of a country-driven, participatory and multi-disciplinary approach was another principle behind the NAPA preparation (Prowse, Grist and Sourcing 2009). In 2008, 38 LDCs completed NAPA with support from GEF's Least Developed Countries Fund (LDCF), which was a pre-requisite for accessing funding from the UNFCCC's financial mechanisms (GLCA 2009).

The PRSP is another policy instrument aiming to enhance growth and reduce poverty, and provides a central framework for macroeconomic, structural, and social policies in developing countries (Griebenow and Kishore 2009). In some developing countries, such as Bangladesh and Mozambique, PRSPs consider climate change a serious issue and make efforts to justify the link between natural disasters, growth and poverty (OECD 2009). Another set of instruments is the Millennium Development Goals (MDGs) set by the United Nations Organisation (UNO) in 2000 for the developing countries, which consist of 10 aims (UNDP 2012). Though its main goal is reducing world poverty by half by 2015, the number seven goal is about ensuring environmental sustainability, which addresses environmental or climatic issues directly. Other goals such as health, water, and food security are also connected with climate change (Halsnaes and Laursen 2009).

2.5. Adaptation

The IPCC (cited in Mitchell, Tanner and Wilkinson 2006, p. 5) defines adaptation as ‘adjustment in natural or human systems in response to actual or expected climatic stimuli or their effects, which moderates harm or exploits beneficial opportunities.’ Adaptation in climate change is important in two ways, as mentioned by Smit and Pilifosova (2001). The first is regarding assessment of impacts and vulnerabilities, and the second relates to development and evaluation of response alternatives. Adaptation can be passive, reactive or proactive to the consequences of climate change (Shukla et al. 2003). Reactive or autonomous adaptation is the reaction to any change such as emergency response, migration and disaster recovery (Ruhl 2009). On the other hand, planned or proactive adaptation measures are conscious policy options which intend to improve the adaptive capacity of the system such as crop and livelihood diversification, seasonal climate forecasting, community based disaster risk reduction and so on (FAO 2007; Ruhl 2009). Smit and Pilifosova (2001) define adaptive capacity as the ability of a system, region or community to adjust to the effects of climate change. Resilience is another important aspect of adaptation which is defined by Giddens (2009) as the capacity of both coping with external shocks and responding actively and constructively to them.

Both adaptive capacity and resilience can be strengthened through different processes such as integration of institutions and focal points; broad based planning and coordination of comprehensive strategies; development of expertise, skill and knowledge; accumulation of resources and access to technology; communication; ecosystem maintenance, adapted infrastructures and asset convertibility (Shaw, Pulhin and Pereira 2010; and Burton, Diringer and

Smith 2006; Yanda and Mubaya 2011). A resilient community has the capacity to ‘bounce back’ as well as the capability to act proactively and deliberately in order to address the approaching crisis (Edwards and Wiseman 2011, p. 187).

2.5.1. Development and adaptation

Development itself is the way to promote adaptation because it increases resilience and reduces vulnerabilities (Stern 2007). Sometimes, development and adaptation overlap. Pure development and pure adaptation activities remain at the two edges of the adaptation ‘continuum’ (OECD 2009, p.50). McGary, H. et al. (cited in OECD 2009) identifies four categories of adaptation in this continuum. The first category includes normal development initiatives such as livelihood diversification efforts in order to reduce poverty and vulnerability to any hazard independent of climate change, nevertheless, these increase resilience. The second category is about developing response capacity through institution building and technological approaches, such as reforestation, weather monitoring and so on. The third category involves activities aimed at managing climate risks, and is separate from normal development activities. These, however can benefit the development process and sectors sensitive to climate change such as innovation of drought resistant crops. The fourth category includes initiatives which are exclusively designed to face the challenges of climate change such as relocation of communities in response to sea-level rise.

2.5.2. Adaptation policy objectives and strategies

According to Geyer et al. (2011), adaptation policies have four main objectives. These are fund raising, efficient allocation of funds among adaptation initiatives, providing incentives to stakeholders for changing behavior, and sharing of financial risks. GLCA (2009) identifies four principles for adaptation strategies, the first of which is the scale, which means the responses should be matched to the growing number of people in danger. The second is the speed, which suggests that response should be faster because the speed of climate change is faster than predicted. The third is the focus which involves managing risk, enhancing resilience of the poorest people and maintaining ecosystem functions upon which these poor depend. The last is the integration which recognises the relationship between environment, development and climate change.

2.5.3. Approaches of adaptation

There are two approaches to adaptation: top-down and bottom-up. Through top-down approaches, the national government enhances the legislative, policy making and administrative capacity of the government institutions (Nakalevu 2006). Parry, Hammill and Drexhage (2005) note that the top-down approach to adaptation provides information on the impacts of climate change on different regions, creates awareness, identifies crucial issues and supports international processes. On the other hand, bottom-up actions can bring the traditional practices of adaptation up to a national level and engage community members in resource mobilisation (Nakalevu 2006). This approach is also known as the vulnerability-driven approach to adaptation which evaluates past and present susceptibility, current coping strategies and future directions of improvement and is more appropriate for dealing with local problems (Parry, Hammill and Drexhage 2005). Therefore, both top-down and bottom-up approaches are necessary for formulating and implementing adaptation policies and their mainstreaming (Mitchell, Tanner and Wilkinson 2006). For mainstreaming, the government of Fiji combines top-down and bottom-up approaches (Nakalevu 2006).

OECD (2009) suggests a four-step approach for adaptation. In the first step, current and future vulnerabilities are assessed by considering socio-economic impacts and capacity of the systems (Smith, Smith Lenhart, cited in OECD 2009). The second step is about identifying adaptive measures. Reactive adaptations are preferable in the case of uncertain events. However, anticipatory adaptation is logical for anticipation of more intensive extreme events (Fankhauser et al. 2008). Regarding anticipatory adaptation, both Giddens (2009) and Pittock (2009) suggest encouraging innovation and creativity among all the sections of the society in terms of greater water use efficiency, cheap water desalinisation or new crop cultivation. In the third step, adaptation options are evaluated and the most appropriate one is selected; necessary legal, administrative, financial, technical and other resource's availability are assessed for implementation. Step four evaluates the success of adaptation by measuring the benefits against the policy objective.

2.5.4. The role of non-state actors in adaptation

Successful adaptation also requires cross-sectoral dialogue and action (Peltonen, Juhola and Schuster 2011). Research organisations are playing a crucial role in creating awareness about the probable impacts of climate change among political leaders and policy makers (Stern 2007). Besides this, Non-Government Organisations (NGOs) have been making efforts to incorporate

adaptation practices into their programs and local climate change practitioners can contribute to place-based learning, and national and international experts can provide input into the policy making process (Yohe et al. 2007). Therefore, the development and scientific community should be engaged more in adaptation operations (Mitchell, Tanner and Wilkinson 2006; and Ayers, Alam and Huq 2010).

Shaw, Pulhin and Pereira (2010) however, argue that the issue of adaptation was discussed mainly in the organisational context; little focus has been placed on integration of adaptation methods in the policy perspective. In fact, it is a challenge for the government to adjust and adapt all the major functions of the state as swiftly as the climate changes (Biermann and Boas 2010; Edwards and Wiseman 2011). In this connection Leary et al. (2008) suggest the integration of adaptation with development planning. In the integration process, different policy aims and instruments should be consistent with each other because there may be conflict between climate change policy aims (Mickwitz et al. 2009). In order to resolve this problem, Mickwitz et al. (2009) suggest creating 'win-win' options such as development and introduction of more heat, drought and salt tolerant varieties of crops and increasing storage capacity of fresh water by building reservoirs or recharging aquifers.

Discussion in this chapter shows that adaptation itself is a policy instrument and that the implementation of adaptation involves other instruments. It also describes the close relationship between development and adaptation. Some development activities facilitate adaptation, the chapter finds, while some adaptation efforts support development. Nonetheless, in order to overcome the problem of resource scarcity and achieve a balance between development and adaptation, mainstreaming of adaptation is recommended. This will be discussed in the following chapter.

Chapter 3

Mainstreaming of Adaptation

This chapter will first discuss the process and level of mainstreaming adaptation. Thereafter, it will describe the challenges associated with mainstreaming into development policy.

3.1. Mainstreaming of adaptation into development planning

The process of mainstreaming adaptation is still at the primary stage. A clear definition of mainstreaming is still unavailable and it is often used interchangeably with other terms such as integration, multisectoral response or comprehensive adaptation (Oates, Conway and Calone 2011; Mitchell, Tanner and Wilkinson 2006). Nevertheless, Mitchell, Tanner and Wilkinson (2006) define mainstreaming as an integration of climate change adaptation into development planning, programs and budgeting in an aim to decrease the negative impacts and maximize the opportunities resulting from climate change. It is a development-oriented approach to climate change adaptation (Oates, Conway and Calone 2011). It involves both stand-alone policies and the integration of adaptation measures into development processes and activities (OECD 2009; Benson, Twigg and Rossetto 2007). OECD (2009) cites an example of mainstreaming adaptation in the agricultural sector which includes changes in farming practices, irrigation, community development plans and projects both within national development and poverty alleviation strategies and donor countries' assistance strategies.

The aim of a comprehensive adaptation is two-fold. One is strengthening the capacity to cope with currently occurring natural disasters and another is facing future challenges posed by climate change (Mitchell, Tanner and Wilkinson 2006). Regarding the importance of mainstreaming, Leary et al. (2008) explain that climate change in poor countries is perceived as a future problem and adaptation requirements are treated as less urgent than development needs. Mal-adaptations, involving higher opportunity costs and limited options for the future can intensify the plight of the vulnerable (Barnet and O'Neil 2010). Moreover, climate-proof development requires both horizontal and vertical integration of climate change into government planning, and engagement of all sectors of the society (the Government of South Africa 2011). Therefore, Ranger (2011) and UNDP-UNEP (2011) suggest the integration of long-term sustainability requirements into short-term development plans by bringing change into development policy.

3.2. Policy cycle and steps for mainstreaming of adaptation

UNPEI (cited in UNDP-UNEP 2011) provides a three stage policy cycle for mainstreaming. Stage one is about finding an entry point and agenda setting. In stage two, mainstreaming of poverty-environment linkages is established in policy processes as policy making. Stage three meets the challenges of implementation and monitoring. UNDP-UNEP (2011) suggests a four step approach to mainstreaming adaptation. The first step focuses on creating awareness among planners and financiers, and building partnerships between decision makers and climate change experts for better understanding the connection between climate change, development and poverty. The second step focuses on integrating adaptation into an ongoing policy process, based on the cost and benefits of adaptation options. In the third step, adaptation requires access to budgeting and financing, implementation and monitoring, and examining general measures with a climate lens. Finally, involvement of stakeholders and coordination between government and non-government development actors need to be considered. For mainstreaming adaptation, the South African government has developed a regulatory framework for the actions by government departments, agencies, businesses and civil society; engaged stakeholders to a vast extent and made information easily accessible and understandable. The government, private banks and microfinance institutions support a range of corporate and entrepreneurial ventures that have the prospect to contribute to climate change resilience. Likewise, the government is promoting development and investment in climate resilient regions. There is also effective coordination between the National Committee on Climate Change and stakeholders (the Government of South Africa 2011).

3.3. Levels of mainstreaming of adaptation

The impacts of climate change are observed and adaptive measures taken on four different levels; private individuals, communities, national government and international organisations.

Small family units and individuals pursue different methods for adjustment to changed climate. For example, in Nicaragua, in response to drought in 1997 and Hurricane Mitch in 1998, people cut consumption expenditure, and for higher incomes they raised their working hours by 10 percent (Berg and Burger 2010). However, adaptation in real life depends on people's perception of, attitude to and knowledge about climate change. Treatment of climate change as a lower risk event than other hazards of life, or inaction of neighbours may encourage some individuals not to take necessary action to adapt to a changed situation (Leary et al. 2008).

Communities also adapt in their day to day and professional life since they know about their own environment and potential ways of adapting to climate change (GLCA 2009). For example, in the high Andes of Peru and Bolivia, traditionally farmers observe the stars in order to predict future weather patterns several months ahead. Scientists confirm that in this way farmers have been effectively monitoring El-Niño for centuries (Giddens 2009). In Mozambique, people of the flood-prone Zambezi river delta construct their houses on higher ground (Artur and Hilhorst 2010). Development NGOs work at the grassroots level in order to support poverty reduction initiatives and assist vulnerable communities and households (Mitchell and Tanner 2006). This knowledge from communities and development NGOs can supplement national and international initiatives and make the best use of local and traditional knowledge (Weissbecker 2011).

Some national governments may assess the vulnerability to climate change in the context of both national and local levels for mainstreaming adaptation (Giddens 2009). Mainstreaming at the national level promotes systematic consideration of climate risks and the urgency for adaptation at all levels of decision making including sectoral and sub-national levels and budgeting (UNDP-UNEP 2011). Moreover, disputes over trans-boundary resources such as water sharing, multinational environmental agreements and managing funds from donors are handled at the national level. Above all, the national government has the authority to integrate the NAPA and the PRSP (GLCA 2009). Prowse, Grist and Souring (2009) note that if the PRSPs and other development plans ignore the climate change impacts and neglect to respond, then donor funding and government expenditure may not be able to reduce the climatic vulnerability of the poor.

National governments also mainstream adaptation measures in the plans and programs of climate sensitive sectors such as agriculture, forestry, fisheries, health, environment, energy and infrastructure. In this process, priorities are highlighted at the sectoral level and investments for reducing climatic hazards are promoted (UNDP-UNEP 2011). For example, in Nepal, in order to combat the impact of climate change in the agricultural sector, the government and industries have innovated drought and aridity resilient varieties of rice from which the drier regions are yielding larger harvests than the wetter regions (Easterling 2011). Likewise, the national government guides the local level integration of adaptation policy and action. This can be done by incorporating adaptation into rural development plans, municipal planning processes, community development strategies, risk assessment practices, emergency preparedness programs and so on (Shaw, Pulhin and Pereira 2010; AfDB et al, cited in Parry, Hammill and Drexhage 2005; UNDP-UNEP 2011).

At the international level, donors include the issue of adaptation in Official Development Assistance (ODA) and development operations. For example, international donors to Nicaragua have integrated natural disaster planning into their policies. The American Development Bank approved a project in Nicaragua in order to support it in the preparation of a program for Natural Disaster Prevention which focuses on the effects of climate change (Berg and Burger 2010). The Disaster Preparedness Program of the European Commission Humanitarian Aid Department also works to reduce the risks of the vulnerable people living in the disaster-prone regions by developing local physical and human resources (Berg and Burger 2010). Besides this, the World Food and Agricultural Organisation (FAO) has built partnerships with various international, regional, governmental and non-governmental organisations having strong comparative advantages in agriculture, forestry, fisheries and climate change adaptation (FAO 2007). The Asian Development Bank (ADB) Policy-2004 focuses on both reactive and anticipated adaptation in the developing countries (ADB 2011). By 2009, the rich nations committed \$180 million for adaptation in the developing countries out of which about \$40 million has been disbursed (Prowse, Grist and Souring 2009).

However, the process of mainstreaming adaptation into development policy involves a number of barriers which are discussed below.

3.4. Challenges of mainstreaming of adaptation

Being a new policy issue, mainstreaming of adaptation lacks a clear definition, which creates confusion or opens the way for manipulation and makes its implementation difficult (Oates, Conway and Calone 2011). Hardee and Mutunga (2009) assessed 41 NAPAs submitted by the LDCs to the UNFCCC, and found that the NAPA process has not been fully successful in integrating adaptation actions with the ongoing national development planning. Griebenow and Kishore (2009) evaluated climate change mainstreaming in the PRS process in four developing countries namely Ghana, Albania, Bangladesh and Vietnam under four themes and found that though the degree of environmental mainstreaming is improving, investments in natural capital and monitoring are still not satisfactory. UNDP-UNEP (2011); and Agrawala and Van Aalst (cited in IPCC 2007, p. 732) identify a number of challenges in mainstreaming, which are related to organisational limitations, information and knowledge, regulation and shortages of funds and other resources. The major challenges of mainstreaming adaptation are discussed below.

3.4.1. At the international level, there are three reasons behind mismanagement and inattention to adaptation. Firstly, present global climate governance focuses on technological and economic issues; secondly, its management style is top-down; and thirdly, there is dependence on external experts. However, adaptation in the developing countries requires inputs from local actors and vulnerable communities through the bottom-up approach, and an integration of local and area-specific knowledge (Ayers, Alam and Huq 2010). At the international level there is no target for adaptation and it is funded by different sources all of which are voluntary, resulting in a ‘piecemeal’ approach (Burton, cited in Ayers, Alam and Huq 2010, p. 279). Shaw, Pulhin and Pereira (2010) argue that a fragmented approach to this complex problem will not be effective.

3.4.2. At the national level, there is conflict between development policy and adaptation policy because poverty reduction strategies, multiyear national and sectoral development plans have shorter durations (3-5 years). On the other hand, climate change is a long term issue and many poor countries do not have extensive experience in longer term planning and budget preparation. Assessment of cost-benefit for adaptation is still an emerging field (Dellink, Bruin and Lerland 2010; Ravindranath and Sathaye 2002). Therefore, it is difficult to integrate plans for longer-term climate change risks into shorter-term development policies (Peltonen, Juhola and Schuster 2011). Further, implementation of the PRSPs and development plans are comparatively more popular because of their direct influence in short-term decision making action (UNDP-UNEP 2011). Countries with limited governance capacity require reforms across all sectors of the economy (GLCA 2009). Likewise, weak legal bases, inadequately equipped and understaffed agencies and unskilled staff impede the smooth running of environmental governance (Sterner and Hammar 2010). There is also lack of coordination among agencies working on climate change, development and disaster risk reduction, and insufficient engagement of stakeholders (Mitchell, Tanner and Wilkinson 2006). These problems are aggravated when there is a lack of experts or loss of institutional memory; for instance, key experts involved in preparing Mozambique’s initial national communication to the UNFCCC are no longer available for making further development strategies (Seita, Boschutz and Klein 2011).

3.4.3. Information on climate history, current vulnerabilities to climate, forecast of climate change and their potential impacts on crop productivity, stream flow, water tables, food consumption, health and population movements are important for the decision makers for understanding the critical linkages between climate change and poor-friendly growth (UNDP-UNEP 2011; GLCA 2009). Decisions for responding to climate change should also be based on scientific information (Easterling 2011; Webstar et.al. 2003, Hill 2009). However, there is a lack

of clear understanding among the policy makers about the implications of climate change on development (Parry, Hammill and Drexhage 2005). The OECD (2009) identifies the lack of relevant climate information among common people as one of the key challenges for mainstreaming. For instance, in Tunisia and Argentina, lack of awareness, information and knowledge were the causes behind delayed response to climate change. Inadequate infrastructure for climate and weather monitoring, and limited technical and computing capacity are other challenges for adaptation (OECD 2009). For instance, Mozambique has limited capacity to disseminate climate information in a timely manner meaning that development plans are often made without incorporating climatic events (IRI, cited in Seitz, Boschutz and Klein 2011).

3.4.4. Poverty is another obstacle for the mainstreaming of adaptation because the extreme poor are unable to respond to the catastrophe (Pittock 2009). Leary et al. (2008) summarise the challenges to adaptation from a group of case studies done on the developing countries of Africa, Asia, Central and South America, Caribbean Islands and the Indian and Pacific Ocean, where poverty was found to be a major barrier to adaptation. Leary et al. (2008) report that people of the dry and drought prone Northern Nigeria and some parts of Sudan are low adaptive because of a lack of financial, physical, human and social capital. Having limited or no access to credit, poor people of these regions can neither purchase agricultural inputs nor afford to conserve resources. According to Goodstein (2011) over-cultivation on small plots by landless farmers deteriorates land fertility, and farming on the slope of mountains or cleared out rain forests leads to soil erosion.

3.4.5. Making the issue of climate change adaptation central to government is also difficult as it requires that the process of mainstreaming adaptation to be performed by financially influential ministries such as Planning or Finance (UNDP-UNEP 2011, Stern 2007). However, in the developing countries, the Ministries of the Environment act as the focal points for implementing the UNFCCC process. To overcome this problem, in Kiribati the issue of climate change was first dealt with by the Ministry of Finance and Economic Planning and then shifted to the President's Office (Mitchell, Tanner and Wilkinson 2006). Regarding this institutional issue in Kenya, Oulu and Boon (2011) suggest that a high-level strategic office, unit or department, preferably under the Office of the President or Prime Minister, should oversee such environmental issues. Further, the mainstreaming of adaptation requires strict regulations, strong institutional capacities and better coordination (UNDP-UNEP 2011).

3.4.6. Funding for adaptation may have to compete for finance with mitigation and development affairs (Leary et al. 2008; Giddens 2009; Robert, Parrotta and Wreford 2009). Regarding the

international source of adaptation funding, Ravindranath and Sathaye (2002) note that there is a lack of commitment and available financing is insufficient. In Copenhagen in 2009, the developed countries pledged to provide \$100 billion a year after 2020 to all poor countries to adapt to climate change, although no agreement was reached in COP 17 in 2011 in Durban regarding sources, spending or management of this money (Rahman 2011). GLCA (2009) observes that from 2001 to 2009 the rich nations committed about \$18 billion, yet, less than \$0.9 billion has been disbursed. In terms of this funding crisis and its impact on mainstreaming, Sharma and Tomar (cited in Lebel et al. 2012) note that municipal governments in the developing countries are unable to undertake planning and programs for climate change adaptation or to render services because of insufficient resources. Additionally, administration of adaptation funds is contentious because the developing countries demand that these funds be managed by an entity other than the GEF (Burton, Diringer and Smith 2006). Funding for adaptation through ODA is also strongly criticised by the developing nations because they believe that climate change is caused by the industrialised countries and it should be their responsibility to finance adaptation in the developing countries through channels other than ODA (Ahmed 2010; Giddens 2009; Shah 2012). Internal management of adaptation funds is another problem. For instance, in Mozambique, there is competition among government agencies to establish control over forthcoming adaptation funding (Artur and Hilhorst 2010). Finally, additional funding from donors encourages recipient countries to design separate projects for climate change adaptation rather than undertaking mainstreaming (Oates, Conway and Calone 2011).

3.4.7. Key sectors of the economy such as agriculture, land, water and sub-national bodies should be involved in the mainstreaming process (UNDP-UNEP 2011). However, managing resilience in the agricultural area requires close monitoring of environmental conditions (Easterling 2011). Easterling cites an example from the US National Phenology Network under which a group of volunteers across the USA monitor the changes in lilac blooms influenced by warming spring temperatures. Volunteers report the first bloom date and other phenological information to a central data repository where it is archived and made available to researchers. However, this type of advanced research facility is absent in most of the developing countries. Easterling (2011) also maintains that sudden and irreversible damage such as the loss of national grains storage caused by climatic hazards as well as construction of infrastructure involves enormous costs. Also, irrigation cannot be expanded because of insufficient water supply as it happens in Tunisia (Leary et al. 2008).

3.4.7. Political willingness is necessary for making decisions on uncertain issues like climate change on the basis of limited or inaccurate information (UNDP-UNEP 2011). Above all, climate change poses risks which are beyond experience related to drought, heat waves, and hurricane intensity (IPCC 2007). Morris et al. (2010) argue that the damages from Hurricane Katrina were equivalent to about \$100 billion, and there is no guarantee that the next event will cost less than double this cost.

3.4.8. Population Action (2010) points out that overpopulation in the climatically hazardous areas creates extra pressure on natural resources, and obstructs adaptation.

This chapter shows that though mainstreaming of adaptation is suggested as a way out for the developing countries in order to balance climate change adaptation and development, this process confronts a number of impediments. The next chapter will discuss how Bangladesh, being both a developing country and climatically the most vulnerable, is mainstreaming its adaptation planning, and what challenges are associated with this process. For this purpose, the considerations discussed in this chapter are going to be used as a framework for analysing the case of Bangladesh.

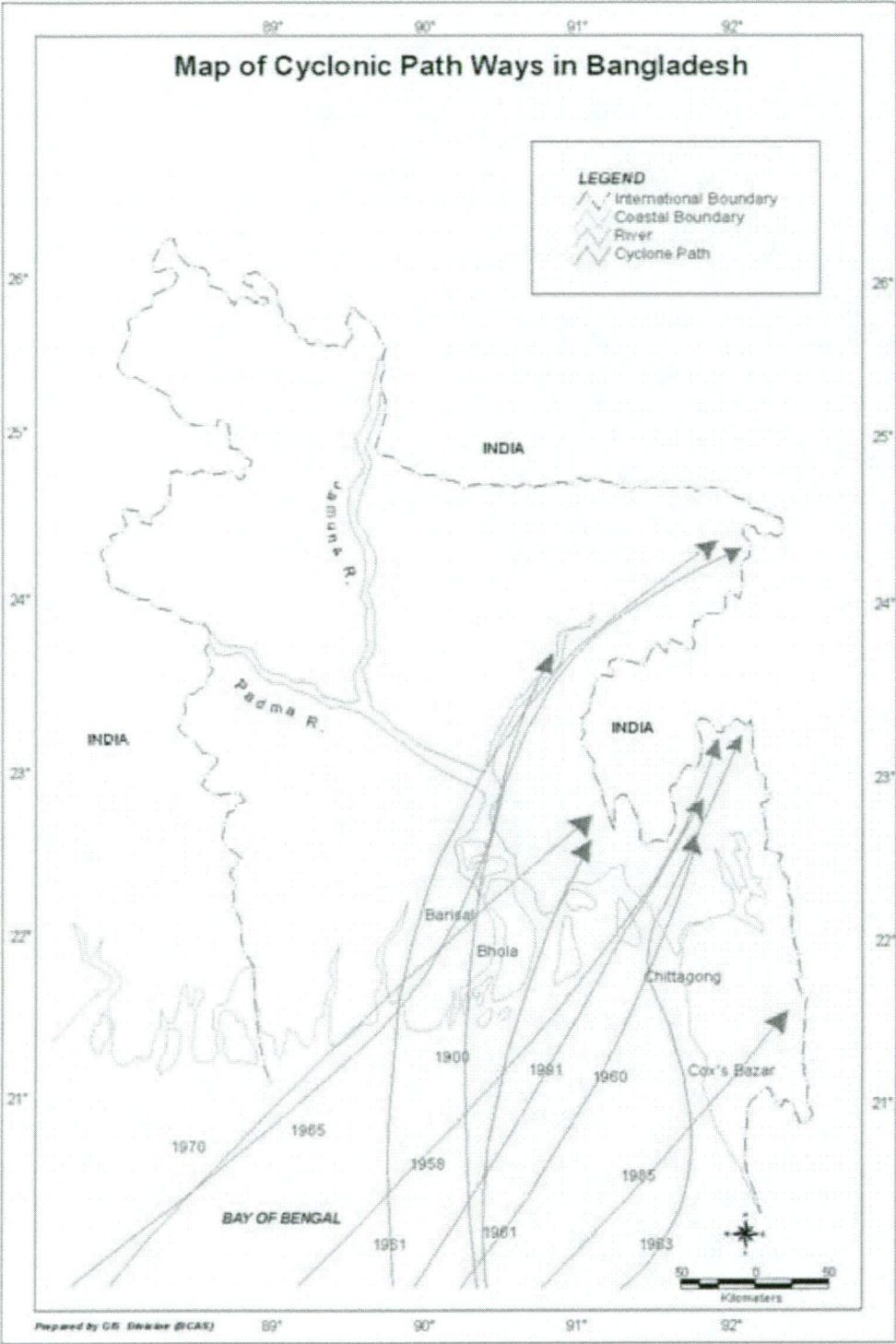
Chapter 4

Bangladesh and Climate Change Adaptation and Mainstreaming

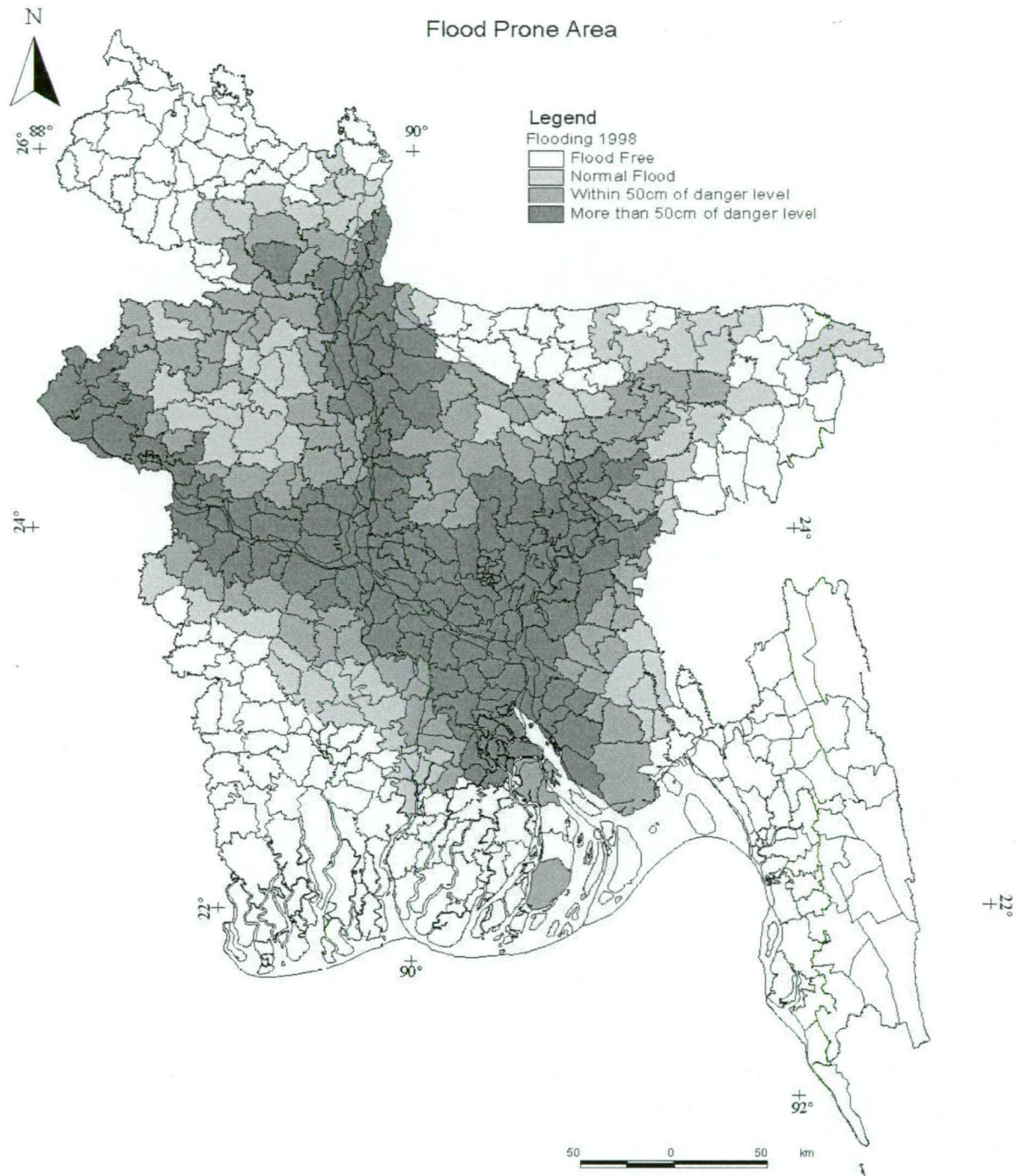
This chapter will first discuss the projected impacts of climate change on Bangladesh in terms of economy, ecology and health. Then the initiatives at the government and non-government levels such as formation of different committees, preparation of the NAPA, undertaking various projects and the process of mainstreaming will be illustrated. Finally it will explain the challenges of mainstreaming in Bangladesh which are related to policy measures and characteristics of the country as a developing one.

4.1. Bangladesh, the most vulnerable country to climate change

Bangladesh is vulnerable to the effects of climate change because of its geographical location and low-lying land structure; agro-based economy; and lower adaptive capacity (Giddens 2009; Stern 2007). The weather of Bangladesh is characterised by hot and humid summer, heavy rainfall in the rainy season and a few months' dry and mildly cold winter (Huq and Ayers 2008). Major potential impacts of climate change on Bangladesh are a higher level of evaporation and longer summer, shorter winter and reduced rainfall, which may cause water shortages. On the other hand, during the rainy season, more intense rain and rapid melting of the Himalayan glacier may cause floods; stronger tropical cyclones in the Bay of Bengal may cause frequent storm surges and coastal flooding and salinity intrusion into crop land which will make them unsuitable for cultivation (Pittock 2009; Mazumder 2010; Huq and Ayers 2008). A one-metre rise of sea-level will engulf 15 percent of its land and up to 30 million Bangladeshis may become climate refugees (Pittock 2009). In coastal areas, agriculture, industries, infrastructure, livelihood, marine resources, forestry and biodiversity, human health and utility services will all suffer, which may cause the GDP to fall by between 27 and 57 percent (Rahman et al. 2007; Huq and Ayers 2008). Therefore, climate change will affect the process of sustainable development (Pittock 2009). The effects of climate change in terms of cyclonic pathways and flood affected areas are shown in Map 1 and Map 2.



Map 1 (Rahman et al. 2007).



Map 2 (Agrawala et al. 2003).

In Bangladesh, the agricultural sector contributes 20 percent of the GDP and employs 65 percent of the total workforce which makes the economy sensitive to climate change (Mazumder 2010; Yu et al. 2010). Bangladesh lost 0.5 million tons of rice annually during the period between 1962 and 1988 because of flood (Paul and Rashid, cited in Huq and Ayers 2008). The shorter length of winter has reduced potato production, and increased water stress may reduce rice production by 8 percent and wheat production by 32 percent by 2050 (Mazumder 2010). Moreover, change in

temperature and deterioration of water resources will affect the climate-sensitive species, and there will be soil erosion and land quality degradation (Huq and Ayers 2008). Rising sea-level is likely to submerge the Sundarbans, the biggest mangrove forest in the world, which absorbs strong winds and waves and works as a flood wall (the Union of Concerned Scientists, cited in Anam 2011). Decline in agricultural production pushes the farmers to over-exploit resources of the Sundarbans (Palma 2012). Climate change also affects human health. In 2004, thousands of people died and millions were affected because of flood and cyclone (Mahmood 2011). Malaria, dysentery, diarrhea, dengue, hypertension, asthma and skin diseases are all increasing in Bangladesh (Huq and Ayers 2008; Pittock 2009).

BARCIK (2009) illustrates an example of the impact of climate change from Gabura, one of the smallest administrative units in the South-West of Bangladesh, which was destroyed in 2008 by intense cyclone 'Sidr'. Gabura was fully inundated as the cyclone destroyed the area-protecting dam, and prolonged water logging ensued. In 2009, another cyclone, 'Aila', hit Gabura with more extreme force and destroyed all the sluice gates and polders of dams and overflowed the highest part of the area-protecting dam. This cyclone was beyond the past experience of local people. Due to the disaster, all the water bodies filled with saline water except one pond. The local residents had to depend on this for drinking water which dried up because of over extraction and lack of rain during the monsoon season. Also, lack of surface fresh water created competition among farmers for deep tube well water for irrigation, and some businessmen took advantage of the situation. Shortage of rain reduced vegetable production in homestead gardens, and also resulted in extreme heat and consequently various diseases.

Therefore, the impact of climate change is already evident in Bangladesh, and not only Gabura but also many other parts of Bangladesh especially the South and South-Western coastal zones and Northern drier regions, are vulnerable to this and are already experiencing extreme weather events. Also, a rising temperature will affect the whole country. Natural disasters such as flood, drought and cyclone are regular in Bangladesh and being a developing country it is already overwhelmed with political and economic pressures, and land scarcity (Ahmed 2006; Matthew 2009; Displacement solutions 2010). The impact of climate change will worsen this scenario. Therefore, the issue of climate change necessitates a response at all levels, in particular in terms of adaptation.

4.2. Response to climate change

4.2.1. Response at the government level

The government of Bangladesh has taken various policy measures including regulatory, financial, information-based and institutional. This section will discuss the policy actions taken by the government, and actions taken at the individual, community and development partners levels.

The government of Bangladesh treats climate change as both an environmental and a developmental issue (MoEF 2009). Adaptation is identified as one of the strategic goals in its policy actions (Griebenow and Kishore 2009). Huq and Ayers (2008) identify a number of actions taken by the government of Bangladesh. Firstly, formation of a national climate change committee in 1994 for policy, guidance and overseeing the implementation of the UNFCCC process in Bangladesh. Secondly, establishment of an inter-ministerial committee on climate change headed by the Minister for the Environment and Forests. Thirdly, there is a National Environment Committee chaired by the Prime Minister. All of these committees are comprised of representatives from the cabinet, members of the parliament, government organisations and civil society. Finally, a number of studies have been carried out by government agencies though research institutes and NGOs have contributed more in this area.

The NAPA and PRSP are the two main policy instruments for integration of climate change adaptation into development planning. The government of Bangladesh first developed the NAPA in 2005, which was upgraded to the Climate Change Strategy and Action Plan in 2008 (BCCAP-2008) and was revised in 2009 by incorporating the suggestions from the Cabinet Review Committee (MoEF 2009). The BCCAP facilitates mainstreaming of adaptation to climate change through the establishment of linkages and promoting inter-sector planning (ADB 2011). The PRSP supported the preparation of the first National Communication on Climate Change vulnerability in the country and the NAPA. This maintains a policy and institutional framework to integrate climate change adaptation activities in all relevant public and private undertakings (MoEF 2009). The PRSP is committed to building capacity in the planning and implementation of the agricultural and water sectors; promoting community-based adaptation projects; and has recommended arranging international financial assistance (Griebenow and Kishore 2009). The interim PRSP of Bangladesh recognises a direct connection between poverty and vulnerability to climate change (OECD 2009). This has been successfully able to incorporate the issue of raising awareness about climate change in line ministries (Agrawala et al. 2003).

In Bangladesh, 'Five Year' plans are undertaken to implement development programs. The objectives of the fifth Five Year plan (1997-2000) of Bangladesh were sustainable economic growth, equity, poverty alleviation, human resource development and sound environmental development (Agrawala et al. 2003). On the other hand, the Climate Change Action Plan is based on six pillars, which are: food security, social protection and health; comprehensive disaster management; maintenance of the existing infrastructure and constructing new defenses; research and knowledge management for forecasting probable scale and timing of climate impacts; mitigation and low carbon development; and capacity building and institutional strengthening (MoEF 2009). Development plans in Bangladesh therefore consider climate change, and climate change adaptation plans also aim to involve development.

Since the 1970s, the government of Bangladesh, with assistance from the development partners such as Japan, European Union and the World Bank, has invested billions of dollars in order to protect rural areas from severe floods. It has undertaken rural flood protection and drainage schemes, river embankments and polder schemes in coastal areas and built 2000 cyclone shelters. The government has developed community based programs and early warning systems (MoEF 2009). It plans to overcome the problems of food insecurity and production shortfall by agricultural development, credit facilities, infrastructure improvement, crop diversification, irrigation schemes and employment generation (Huq and Ayers 2008; MoEF 2009). These general development supports have contributed to reducing the economy's sensitivity to severe climate events (Stern 2007).

The government recognises adaptation as an integrated approach involving different ministries and agencies, civil society and business sectors. Realising the diversity and complexity of the problem of climate change the government has issued a Standing Order for all Ministries, Divisions/Departments and Agencies for preparing their own Action Plans with respect to their responsibilities (Rahman et al. 2007). Main implementing ministries for BCCAP are the Ministries of Environment and Forest (MoEF), Flood and Disaster Management (MoFDM), Water Resources, Local Government, Agriculture, Fisheries and Livestock, Power-Energy and Mineral Resources, Health and Family Welfare, Communication, Foreign Affairs and Planning Commission (MoEF 2009). Huq and Ayers (2008) note that the MoEF, being the leading Ministry, and the Department of Environment (DoE) as the main implementing agency for climate change action, are being strengthened. A 'Climate Cell' within DoE has been formed for coordination of climate change issues. Moreover, climate change has been integrated into sectoral plans and national policies such as Coastal Zone Management Programs, Disaster

Preparedness Plans, the National Water Policy 1999, the National Water Management Plan 2001; National Environmental Management Plan, the National Land Use Policy and the National Forest Policy. The new Education Policy of Bangladesh has also addressed the issue of climate change (Sarker and Azam 2012).

The Bangladesh government pursues both pro-active and re-active adaptation measures through the Participatory Disaster Management Programme (PDMP). Proactive measures are creating awareness, enhancing skills of the people dealing with disasters, improving warning systems and setting disaster action plans in the most disaster prone areas (Huq and Ayers 2008). In Bangladesh, flood protection activities are regular, and satellite and information technology are used for forecasting cyclonic disasters and weather (Giddens 2009). The Ministry of Information (MoI) disseminates information on disaster preparedness and survival techniques through leaflets, booklets, and different programs in the mass media such as radio, television, news media and films. Broadcasting of cyclone warnings through community radio and cell-phones in the coastal areas has enhanced resilience (ADB 2011).

In order to resolve the problem of finance, the government of Bangladesh, with Sweden and three other donor countries, has created a common trust fund named Bangladesh Climate Change Resilience Fund (BCCRF) which consists of \$125 million (SIDA 2012). Bangladesh has allocated \$40 million to this fund from its national budget. This fund will be used for implementing programs under the NAPA or BCCAP. There is a provision of 10 percent allocation of the fund for the projects administered by civil society (SIDA 2012). During the fiscal year 2009-10 and 2010-11, the government of Bangladesh has allocated \$200 million for adaptation and mitigation from its budgetary resources (Ahmad 2011).

The government takes action at the macro level and it is not always possible to address problems at the individual and community levels. So, integration of adaptation initiatives at the individual and community level remains important.

4.2.2. Response at individual and community levels

Other than government initiatives, traditionally, the people of Bangladesh are adaptive to nature such as in the low lying areas; people build their houses above the regular flood level, and adjust their cultivation time (Giddens 2009). Floating gardens are another innovative production process which were first introduced in Bangladesh and are now practiced in other countries. This system uses aquatic weeds as a base on which crops can be grown (Paul 2012). In the coastal areas, after a cyclone all the sources of fresh water are filled with salty water and the disaster

washes away everything. This is why when people of coastal areas hear the cyclone warning, before taking shelter in cyclone centre, they store fresh water in plastic containers, wrap dry food, match-sticks, candles and life-saving medications with polythene or plastic paper and bury them in a designated place so that after the disaster they can start life again. Following the cyclone event almost all the families repair their dilapidated or destroyed houses (CCC 2009).

On the other hand, both the government and NGOs of Bangladesh have been trying to strengthen the resilience of local communities by providing training, incorporating local knowledge and expertise, and ensuring their participation (MoEF 2009). Integration of local knowledge is important as outlined in Chapter 2. In the coastal mangrove forest areas, now, the government agencies consider local communities as potential protectors and managers of the forest resources rather than a threat (GoB-UNDP 2008). A pilot program on community engagement in cooperation with local government in flood management has become successful in reducing the impact of flood in a locality (Yohe et al. 2007).

4.2.3. Contribution of development partners

Foreign assistance plays an important role in the development process of Bangladesh, which received a total of around \$53.93 billion of foreign aid from 1972-2006 (Khan nd). However, 22 to 37 per cent of aid-funded projects in Bangladesh are affected by climate risks, which creates concern among donors to Bangladesh (Huq and Ayers 2008). The Department for International Development (DFID) has mainstreamed climate change activities into its development programs and finances the Comprehensive Disaster Management Programme (CDMP) under the MoFDM (UNEP 2010). This has also launched a pilot project in Bangladesh to offer weather based index insurance at the community level (Stern 2007). Another DFID funded project in Bangladesh is ‘the Char Livelihoods Programs’ (CLP) which builds flood protection infrastructures; makes arrangements for safe drinking water and sanitation; provides cash for work, facilitates other financial affairs, and ensures an education and social safety net (BCAS 2010). It was stated in the Daily Star (online, Bangladesh, 1 November, 2011) that, the European Union is funding a 6 year project named ‘Strengthening Adapting Farming in Bangladesh’ in the Northern drought-prone areas of Bangladesh in which 2700 people from 1400 families of 30 villages under three sub-districts have been selected to be beneficiaries. The FAO undertook a project in Bangladesh to enhance adaptive capacity and resilience to drought and other climatic impacts (IASC 2009). The United States Agency for International Development (USAID) is funding a five-year project for an early warning system, namely ‘the Community Flood Information System (CFIS) which monitors and forecasts floods and cyclones, helps the Bangladeshi community to adapt to natural

disasters and protect crops, habitats and livestock (UNFCCC 2006). The World Bank financed the Bangladesh Climate Change and Sustainable Development Study 2000 (Huq and Ayers 2008). The UK government has pledged \$132 million to the Bangladesh Climate Trust Fund (SIDA 2012). The Daily Star (online, Bangladesh, 20 October, 2011) stated that 350 farmers of the drought prone eight northern districts have become successful in cultivating two drought-resilient varieties of rice developed by the International Rice Research Institute.

Both national and international NGOs have undertaken actions for mainstreaming adaptation in their development initiatives. Mitchell and Tanner (2006) report that CARE, an international NGO, worked between 2002 and 2004 for a project named 'Reducing Vulnerability to Climate Change' which intended to strengthen the community adaptive capacity in the South-Western region of Bangladesh. With the cooperation of 17 partner organisations at the local level, CARE had been successful in helping 270 households to grow vegetables on floating gardens in waterlogged areas and 1700 households began rearing ducks. The Canadian International Development Agency (CIDA) funded this project. Practical Action, a local NGO, is working in Gaibandha, a Northern drought-prone district in Bangladesh, in order to build resilience among the homeless, landless and poor communities against drought, river erosion, storm, cold waves and other climatic hazards as well as poverty (Rahman et al. 2007). Furthermore, Bangladeshi scientists and civil society have been playing an important role at the international level in promoting the issue of community based adaptation (Rahman 2011).

4.2.4. Government actions at the international level

Climate change is a global problem, and Bangladesh requires adaptation funding from the international communities. So, Bangladesh has taken action at the international levels. Bangladesh has placed the demand for money for adaptation through LDCs, Group-77, China and other groups and is seeking strong political commitment and support from the international community (MoEF 2009). In COP17 in Durban, Bangladesh sought additional resources from the rich nations for the period of 2013 to 2019 on an incremental basis to reach \$100 billion (Rahman 2011). Bangladesh played a leading role in COP17 under the umbrella of the Climate Vulnerable Forum on behalf of three negotiating groups of vulnerable countries, namely, LDCs, SIDs and Africa (Huq 2011). On the other hand, the Bangladesh government includes non-government experts and representatives in the official delegation and over the years the Bangladeshi delegates have gained remarkable negotiating capabilities (Huq 2011). Also, the government consults with stakeholders before joining international conferences on climate change and shares its experiences after.

4.3. Challenges for mainstreaming adaptation in Bangladesh

As the previous section has shown, the people of Bangladesh are adaptive in nature and government has undertaken various policy measures in order to mainstream adaptation. Development partners are also supporting this process. However, these are insufficient compared to the vastness of the predicted impacts of climate change (Rahman et al. 2007). The challenges for mainstreaming adaptation in Bangladesh are discussed below.

4.3.1. Information and knowledge sharing: The first challenge is about information dissemination and knowledge sharing because the BCCAP has not included the Ministry of Information (MoI) as one of the main implementing ministries (MoEF 2009). In Bangladesh only the DoE and a few other autonomous bodies and private research institutes have been working on climate change and poor documentation systems and limited access to the results of research weakens the knowledge sharing and information dissemination system (BCAS 2010). There is an absence of pragmatic and ecosystem-based databases, and a lack of understanding of the issues and implications of climate change among the policy makers and implementers, civil society, professionals and the vulnerable community (Rahman et al. 2007; MoEF 2005). Shaw, Pulhin and Pereira (2010) cite an example from the Kurigram district in Bangladesh where almost 80 percent of the farmers believed that rainfall had decreased although statistics showed that the average annual rainfall was increasing. The reason behind the gap between the reality and farmers' belief was that monthly rainfall patterns shifted significantly which affected the agricultural production. In this case, since the farmers were not provided with weather information, they did not change the timing of cultivation. Moreover, weather forecasts in the mass media are prepared and delivered in highly educated language and technical terms which are difficult for the largely illiterate farmers and fishermen to understand (Sarwar 2005).

4.3.2. Poverty: In Bangladesh the central focus of the planning of the government, non-government and international donors is poverty reduction (Rahman et al. 2009). Almost half of the population of Bangladesh lives below the UN designated poverty line, 28 percent of whom are ultra poor suffering from continuous food and water insecurity, and are under threat of losing livelihood and even lives because of frequent natural disasters (Matthew 2009; WFP 2011). Therefore, the main aims of policy instruments such as PRSP and the MDGs are employment generation, food and water security, education and gender equality (WFP 2011).

4.3.3. Limited resources: Being a developing country, Bangladesh has limited resources to undertake adaptation initiatives. It was stated in the Daily Star, (Bangladesh, online, 2 March

2012) that in order to cover the adaptation costs for potential risks of cyclones and floods, Bangladesh requires around \$5.7 billion by 2050. Out of this requirement \$3.3 billion will be required for maintenance of damages caused by extreme weather events and \$2.4 for avoiding further damage and loss from cyclonic storm surges. So, Bangladesh requires funding from international sources. However, among the three main funding mechanisms under the UNFCCC, namely Special Climate Change Fund (SCCF), LDCF and Adaptation Fund (AF), Bangladesh has received \$3.3 million only from the LDCF (Ahmad 2011).

4.3.3.1. Another issue is **fund delivery systems** from the donor countries for which Bangladesh has turned down £60 million offered by the DFID for climate change (Williams 2010). The DFID wanted to give that money through the WB. Bangladesh suggested that the World Bank delivery process might involve hard conditions. The most important thing was that the WB would have deducted £4.9 million for administrative purposes and a 13 percent cut for administering the fund. Therefore, Bangladesh wanted the money to be channeled through the United Nations, and consequently failed (Williams 2010).

4.3.4. Organisational: Despite the government initiatives previously outlined, Bangladesh lacks a suitable institutional, decision making and planning structure for dealing with climate change (Koudstaal et al. 1999). This is mainly because of lack of interest among high-level-policy makers on this issue (Huq et al. 2003). Other barriers are highly centralised administration; fragmented and ineffective resource allocation and management systems; and project oriented planning instead of resource based planning (Koudstaal et al. 1999; MoEF 2007). Likewise, the adaptation activities are confined to a pilot scale by government agencies, NGOs and private research organizations, and they have shown limited capacity to integrate this learning into national and local development planning (Rahman et al. 2007; Mitchell, Tanner and Wilkinson 2006). There is also an absence of skilled manpower in the technical areas of water management and so on (MoEF 2005). Adaptation through improved water efficiency, crop diversification, and development and introduction of new crop varieties requires research. However, the degradation of the Agricultural Research Institute in Bangladesh has slowed the initiatives for development of climate change resilient varieties (Rahman et al. 2007).

4.3.4.1. There exist **inefficiencies** within the government agencies in managing natural disasters. For instance, after the cyclone 'Aila' in 2009 the concerned authorities failed to reconstruct the damaged embankment and rehabilitate the displaced people for a long time (Roy 2010).

4.3.4.2. Lack of coordination: The government has established the Climate Change Cell for coordination of climate change issues. However, GoB-UNDP (2008) reports that lack of coordination between government agencies is an obstacle to mainstreaming adaptation. For instance, the Department of Forest (DoF) plants vegetation in the mangrove forests of the newly emerged land in coastal areas. However, after 20 years of this plantation the Ministry of Land (MoL) divides this land among local communities who clear the forest in order to build houses and other structures (GoB-UNDP 2008). As a result, the DoF's plantation project in these mangrove forest areas fails. BARCIK (2009) observes that the NAPA has proposed construction of infrastructures in the most vulnerable areas by the Local Government Engineering Department, Department of Bangladesh Water Development Board and Disaster Management Bureau all of which are under separate ministries. These departments routinely construct dams, culverts, cyclone shelters, and sluice gates mainly in the South-Western and North-Eastern regions under different projects without any coordination among them, which creates overlapping of projects and causes environmental hazards such as water logging. Also, after completion of projects, there exists no authority to maintain these infrastructures (BARCIK 2009). Constant monitoring and maintenance of the flow regulations on coastal embankment and interest and active participation of the government, donors and local community are necessary for the durability and sustainability of coastal embankments and salinity reduction projects. However, both national and local institutions prefer rehabilitation to preventive maintenance (Agrawala et al. 2003).

4.3.4.3. There is also a **lack of assessment of sectoral impacts and as well as capacity** to find out the gap between existing institutional capacity and requirements (GoB-UNDP 2008). Further, some development policies of the government are contradictory with climate change responses such as policies for constructing tourism infrastructures in the vulnerable South Eastern coastal zone and Sundarbans (Agrawala et al. 2003). Similarly, dyke construction in the Sundarbans mangrove forest coastal areas may hinder the tidal interface between land and sea and harm the plants of Sundarbans (Sarwar 2005). Rahman et al. (2007) observe that increasing surface water availability is necessary to address the problem of drought and salinity in the dry season, and augmentation of river water through increasing local storage capacity of surface or groundwater can protect the Sundarbans. However, these projects involve higher costs, and also culverts, bridges and regulators hamper drainage systems (Rahman et al. 2007).

4.3.4.4. There is a **gap in the planning process** to accommodate the issue of climate change in the existing programme and planning. BARCIK (2009) reports that the NAPA was developed in

November 2005 and waited for funding to be implemented. Most of the partners of NAPA were government agencies having their own regular staff and resources, and spent several million Bangladeshi taka during the period 2006 to 2008 to implement similar activities. NGOs were also working on the same issue. Nevertheless, the NAPA failed to be integrated in these ongoing functions. Another observation made by BARCIK (2009) is that NGOs are working only for plantations in rural areas, however, not for conservation of bio-diversity and ecology. Griebnow and Kishore (2009) argue that though the PRSP in Bangladesh has been increasingly including environmental issues, its focus is on short-term changes in the climate not on long-term issues.

4.3.4.5. There is lack of integration of local knowledge in the NAPA which was prepared by a group of experts on the basis of secondary document consultations. Local level knowledge and experiences from different communities such as farmers, fishermen or weavers have not been included in this document, which is a top-down adaptation framework (BARCIK 2009; Nakalevu 2006). Ecologically, Bangladesh has 30 areas and each of these areas has different climate, land patterns, crop patterns, livelihood style and adaptation practices. For example, the level of drought in the North-Western part of Bangladesh is different from the Northern part (BARCIK 2009). Also, different regions have different adaptation patterns, for instance some families in the Mongla sub-district in Southern Bangladesh reduce their vulnerability to climate change by receiving remittances from other family members working in big cities of the country, cultivating fresh water crops in the dry season and crabs in the saline water in the rainy season (Ahmed 2010).

4.3.5. Loss of institutional memory: High turnover of officials in the government offices and discontinuity of experts in the international delegation for climate change conferences cause loss of institutional memory (Luxbacher 2011; ADB 2011). Besides this, late starting of climate change projects is another obstacle to mainstreaming adaptation. It is seen that the initiators of the project have been retired or posted to other places; new officials come without prior knowledge about the project.

4.3.6. International dimension: The climate change problem in Bangladesh has an international dimension regarding water sharing with India because India has a plan to divert water from the Himalayan river components flowing through the Northern and Eastern side to the central and drier regions of India (Pittock 2009). A cross-boundary institutional arrangement such as the Ganges Water Sharing Treaty is required to resolve this issue (Agrawala et al. 2003). There is

also a shortage of experts with international experience on negotiations, networking, and policy analysis in Bangladesh (Rahman et al. 2007).

4.3.7. Population problem: Hardee and Mutunga (2009) argue that faster growth of population worsens the vulnerability and reduces resilience through food insecurity, natural resource depletion or degradation, water resource scarcity; poor human health; migration and unplanned urbanisation. However, the NAPA of Bangladesh has failed to recognise this close link between population and climate change (Population Action 2010). The size of Bangladesh is too small and resources too scarce to accommodate and feed 160 million people (FAO 2010). Population density in Bangladesh is more than 1000 per square kilometre. The capital of the country, Dhaka, is the most densely populated city in the world where 2,693 persons live per square kilometre (Pulitzer Centre 2010). Every day 2,200 people enter Dhaka city and additional people are building houses and other structures on valuable wetlands and creating tremendous pressure on its natural resources (the Woodrow Wilson International Centre for Scholars 2011). On the Eastern and Western peripheries, several rivers have been filled up and used as residential and commercial areas. Agricultural lands are overexploited in order to fulfill the additional food requirements of the extra population (Islam and Rahman 2011).

4.3.7.1. Climate change may aggravate the **food crisis** in future. Regarding additional food demand in the future, Basak (2011) observes that the population growth rate in Bangladesh is two million per year and total population will reach 233.2 million by 2050, which will require more than 55 million tons of rice per year. Rice shortages derived from faster population growth are predicted as 5.08, 6.02, 7.80 and 10.50 million tons in the years 2020, 2030, 2040 and 2050 respectively. This food crisis will be intensified because of rising temperature derived rice production shortages, which are forecast to be 2.59, 2.24, 2.62 and 3.43 million tons for the same consecutive years. Therefore, the combined effect will be shortages of rice by 7.68, 8.50, 10.40 and 13.93 million tons for these projected years.

4.3.8. Community based adaptation: Regarding community based adaptation, Ahmed (2010) argues that it will be difficult to face the challenges through community based adaptation such as floating gardens and reinforced houses for a long period of time. There is lack of clear distinction between community based adaptation and community based development which creates confusion among practitioners and donors (Ahmed 2010).

4.3.9. Gender and vulnerability: In the 1991 cyclone and flood, the number of deaths of women was five times higher than that of men. The main reason is that information was

transmitted in public places where the only audience was male and it was not properly communicated to the rest of the family members (CCC 2009). Besides this, women had to manage the whole household and take precautionary measures to safeguard the family's assets including livestock before taking temporary refuge to cyclone shelters. CCC (2009) maintains that women also avoid going to cyclone shelters due to social insecurity and the unhygienic conditions of the shelter. Furthermore, for the elderly and pregnant women, it is difficult to walk in the rural muddy roads under the stormy weather to go the cyclone centre far from home. So, many women die only because of staying at home during extreme weather events.

It is clear that while some of the challenges discussed above are related to policy measures such as NAPA as a regulatory instrument which fails to be fully integrated into development plans, others arise from traditional forms of institutional arrangement such as the gap between plan and implementation, and lack of coordination. Other challenges are connected to the characteristics of developing countries like Bangladesh, such as weak infrastructure and higher population growth rates. Effective application of different policy instruments and socio economic development may help to minimise the barriers which are discussed in the following chapter.

Chapter 5

Recommendations and Conclusions

It is not always possible to solve one problem with only one policy instrument. One particular problem may require more than one policy instrument. Again, it is difficult to differentiate between policy instruments. The government of Bangladesh has been pursuing information-based, regulatory, organisation-based and financial instruments for the mainstreaming of adaptation. These policy instruments are used separately as well as jointly. Their effectiveness requires minimisation of the problems associated with these.

5.1. Recommendations

5.1.1. Information-based instruments

The Bangladesh Climate Change Strategy and Action Plan should consider the MoI as one of the main implementing ministries regarding information dissemination (MoEF 2009). This situation calls for continuous top-down flow of information to sensitise all parts of the government, from the policy planners to implementers, about the impacts of climate change on the Bangladesh economy and people's living conditions. In order to create interest among the high level policy makers and political leaders, media and civil society can play an important role through campaigning.

Vulnerable communities need to be aware of the risks. Timely and accurate weather information allows farmers, fishermen, and residents of the drought prone Northern areas, the South and South-Western coastal areas, and other flood prone regions to take appropriate adaptive measures, such as changing cultivation times. Also, a disaster calendar mentioning the dangerous time periods and marked areas for farming and fishing may assist the crop and fish farmers of the coastal areas to avoid salinity intrusion, storm surges and cyclone damage. Mass media message delivery in simple language, and in some cases in the local dialect, will help the target group to understand the situation properly and take action before, during and after the disaster. The flow of information should be available to men and women equally. On the other hand, local level adaptation knowledge and strategies can be incorporated in the national development policies through a bottom-up flow of information. ADB (2011) suggests delivering information and research results in the form of coping strategies.

5.1.2. Regulatory instruments

There should be strict regulations over building settlements in the flood or cyclone prone areas. Stringent enforcement of building codes, zoning and land use law is important. During the design of infrastructures, their durability and sustainability must be considered in the context of climate change. Design of flood or cyclone shelters should accommodate the aged, pregnant women and breastfeeding mothers. Likewise, there should be vigilant teams in the emergency shelters which work in cooperation with the local people of the disaster prone areas during disasters to ensure the safety of young girls and women. The NAPA should recognise the close link between climate change and the rapid growth of population. For controlling population, regulatory measures like the Chinese 'one child' policy may help. Additionally, the introduction of planning measures to achieve an equal distribution of population in all the regions will reduce pressure on the big cities particularly the capital city Dhaka.

5.1.3. Finance-based instruments

Finance-based instruments such as the development and facilitation of alternative sources of income can reduce economic sensitivity to climate change. About 2 million workers are employed in the garment manufacturing sector in Bangladesh (Rashid 2006). So, the government has a responsibility to take measures that ensure the smooth running of this sector, and to put more emphasis on other non-agricultural sectors such as cage cultivation or pearl culture in the coastal areas and small scale industries in rural areas. Post-disaster financing, access to credit and micro credit, a commodity support fund, increased remittances and enhanced donor assistance may reduce the sensitivity of the economy to the effects of climate change. Expansion of insurance services to the vulnerable areas and development of index-based weather insurance and its connection to micro-credit for agricultural inputs may be helpful. In the coastal areas, participatory community funds, saved for and managed by the fishermen may help them during harvest failure and natural disasters (Sarwar 2005). Both government and the private sector can invest in agricultural research and the advancement of technologies. Different sources of funds for climate change should be harmonised and aligned, and there should be governance mechanisms for appropriate management of outdated funds.

5.1.4. Organisation-based instruments

Organisation-based instruments can be used for bringing change to institutional mechanisms, upholding institutional memories, planning, and building and maintaining infrastructures.

5.1.4.1. Institutional mechanisms: Capacity should be built at institutional, systematic and individual levels for coping with climate change challenges. Officials must be trained in managing projects as well as in climate change negotiation at national, sub-national and international levels. Skill development within the government agencies on technical aspects of climate change adaptation methods, such as water management, will help to address them properly. Local government capacity in mainstreaming efforts should be utilised fully. A cross-sectoral approach will be helpful to implement adaptation programs in different sectors. The knowledge gained through pilot programs should be applied at the national and local levels. Better coordination among government departments in building infrastructures, supplying agricultural inputs and creating awareness is also important.

5.1.4.2. Institutional memory: In order to maintain institutional memory regarding change projects, it is vital that officials are not frequently transferred and also that projects are started in due time. Continuation of the involvement of key experts throughout the entire international negotiation process is another crucial part of ensuring institutional memory.

5.1.4.3. Planning and budget: The NAPA or BCCAP should emphasise resource-based planning instead of project-based planning. Plans and programs by both government and NGOs should have the provision to incorporate climate change initiatives within their own capabilities. Win-win adaptation plans such as social forestation, innovation and introduction of drought and salinity resilient varieties of crops may assist the government to avoid contradiction between the aims of different plans for different sectors. More research is required in order to assess the impacts of climate variability in different agro-ecological zones and ecosystems in Bangladesh and plans should be based on that assessment. Government budgetary allocation should be climate responsive. Also, implementation, monitoring and evaluation of projects should consider climate change adaptation.

5.1.4.4. Management style: Bangladesh should pursue both autonomous and anticipatory adaptation policy in order to strengthen the adaptation base of the country and for facing future challenges respectively. Also, anticipatory adaptation measures encourage preventive maintenance rather than rehabilitation after the disaster. Moreover, emphasis should be given on both top-down and bottom-up approaches of adaptation. Through a top-down approach the government can strengthen different ministries and organisations such as the MoEF, MoF, MoP, MoA, and the DoE, CCC and agriculture research institute. The top-down approach will assist

negotiations with India regarding Ganges water sharing, and also in international conferences regarding adaptation funding. The strengthened organisations will be able to provide urgent support for poor people living in cyclone and salinity prone coastal areas, flood-prone low land, drought-prone upland, hilly areas and urban slums by supplying food and water, and ensuring health security and social protection. On the other hand, through bottom-up approaches government can utilise the knowledge of farmers on drought or saline resilient varieties of crop, and also local resilience against flood, cyclones and salinity. This will also help to develop area specific adaptation strategies, for example, plantation of vetiver grass and palm species, and wider space between trees for preventing saline-caused soil erosion in the coastal mangrove forest areas. Not all the coastal areas are equally saline: some are low, some are moderate and others are highly saline meaning that different varieties of fish should be cultivated according to their tolerance to salinity. Therefore, the NAPA should incorporate the opinions and suggestions of the vulnerable groups and communities such as farmers, fishermen and people of coastal areas.

5.1.4.5. Building and maintenance of infrastructure

Higher exposure to climate change can be reduced through constructing infrastructure such as cyclone shelters, coastal embankments, landfills, ponds, irrigation schemes and also through the modification of existing infrastructure. Vulnerable farmers and local landless people can be engaged to maintain the embankments; they can share the benefits resulting from the trees being planted on the embankments. In Bangladesh, earthen embankments erode within one or two years of construction. So, permanent embankments should be constructed with durable materials, in conjunction with mangrove greenbelts, and these infrastructures should have a long-term maintenance program with the engagement of the local community. The coastal embankments destroyed by cyclone ‘Sidr’ and ‘Aila’ should be reconstructed, and the displaced community rehabilitated urgently.

5.1.5. Supplement by other instruments

In case of the ineffectiveness of one particular policy instrument, a combination of other mechanisms can be used to perform the task. In the event of failure in regulatory policy instruments, information- or finance-based instruments provide an adequate supplement. Although the NAPA is a regulatory policy instrument, it requires application of all other policy instruments such as information-based for creating awareness and sharing knowledge, treasury-based for financing climate related projects; and organisation-based for implementing projects,

enhancing adaptive capacity and building resilience and, above all, coordinating the activities undertaken by different ministries, departments and agencies. For example, when regulation fails to protect forest plants, the financial reward to the protectors/ guardians of the forest plants will assist in the avoidance of forest clearing.

Also, before implementing any regulatory policy, prolonged mass campaigns under information-based instruments, can facilitate smooth implementation of the rule of law. For example, people must be aware of land area specifications or building codes for proper and timely implementation of these regulations. In some cases, organisation-based instruments require supplementation by information- and finance-based instruments. Changing agricultural inputs and cultivation time is necessary for adaptation in the agricultural sector, for instance, in drought prone areas, farmers are required to switch to crop varieties more adapted to lower soil moisture. In this case, farmers must first be given the information on changed climatic conditions and their impact on crop output before the concerned government agency, such as the Department of Agriculture, makes arrangements for the easy availability of the new varieties of crop seeds in the market, and the government finance department should ensure loans where necessary.

5.1.6. Non-government organisations

NGOs and research organisations receiving funds from the government and donors must utilise resources in a way that the ultimate goal of facing the climate change challenge is achieved. Along with this, civil society should take action to create awareness among common people about climate change impacts through campaigns in the mass media and apply pressure to the government to take necessary action in facing challenges expected from climate change. Also, there should be coordination between government departments and NGOs in order to avoid overlapping in undertaking climate change adaptation initiatives.

5.1.7. Recommendations for Gabura

BARCIK (2009) suggests the bottom-up approach for adaptation at Gabura in Southern Bangladesh. People of Gabura believe that dredging up 15-16 canals will help to minimise the problem of water logging, and increase the supply of fresh water. Government departments should be mindful when constructing dams and embankments in Gabura because ill-designed construction of these infrastructures causes waterlogging. The local people also suggest facilitating the free flow of clean water from the northern side. Finally, emphasis should be placed on deep-water rice varieties, especially 'Amon' and 'Aush', because of long-term water

logging. Also, their straw is used as a base for floating gardens (BARCIK 2009). The Bangladesh Resource Centre for Indigenous Knowledge (BARCIK) has started digging ponds and planting trees jointly with local people under a project in Gabura. These initiatives can be undertaken in other areas that are suffering water crises due to climate change. The farmers of Gabura demand that internationally, government and civil society raise their collective voice to the developed countries, to support the transfer of technology and gain assistance for poor farmers of Bangladesh to do their own research for improved seeds and cultivation methods.

5.1.8. International linkages

Regarding international finance, Huq (2012) suggests that the Ministry of Finance (MoF) must be familiar with the new flow of finance, which is different from ODA, and this comes under the ideology of 'polluters pay'. Huq (2012) also maintains that this knowledge about new financing may help Bangladesh dictate some of the terms during international negotiations on the climate change adaptation fund. On the other hand, rich countries should give emphasis to adaptation when providing financial assistance and aid. Bangladesh should negotiate to receive more international support, and for this purpose the government should show integrity, transparency, responsiveness and accountability in the adaptation process. Huq (2011) suggests that until now Bangladesh has played a significant role in focusing on adaptation and funding in the COPs. Now it should stand for mitigation because there is a limit to adaptation, and mitigation reduces the necessity for adaptation (Jerneck and Olsson 2010). Also, for changing fund delivery systems, Bangladesh can place pressure on the developed nations along with other vulnerable groups of countries such as the LDCs, Group-77, SIDs and Africa. These vulnerable groups should be vocal and create awareness among the international community to put pressure on the intergovernmental organisations through the global network of NGOs and civil societies including scientists, journalists and scholars for reducing global emissions and disbursing more funds for adaptation. International support in the form of 'cash and kind' is necessary. Cash will be used for building infrastructures and kind for accepting 'climate refugees' (Paul 2012).

5.2. Conclusions

Climate change will affect the natural and human environment, damage habitat and the sources of food for all species on the planet, cause diseases, and disturb the socio-economic order of life. Above all, it will slow the growth path and retard the process of development. Developing countries are more vulnerable than the developed nations because of their geographical location and lower adaptive capacity. Bangladesh is the most vulnerable to the impacts of climate change in terms of natural disasters, agricultural production losses, ecological damage and human health, and ultimately slower rate of growth. Already, some parts of this country have been experiencing the impacts of climate variability. However, being a developing country, Bangladesh has limited resources for undertaking separate programs for climate change adaptation. Therefore, mainstreaming of adaptation is a suitable option to this country.

Governments are responsible for the overall wellbeing of the citizens, and global communities are also committed to ensuring the betterment of the earth. The same is true for climate change problems, and in order to deal with them Government utilises policy instruments to make people aware; it has authority to make rules and regulations and enforce them for adaptation to climate change; it can invest money and other resources for adaptation; it has organisation and manpower to implement adaptation policies. International communities, realising the importance of adaptation to climate change, have developed the NAPA, a policy instrument for mainstreaming of adaptation to climate change, and handed it over to the LDCs. The developing nations have their own development plans and programs, and have received the PRSP and the MDGs from the international agencies as guidelines for their development. Mainstreaming suggests integration of the NAPA in the PRSPs and the MDGs, and other development plans.

Bangladesh has taken measures towards mainstreaming of adaptation which involve four steps as suggested by the UNDP (2011). In the first step, the government of Bangladesh makes efforts to sensitise all the ministries, government agencies and common people, and incorporates representatives from civil society, NGOs and research institutes in government committees, and delegation teams. Secondly, the government has established a link between the NAPA and the PRSPs, the MDGs and other development plans. Thirdly, the government has formed the Bangladesh Climate Change Resilience Fund (BCCRF) and allocated money for adaptation from its budgetary resources. Also, it has already received adaptation funding from the international process of adaptation and been continuing negotiations with international donor agencies, developed countries and the UNFCCC for more funds. Climate change is considered a cross-cutting issue and many government projects are evaluated through the lens of climate change

adaptation. Finally, though participation has been limited, the government and NGOs have engaged stakeholders in some cases, for example, in protecting mangrove forest in the Sundarbans, local level flood management, crop diversification, producing crops and vegetables in the floating gardens, irrigation and fresh water supply through digging of canals and ponds, and livelihood programs through non-agricultural activities. The international community is also contributing to some of these adaptation initiatives through recognising the position of Bangladesh in terms of vulnerability to climate change and funding programs and projects.

However, this process of mainstreaming faces challenges which are mainly connected to policy instruments. Firstly, policy makers, government officials, NGOs, common people and vulnerable communities are not yet fully aware of the impacts of climate change because of inefficiency in the application of information-based policy instruments. Secondly, being a developing country, poverty is the main focus of all government plans, and also it has resource limitations for initiating adaptation efforts, which hamper the effectiveness of finance-based instruments. Thirdly, organisation-based policy instruments are unable to facilitate mainstreaming functions properly because of inefficient planning and decision making processes; fragmented resource allocation systems, lack of coordination among government agencies; weak infrastructures and poor maintenance systems; top-down management practices; reactive adaptation style; and loss of institutional memory. Finally, though the government has made rules and regulations for climate change adaptation and mainstreaming, they are not enforced strictly. Other than policy related problems, the socio-economic and demographic conditions of the country such as overpopulation and gender discrimination create obstacles for mainstreaming.

In order to overcome the challenges of mainstreaming adaptation, the gap between the theory of the policy instruments and the real world application, and the challenges derived from this gap, have to be removed or at least minimised. This study finds that literature on the discussion of mainstreaming of adaptation to climate change is insufficient and this calls for further study in this area.