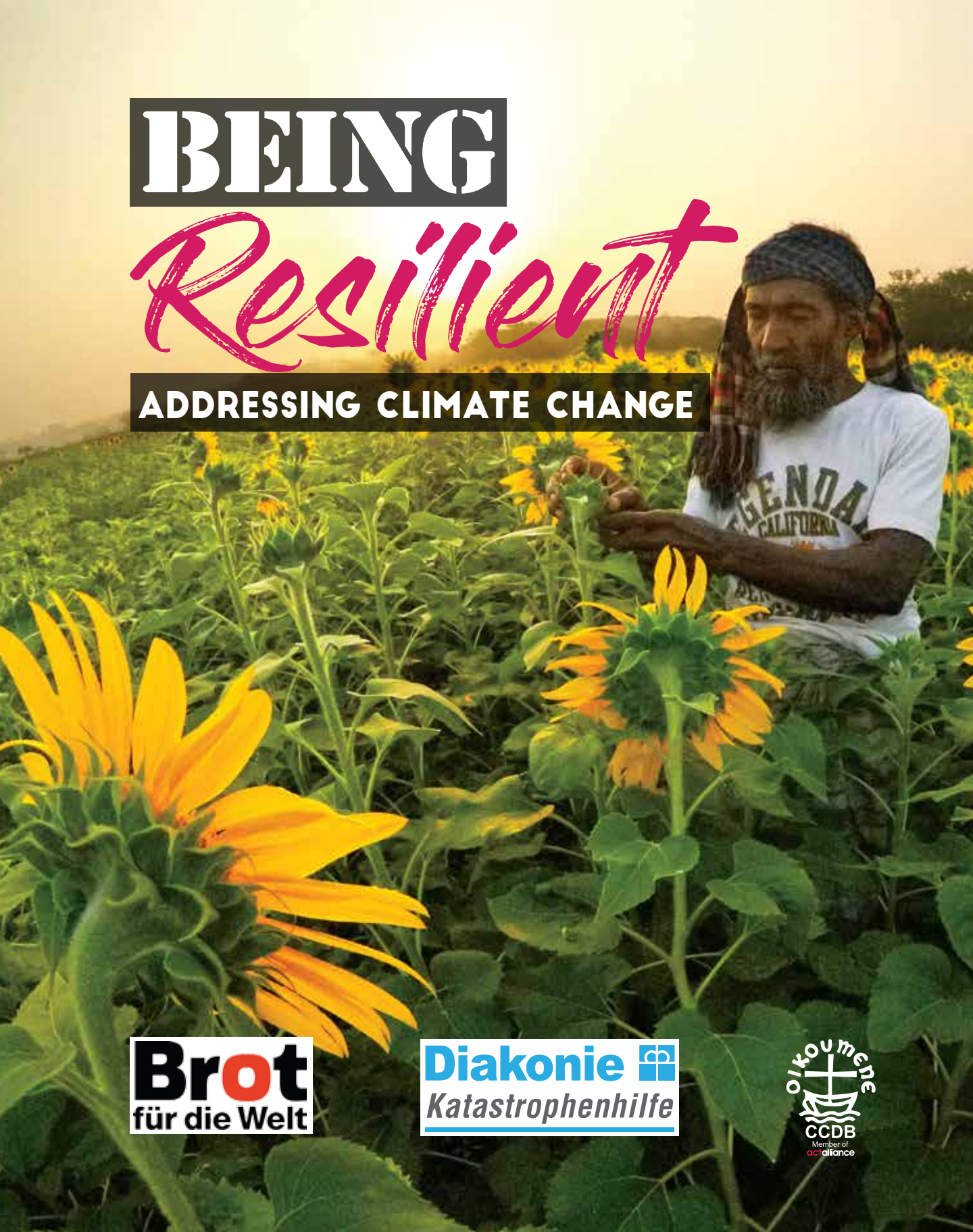
BEING *Resilient*

ADDRESSING CLIMATE CHANGE



Brot für die Welt

Diakonie Katastrophenhilfe

Oikoumene CCDB Member of ACT Alliance

Developed by
Md Shamsuddoha
Chief Executive, CPRD
Email: m.shamsuddoha@hotmail.com
&
Md Foezullah Talukder
Project Co-ordinator
Light House Project, CCDB
Email: foezullah@ccdbbd.org
&
Muhammed Atikul Haque
Advocacy Officer
Climate Change Unit, CCDB
Email: atikulhaque@gmail.com

Edited by
Thomas Hirsch
Executive Director
Climate and Development Advice, Germany

Special Thanks
Imran Kibria, Omar Rashid Chowdhury, Abul Kalam Azad, Subrata Mistry, Danesh Ali Mondal, Abu Sharif Md. Mahbub-E-Kibria, Joyanta Ghosh

ISBN: 978-984-34-3160-8

Published in
October 2017

Graphics & Layout
Habib Torikul

Photo
Habib Torikul (Cover, P-10); Probal Rashid (P-30, 31, 32, 34); Lighthouse team

Printed by
Christian Commission for Development in Bangladesh (CCDB)

BEING RESILIENT: ADDRESSING CLIMATE CHANGE EVIDENCES ON THE OUTCOME AND LEARNING OF BANGLADESH LIGHTHOUSE PROJECT

Christian Commission for Development in Bangladesh (CCDB)
88, Senpara Parbatta, Mirpur - 10, Dhaka - 1216
Phone: 9020170-3, Fax : 880-2-9020227

MESSAGE
FROM EXECUTIVE DIRECTOR

The earth, the pale blue dot in the cosmos that has been our only home for millions of years, is going through a phase of mass extinction. Recent scientific findings have identified that a sixth mass extinction event has already started with unprecedented rates of species loss. Scientists also warn that humankind's future will be at stake if we are continue to deal with the planet's ecosystems without care. One of the most serious threats leading to these extinction scenarios is climate change: The stressor brought upon us by ourselves.

With an accelerated rate of global warming, ocean acidification, deforestation and deteriorating pollution, our planetary boundaries are under severe threats. The climate crisis affects those countries most that are the poorest, and that have contributed the least to climate change. Bangladesh as one of these nations is extremely climate vulnerable and suffered from continuous loss and damage in the context of climate change.

Bangladesh is experiencing more extreme weather, extended monsoons and droughts, frequent devastating cyclones, higher tidal surges and invasive salinity intrusion in coastal areas. With an unprecedented rate of sea level rise, coastal areas of Bangladesh will face a bleak future, and are threatened to be flooded within the next 50 or so years.

The livelihoods of poor communities in coastal areas are deeply affected by climate change. With little or limited means of production like fishing and a rudimentary level of agriculture, people have limited options to make their living better. Moreover, adverse impacts of climate change further deteriorate the situation. For millions of people in the coastal areas, a better life depends on the development of more effective climate adaptation and climate risk management strategies, leading to resilience. To make this happen, local experiences and technological innovations need to be blended, and embedded in the socio-economic context.

This report draws on observations and findings from local experiences and outcomes from the application of a new and innovative strategy. It is a qualitative approach in defining and specifying the degree of risk and resilience of coastal communities being vulnerable to climate change. The study finds that people can be motivated and empowered, taking more responsibilities and becoming resilient. It also identifies some key elements of resilience building in communities. One important finding from the assessment is that there is a close relation between socio-economic activities and the environment, including the climate, which leads to the conclusion that any local level intervention or introduction of a new technology needs to be contextualized.

The Lighthouse Project was developed by CCDB to reduce climate risks and to increase resilience of coastal communities which can be measured. To measure and verify results hence has become a key element of this project. The report therefore provides a lot of information about the impacts of a number of local knowledge-based technology, their feasibility, availability, cost-effectiveness and applicability. The report concludes that apart from technological innovations and ecological awareness at the policy level, communities in Bangladesh need to be empowered in order to manage their local resilience building programs.

Joyanta Adhikari

Executive Director
Christian Commission for Development
in Bangladesh (CCDB)

FOREWORD

Being resilient is paramount to achieve the Sustainable Development Goals in a climate constraint world. This is even more so relevant in a country like Bangladesh, being listed as the sixth most climate vulnerable country of the world, and, at the same time having a huge population still suffering from extreme poverty.

This is why Brot für die Welt, the development cooperation agency of the Protestant Church in Germany, together with its twin Diaconia Emergency Aid, has initiated in 2008 a series of pilot Lighthouse Projects throughout the World. They aim at testing and innovating aligned climate disaster risk management, adaptation, clean energy and sustainable development approaches, which make poor and climate vulnerable communities become resilient, climate friendly and prospering in terms of achieving sustainable development goals. Our Lighthouse Projects, which all have become success stories, are situated in very different cultural and geographical contexts. What they have in common is that they are all located in hot spots of climate change, that they have become laboratories of innovation and cross-sector co-operation of multiple stakeholders, and, perhaps most important, that they are owned by the people, who have turned from victims into drivers of transformational change.

The Lighthouse Project run by the Christian Commission for Development in Bangladesh is one of these success stories, as outlined in this report. The project, which started in 2012, has come a long way of understanding the challenges, identifying opportunities, testing out-off-the-box ideas and technological innovations, bringing people together, and resulting in measurable and very visible reduction of climate risk exposure and vulnerabilities. This report explains the concept, and makes the distinguished reader becoming part of the journey, describing approaches and milestones, but also telling short stories of the people and what differences the Lighthouse Project has brought to their lives and livelihoods.

Being resilient is not a status that can be achieved and secured, but a complex and open-ended transformational process in a changing world, based on knowledge and permanent learning, on openness for innovation, but also deeply rooted in the specific cultural, socio-economic, and environmental context. Resilience in large degree builds on the people and how they manage the situation they face. In so far, the success of the Lighthouse Project is first and

foremost the success of its main actors. Resilience, on the other hand, cannot be completely de-contextualized from the broader framework conditions and the political environment: Local resilience-building also relies on favorable political, socio-economic and environmental framework conditions. This is where the local and the national or even international level action meet and are to be connected, as the report shows.

The Lighthouse Project has achieved great successes for the communities: Improved infrastructure and disaster risk management has reduced the risk of extreme events. Clean water is available again, agricultural productivity has increased and thereby food security; poor families and women in particular have used new livelihood opportunities and the communities' social cohesion and common capability to understand, minimize and systematically address climate risks have been strengthened. Cooperation with local government authorities has improved and academic advice informs practical action. A lighthouse is designed to enlighten others, and to provide guidance. Over the years the project has turned into such a lighthouse. Still, however, there is a long way to go, to address manifold remaining challenges.

The report describes the lessons of the past and openly discusses the challenges ahead of us. I wish CCDB and the people in the Lighthouse Project communities continuous strength, inspiration and the necessary innovative spirit will continue to meet future challenges as they have successfully managed past ones. I am grateful for having had the opportunity to accompany you on your journey in the past, and I am feeling proud and encouraged to continue to do so in future.

Pamela Metschar

Program Coordinator
South Asian Desk
Brot für die Welt, Germany

TABLE OF CONTENTS

1 BEING RESILIENT: COUNTRY CONTEXT AND OVERVIEW

Building resilience against the impact of climate change has become a policy priority so as to reduce inequality and poverty. Bangladesh, despite being one of the top performers on 'Social Progress Index' especially in ensuring basic nutrition and basic medicine, often scared in achieving harmonized economic progress which may be further aggravated by the impacts of climate change and associated loss and damages. Already the 5th Assessment Report of the IPCC (IPCC AR5 2014) pointed to the likely fact that Bangladesh is going to face increasingly adverse impacts of climate change in the years to come. They include, inter alia, too much precipitation during monsoon and too little water during dry season (MOEF/GOB, 2012), more intense and more frequent cyclones and the move of the saline front further up-stream(CEGIS, 2006), massive coastal erosion (Ahmed, 2008) and secondary implications such as food and health insecurity, loss of lives and livelihoods, damage to infrastructures, loss of productive assets and damage to the national/local economy (MOEF/GOB, 2012). The IPCC's AR5 report also mentions the risk of a rise in poverty in Bangladesh by 15% by 2030 due to increased risks of climate induced disasters and consequent loss of lives and properties and decline in food productivity.

These are predictions and not just fictional future scenarios – and they rather approach faster than predicted. The level of climate vulnerability in the country's different agro-ecological zones has already been increased with more frequent and more severe climate extreme and slow events. Higher than average monsoon rainfall rates are already observed. The sea level is rising in a range from 6 mm/yr to 21 mm/yr. Observations of tidal levels in Hiron Point, Char Changa and Cox's Bazar between 1977 and 1998 indicate a raise of 4 mm/yr, 6 mm/yr and 7.8 mm/yr respectively (CCC 2016). Since 1985, the surface temperature of the Bay of Bengal has increased by 0.30-0.48°C at rates between 0.0126° and 0.0203° per year. Such a temperature increase implies rise in the frequency tropical cyclone currently from 5 storms per year to 8 storms per year or once every 6.5 weeks by 2050

(Chowdhury, S. R, et. al 2012). The impacts of climate change became starkly obvious in 2007, when two consecutive floods in June and August caused economic damage to the tune of nearly US$ 1.1 billion, followed by Cyclone Sidr in November, which killed 3500 people and led to estimated economic damage of US$ 1.7 billion. These events and their impacts led to intensified efforts to tackle climate change and disaster impacts in Bangladesh (Alam et.al. 2011).
Despite the current challenges, Bangladesh still has been successful in achieving the expected growth of the annual Gross Domestic Product (GDP) of around 6% and is on track of becoming a middle-income country by 2021 with a targeted per capita income of at least $2,000 by 2021. However, climate change impacts may slow down the economic growth and development as increased frequency and intensity of climate-induced natural disasters could cause losses of 1.5% of the country's GDP (GOB 2012). This may also hinder the achievement of several key SDGs.

While Bangladesh is said to be in relatively more advanced stage than other LDCs in mainstreaming of climate change adaptation measures and actions into overall development policies (Huq, S and Rabbani, G. 2011). But during deciding actions and priorities, area specific climate change vulnerabilities and participatory, transparent and accountable processes were least considered. The plans and policies rather follow 'top-down' authoritative planning processes i.e. 'planning for the people'. This undermines rights-based and democratic planning processes i.e. 'planning by the people'(Shamsuddoha, M . and Bijoy, M.R. 2015). There has been widespread criticism by civil society organizations and researchers on the process of developing climate resilient plans and strategies for instance NAPA [1] and BCCSAP [2]. According to these critical voices, they have neither been informed by the area specific climate change vulnerabilities, nor have they followed a participatory, transparent and accountable approach with regard to decisions taken on actions and priorities.

[1]The National Adaptation Programme of Action (NAPA) was the first initiative of adaptation planning that followed a "generic guideline" of the UNFCCC. Preparation of Bangladesh NAPA was guided by the a high powered Project Steering Committee and involved several national and international consultants and selected stakeholders with little evidence of broad based consultation with, "communities at risk".

[2]Bangladesh prepared its national strategy 'Bangladesh Climate Change Strategy and Action Plan in 2008. The formulation of BCCSAP followed a specialist driven process and did not involve the most vulnerable communities affected by climate change (Raihan M. et.al.2010; Hossain, M.K. 2009).

Given all the gloomy scenarios in respect of vulnerability and resilience planning, Bangladesh is often marked as 'global adaptation capital' (Irfanullah, 2013) because of its remarkable progress in site-specific or community based efforts in resilience building. Such efforts, primarily implemented as people-centered approaches, have evolved over the years alongside the UNFCCC's slow move in agreeing on modalities for country-led approaches of resilience building.
This report draws examples of 'being resilient' from a project called Lighthouse Project that so far introduced technological solutions ranging from water desalinization to water purification and harvesting, climate resilient crop varieties to crop agriculture modeling, climate resilient on-farm Income Generating Activities (IGAs) to capacity building for off-farm IGAs etc. in three climate vulnerable districts of Bangladesh. Based on a thorough assessment on the achieved results, the report discusses innovations and opportunities resulting from the project interventions and their impact on community empowerment in addressing climate change risks and vulnerabilities through a rights-based and democratic planning process.

The report further explains the approaches of resilience building followed by the project and the challenges that may hamper sustainability of climate resilient innovations and technologies and how those could be minimized.

Abdur Rahim (45) cultivating potato through minimum tillage

2 THE LIGHTHOUSE PROJECT

Christian Commission for Development in Bangladesh (CCDB), a development organization with a long-standing partnership with Brot für die Welt (BftW) and great experience in actively engaging with different communities in the country, launched the Lighthouse Project in 2012 in three coastal locations. The Lighthouse Project is a multi-country pilot project aiming at 'improving resilience of the most vulnerable population groups'. The different pilot Lighthouse Projects were designed based on site and context specific climate risk assessments with a view on past, current and future climate trends.

In Bangladesh, the project locations were selected in a way to cover hot spots of climate change, where climate extreme events have recently been increased in frequency and severity. For instance, all project locations, i.e. Satkhira and Bagerhat at the southwestern coast and Patharghata at the south-central coast were hit hard by Cyclone 'Sidr' in November 2007 and Cyclone Aila in May 2009. The succession of two extreme events within shorter duration let to residual impacts on productive assets and livelihood opportunities. This demands long-term interventions for a transformational shift towards a resilient economy that can better withstand climate shocks and climate stressors. Along with predominant vulnerability to cyclonic disasters, the coastal areas are also experiencing unprecedented impacts of slow onset events such as sea level rise and salinity intrusion. Besides, prevalence of weather irregularities and un-predictabilities often marked by shortened rain periods or excessive rain fall in a shorter duration are also hampering traditional agricultural practices, making farmers largely feeling uncertain what to plant and how to keep them growing amid of weather variability and adversity. The increase of meteorological hazards i.e. depressions and cyclones in the fishing zone of the Bay of Bengal is also affecting 'sole means of livelihoods' of the fishing communities through decreasing number of fishing days while at the same time fishing expenditures are increasing (Chowdhury, S. R, et. al 2012).

Hence, the increase of extreme events and of irreversible risks of slow onset provides the argument to undertake the Lighthouse Project in these coastal areas.

This report draws examples of resilience building from the Lighthouse Project. So far, its technological solutions range from water desalinization to water purification and harvesting, from the introduction and testing of climate resilient crop varieties to climate resilient crop modeling, and from climate resilient on-farm IGAs to capacity building for off-farm IGAs, to mention just these. Based on a thorough assessment on the 'impact areas', the report discusses innovation and opportunities resulting from project interventions and their impact on community empowerment in addressing climate change risks in a rights-based and participatory planning process with the objective to increase resilience step by step.

Project Aim: Creating Climate Resilient Communities

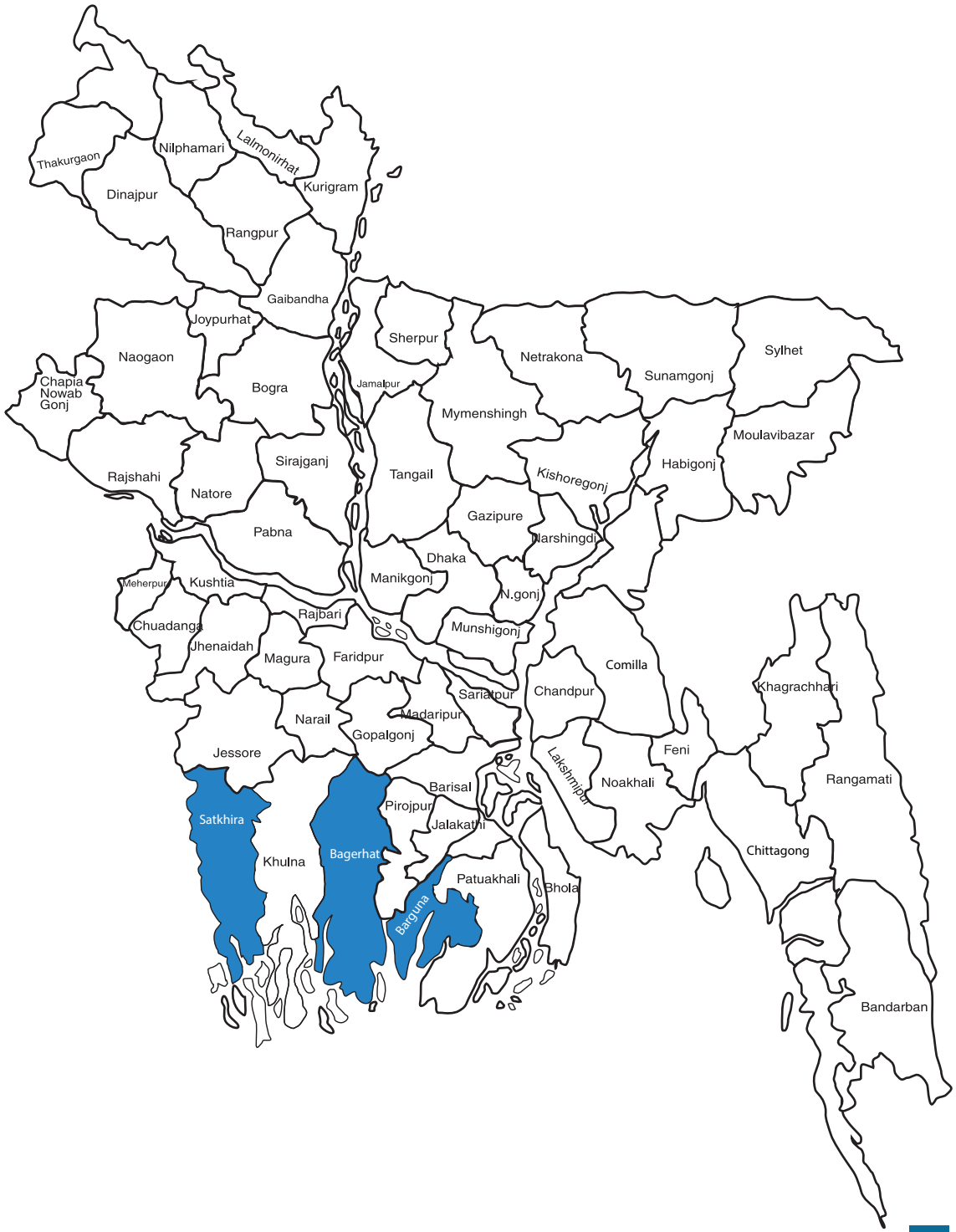
Objective:
Reduce the risks of climate change particularly to vulnerable population groups and, thus, provide them with prospects for sustainable development.

Impact Areas:

i) Climate resilient livelihoods and improved food security
ii) Technical solution and community centric management: an effective solution of potable water crisis
iii) Ensure that people will take safe refuge during cyclonic disturbances
iv) Strengthened peoples' institutions
v) Lobby and advocacy for climate adaptive service delivery

The report further explains the approaches of resilience building followed by the project, the challenges that may hamper sustainability of innovations and technologies, and how those could be minimized.

Map of Project Location



2.1 Project Framework

The Lighthouse project defined its overarching goal as to improve climate resilience of the most vulnerable population groups and, thus, provide them with prospects for sustainable development.

The concept of resilience describes the adaptive capacity of a community or a household that enable them to withstand climate extreme or slow onset events, and to recover soon from a disaster. A resilience approach also implies that social and ecological systems cannot be considered separated from each other but must be understood as mutually interrelated systems. Hence the broader framework of resilience building incorporates the complex functioning and inter-play of social-ecological systems rather than looking at individual components in isolation.

Unlike adaptation that primarily takes an actor centered view, focusing on the agenda of social actors to respond specific environmental stimuli, the resilience approach takes a more dynamic and system- orientated view (Nelson, D. R. et al 2007). It is considered as a 'function of wealth, technology, education, information, skills, infrastructure, access to resources, and stability and management capabilities' (McCarthy et al. 2001).

Aligning to similar thought and understanding, Folke et.al (2006) defined resilience as the capacity for a socio-ecological system to: (1) absorb stresses and maintain function in the face of external stresses imposed upon it by climate change and (2) adapt, reorganize, and evolve into more desirable configurations that improve the sustainability of the system, leaving it better prepared for future climate change impacts.

However, putting disaster risk reduction at the center, the prevailing definition of 'resilience' refers to the capacity of a system, community or society potentially exposed to hazards to adapt, by resisting or changing in order to reach or maintain an acceptable level of functioning and structure. This is determined by the degree to which the social system is capable of organizing itself to increase its capacity for learning from past disasters for better future protection and to improve risk reduction measures' (UNISDR, 2004: 6 volume II).

Given these two broader perspectives of resilience, the Lighthouse Project contextualized its resilience from a disaster risk reduction (DRR) centric approach and emphasizes to enhance people's ability to respond appropriately and through their own resources to adversity, such as extreme and slow onset events (InFocus 2016).

In the process of improving resilience of the most vulnerable population, the Lighthouse Project undertakes twofold integrated approaches, i.e. a) linking disaster risk reduction and development and b) combating climate change with increasing resilience in a targeted and people-centered way. The first approach puts the often-demanded measures of linking relief, rehabilitation and development (LRRD) into practice. The second approach includes community based risk analysis and the method of prioritizing assistance in accordance with the degree of risk of a household or community, as well as showing respect for, and extending, the self-responsibility and competence of aid recipients.

In respect to combating climate change with increasing resilience in a targeted and people-centered way, the Lighthouse project also puts specific focus on innovation and up scaling of traditional adaptation practices, strengthening of people's self-organization and local level institutions, and advocacy for quality service delivery and governance so that individuals as well as communities could survive and recover soon from both sudden and slow onset events. In so far, the Lighthouse Project also stimulates transformational change towards more sustainable socio-economic structures and more responsive governance mechanisms.

Such an approach leads to a continuous process of building transformative capacity by gradually shifting from absorptive and adaptive capacity (see figure 1). This gradual progression of resilience building enables households and community not only to cope with adverse impacts but to predict risks, to strategically assess options and to undertake anticipatory adaptation measures.

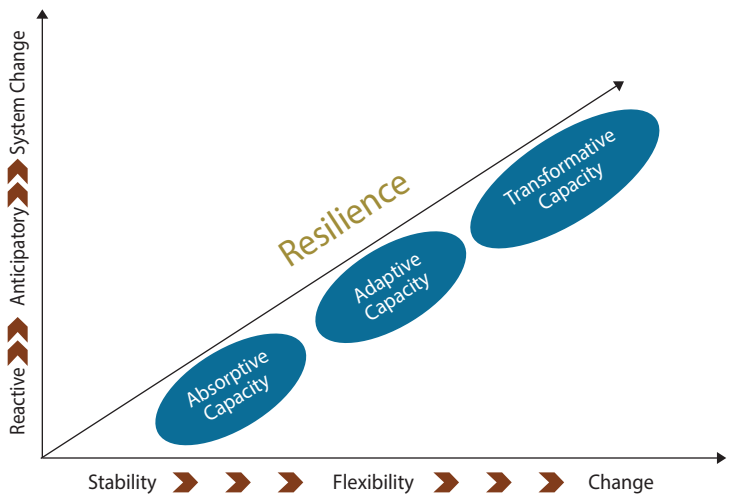


Figure 1: Analytical framework of resilience along with its three major elements

In the process of facilitating anticipatory adaptation measures, the CCBD Lighthouse Project puts much of its effort in developing people's institutions called 'Community Climate Resilience Centers - CCRC'. They act as a platform of community groups and external actors who share a common goal of building resilience to resist the impacts of climate change. This platform of community groups is involved in analyzing the causes and effects of climate change, in identifying community knowledge and resources, in developing community resilience plans and in prioritizing of actions etc. Figure 2 describes the framework of project implementation.

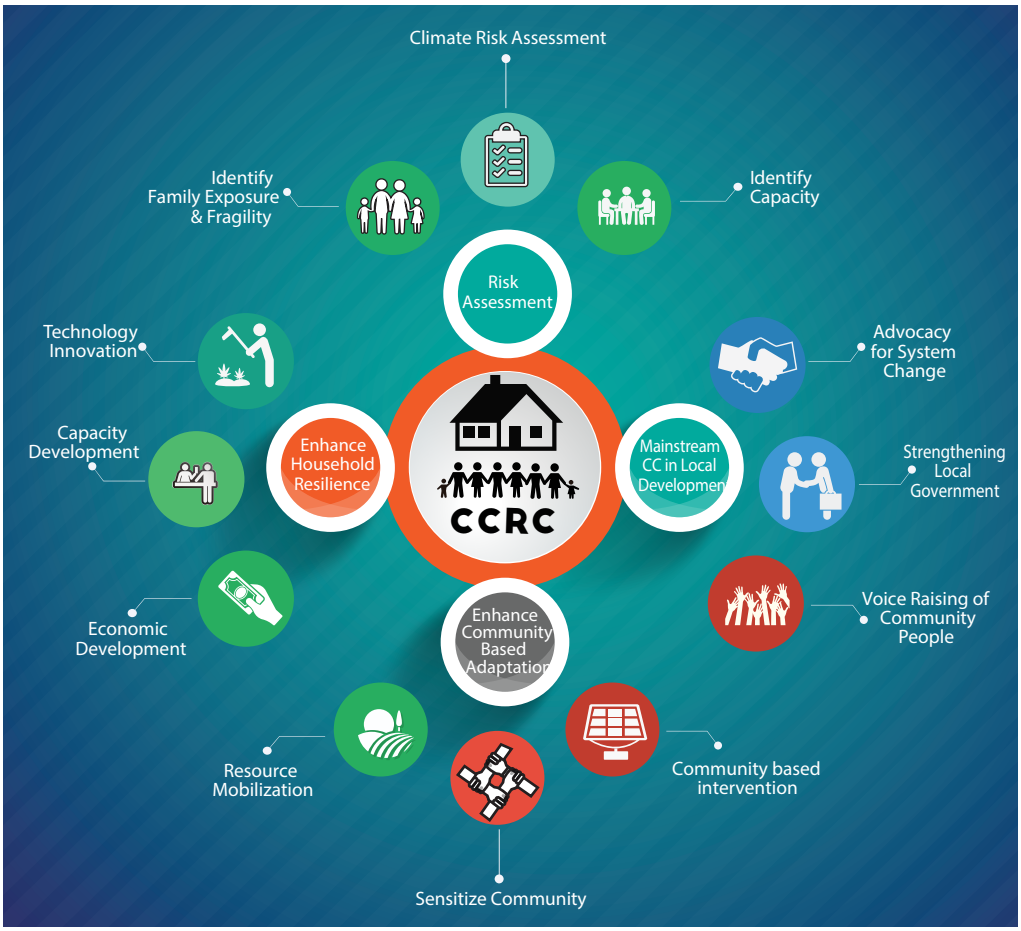


Figure 2: Project implementation framework

The pivotal role of the CCRCs in addressing existing and anticipatory climate change risks fundamentally enhances their capacity to reshape or establish new economic or social structures and bring changes in governance mechanism towards building resilience.

2.2 Methodology

The main objective of this report is twofold: (i) To assess the project outcome in terms of resilience-building at both the household, and the community level, and (ii) To identify challenges leading to recommendations for future interventions.

Given this scope, a qualitative research approach has been employed to understand the impact of project interventions in terms of climatic risk reduction and accelerated socioeconomic development of individual households. At the same time, it has been assessed in how far project-induced community-based initiatives have contributed to the process of resilience building. In doing so, a multi-method data collection took place. A targeted sampling was used in order to select respondents for different qualitative data collection methods. A total of 12 focus group discussions (FGDs) (four in each project location) were conducted, keeping a representational balance in terms of gender, age and socioeconomic groups. 15 key informant interviews (KIIs) (five from each location) with authorities of the local government, community based organizations (CBOs) and community representatives were held, and 12 case studies with project beneficiaries as well as with other community members were conducted (Table 1). Data was collected between October and November 2016. Separate guidelines and checklists for the, FGDs, KIIs and in-depth case studies were developed and followed.

Table 1. An overview of methodological tools

Data collection methods	Instruments	Sources of data	Total unit
FGDs	Guideline	Community	12
In depth case studies	Guideline	Project beneficiaries, local government authorities, Committees of Climate Resilience Centers (CCRCs)	12 (four from each project location)
	Checklist	Local government, Committees of Climate Resilience Centers (CCRCs), project beneficiaries	15 (five from each project location)

Additionally, a number of relevant documents (e.g. baseline risk assessment) were reviewed in order to get a better understanding of the concepts and to develop a conceptual framework for the study.

2.3 Setting the Scene: Climate Risk Analysis

A careful climate risk analysis is a crucial starting point for developing effective adaptation strategies. Such an analysis identifies the different hazards, vulnerabilities and resulting levels of risk exposure within the intervention area. It classifies people at household level according to their risks and, thereby provides a rational to define the type and level of particular support required.

The Lighthouse Project follows internationally recognized concepts and methods of natural hazard and vulnerability analysis, leading in the final step to the climate risk analysis. In the first step of climate hazard analysis, the project stakeholders identify frequency and magnitude of both extreme and slow onset events that hit the project area in the past. Based on past experiences, future hazard trends (frequency and severity) are determined. Cyclones, for instance, are of almost annual occurrence in the coastal areas of Bangladesh. Most recent cyclones, however, have become more severe in terms of wind speed and height of the tidal surges. Fishermen confirm that rough seas, along with more frequent cyclones, have increased in the Bay of Bengal. Hence, the hazard analysis of the Lighthouse Project in the coastal areas built on the experience of the community.

The second step of vulnerability analysis is comprised by three components, i.e. hazard exposure, fragility (sensitivity to hazards) and adaptive capacity. Accordingly, the vulnerability of a community to climate related hazards depends on the exposure of the people (and their assets) to hazards (e.g. is a house exposed to the sea), the fragility of the people (can the house resist high wind speed or not), and their adaptive capacity and resources to recover soon (e.g. has the household financial reserves, a climate risk insurance, a supportive family network etc.).

The degrees of exposure, fragility and adaptive capacity can greatly vary from community to community, and even more so from household to household, mostly due to different socio-economic conditions. For example, a salinity affected community in the southwestern coastal areas that fully depends on household-level rainwater harvesting is much more sensitive – and vulnerable - than a community in the south-central coastal areas that has access to large ponds with filtered water in combination with up-scaled rainwater harvesting. To take another example from the household level: A family with several elderly people or a person with disabilities is more sensitive to risks than a neighboring family consisting of younger and economically active family members.

The CCDB Lighthouse Project assessed both household and community level vulnerability. A set of indicators was developed for a questionnaire. In total, 5502 households were surveyed in 2012; 2671 in the southwestern coastal areas of Shymnagar and Morelgonj, and 2831 at the south-central coast in Patharghta. The survey generated information on the extent of hazard exposure of household's including their agricultural land, means of livelihood, income, homestead, ponds, drinking water sources, access to cyclone shelters etc.. The fragility and resilience of individual households was also assessed based on information gathered in the survey. The climate risk of every household was then calculated based on scores generated in the hazard and the vulnerability assessment. In a next step, a risk map was elaborated, showing every single household's risk index, as well as different risk zones. The results were shared with the community, enabling them to jointly identify the most vulnerable families with the highest risk scores, and to prioritize households and zones for interventions.

Aside from the household level risk analysis, the risk level of the community level was quantified and shown in the risk map. Building on these findings, the community decided on interventions to be taken and how the available resources for resilience building should be spent. In the process leading to these decisions, focal group discussions (FGD) and participatory rural appraisal (PRA) methods were used to ensure a duly inclusive, participatory and transparent process.

Risk formula:
Hazard multiplied by vulnerability defines the risk:

Hazard x Vulnerability = Risk

Hazard:
A natural physical phenomenon which can lead to a loss of life or damage to assets, buildings and the environment.

Vulnerability:
People's susceptibility and predisposition to be affected, suffer injury or incur damage as a result of natural phenomena as well as their ability to protect themselves against and recover from the consequences without outside help.

Risk:
The probability of an encounter between a specific hazard and an element vulnerable to this is interpreted as the probability of occurrence of loss of life or damage as the result of an extreme natural phenomenon with a specific strength or intensity.

The combination of both household level and community level risk assessment helped to identify the necessary interventions to increase resilience. For instance, in the salinity-prone southwestern coastal areas both household and community level interventions were identified to ensure access to potable water throughout the entire year. The household- level rainwater harvesting systems established ensure water security for five to six months. For the rest of the year, households rely on the community-level pond-sand-filters (PSF). To better protect people against strong floods, winds and cyclones, fortified houses on raised plinths were introduced for some selected households, while the construction of a cyclone shelter and the establishment of early warning systems benefit everyone.

To conclude, the risk analysis provided the baseline information with the individual risk profiles of households and communities. It guided the identification and prioritization of resilience-building interventions in a transparent and measurable way. It now serves as an important monitoring tool to measure progress to what extent the resilience at household and community-level has increased. Hence, another risk analysis at the end of the project will provide the data to compare the risk scores at the beginning and in the end of the project, which allows to exactly measure achievements in risk reduction and resilience building.

2.4 Vulnerability of Project Area

Vulnerabilities and risks are location and community specific. The same is true for adaptation actions. In the risk analysis, hazards appear as physical events, whereas the vulnerability (i.e. exposure, fragility and adaptive capacity) is composed by socio-economic factors and the local ecological context. While the hazards types “cyclone”, “tidal surge” and “salinity intrusion” are appearing in both regions, the southwestern and south-central coastal areas, the extent and nature of fragility largely varies from place to place, and from community to community. The fragility is often determined by the local ecological context, which has been shaped and reshaped by the local economy and social activities.

For instance, the ecological context of the southwestern coastal areas has significantly changed during the last decades due to the horizontal expansion of brackish water shrimp aquaculture, locally known as 'Gher’. Powerful and influential shrimp farm or Gher owners have largely determined water regulations and the construction and use of sluice gates. Water flows are controlled in a way that favors their businesses rather than protecting smallholders’ land from salinity

intrusion. Availability of saline water boosted shrimp aquaculture are putting agricultural activities, animal husbandry and livelihoods of farm workers at stake. While the number of shrimp farms increased, the number of unemployed people raised as well, because shrimp farming requires less labor than rice farming.

This situation aggravated further due to chronic and long-term adverse effects of Cyclone Sidra and Cyclone Aila, e.g. they contaminated almost every fresh water sources, resulting in further losses for agriculture. Therefore, the peoples' fragility in the southwestern coastal areas is largely determined by the local ecological context and socio-economic development activities.

In comparison, the south-central coastal area is less fragile due to fewer human intervention and mal-development practices. Though the residual impacts of Cyclone Sidr and Aila on the environmental services, e.g. fresh water sources, is still there, agriculture is gradually recovering. Hence, the risk analysis for the south-central coastal areas identified more options and opportunities for enhancing farm-based adaptive capacities, which could be scaled up further through advanced technological intervention, awareness raising and strengthening the capacity of local institutions in terms of adaptation planning and implementation of respective interventions.

On the basis of differentiated risk profiles of the project locations, a number of project interventions were designed and categorized under six impact areas. Some interventions are common for both the areas and some are stand-alone and context specific.

Farida Khtun (35) cultivating floating vegetable in saline water through drip irrigation at Shayamnagar

3 PROJECT INTERVENTIONS

3.1 Climate Resilient Livelihoods and Improved Food Security

Impacts of climate change are affecting coastal agriculture and livelihoods in several ways. While climate induced sudden onset events for instance tropical cyclones are causing damages of productive assets and standing crops, the slow onset events for instance sea level rise are imposing severe threats to traditional crop practices. Increasing climate variability, in particular changes in rainfall pattern, are affecting traditional cropping practices. In the selected project areas, intrusion of salt water has already dramatically reduced fresh water availability for irrigation. As a result, productivity of local rice varieties has been going down.

Climate change induced weather anomalies and rough sea events are also affecting marginalized coastal fisher communities as they have limited adaptive capacity and are highly exposed to extreme events. Both in southwestern and south-central coastal areas, fishermen, who are the biggest group within the economically active population, are increasingly forced to give up fishing in the peak season, because the frequency and intensity of 'rough sea events' is growing due to higher sea surface temperature (SST), a trend which will most likely to accelerate in future.

Given this context, the Lighthouse Project has designed a number of strategic interventions to ensure food and livelihood security. They include, among others, a) the introduction of salinity tolerant rice varieties and other cash crops as for example sunflower, b) the promotion of additional off-farm and on-farm income generating activities, mainly for the marginalized fisher-folk households, c) the introduction of innovative farming practices in those areas, which are extremely salinity prone, d) the promotion of compost and other organic fertilizers to offset salinity, e) the promotion of climate adaptive cropping practices, and f) the introduction of highly efficient irrigation and water preservation systems.
There are several success stories of introducing climate adaptive copping practices, as for instance the conversion of a 95-acres mono-crop paddy field to triple-cropped farmland. Only three years back, this seasonal

rain-fed 95-acres paddy field was used to produce only one local rice variety. However, changes in rainfall pattern as well as regular flooding of the paddy field with saline water have caused a yield reduction, which made farmers to leave the land fallow rather than accumulating losses.

The Lighthouse Project organized the farmers, trained them in climate adaptive cropping practices and introduced saline tolerant short maturing rice varieties, as for instance BRRI 54, replacing the traditional variety. This new rice variety has almost doubled the yield. The variety planted in mid-July is getting mature in the end of October, just within 105 days of planting, whereas the traditional one required 150 days. The double benefit of BRRI 54, i.e. higher yields and shorter maturation, already made this variety popular among the beneficiaries, and created huge demand for seed. To meet this demand, CCRC, with the help of the Lighthouse project, started producing BRRI 54 and the current production capacity reaches more than 2.5 metric ton seeds per year.

Cultivation of saline tolerant rice (BRRI-54) at Patharghata

As another alternative crop, the Lighthouse Project introduced sunflower cultivation by providing training and improved seed to 206 farmers. Sunflower cultivation, along with other cash crops such as maize, mung bean, soybean, potato, pulses and vegetables can increase the yield in the project area by additional 60 tons or 11 million BDT (113,300 €), according to the local Department for Agriculture.

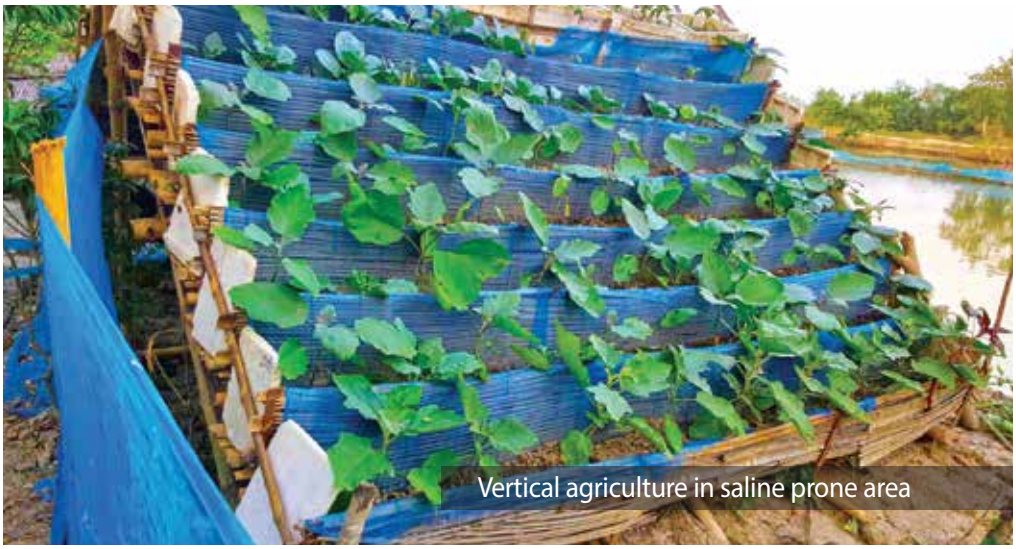
The Lighthouse Project organized farmers, advocated the local government authority to repair water regulators to prevent tidal water influx, jointly raised funds for re-excavating canals to store freshwater for irrigation, introduced a salinity tolerant short-maturing rice variety, and promoted other winter cash crops. By these activities, 95 acre of barren farmland has been revitalized, and the new model of cropping patterns have already increased cropping intensity by four times

Vegetable cultivation at Patharghata

However, making sufficient water available for agriculture remained a big challenge in the saline-prone project areas. To optimize water use, the Lighthouse Project introduced drip irrigation using polyvinyl chloride (PVC) pipes and earthen pots especially at household level, excavated 44 small ponds for holding rain water for winter irrigation and, at large scale, re-excavated a 3200 feet long canal in a joint initiative with the community. Under an initiative of testing innovative ideas, a cemented underground water tank was built on the farmland to store rainwater during monsoon, which could then be used in winter for cash crop cultivation.

In areas with high salinity (e.g. southwestern coast), vertical gardening practices as for example vegetable towers were demonstrated as a potential option for home gardens: Salt-free soil in earth pots is placed on a vertical structure and then drip-irrigated. These technologies provide households with a good harvest of tomatoes, eggplants and bottle gourd even in tiny homesteads. Productivity as compared with traditional agriculture can be doubled.

Cemented underground water tank to store rain water



Vertical agriculture in saline prone area

The Lighthouse Project also introduced Integrated Floating Farms (IFF) for those farmers whose land are regularly inundated by tidal water, as it is the case for millions of people in Bangladesh who live outside the embankments. The IFFs integrates several practices as fish farming, vegetable production and duck husbandry in a 400-square-feet (20ft x 20ft) floating structure, made out of plastic drum and bamboo. Fishes are kept in wire cages in the floating part under water and vegetables and ducks above water. The introduction of this technology allowed families in highly saline areas to diversify their income instead of depending on fishing only.

In order to reduce intensity of soil salinity, the Lighthouse Project has been experimenting with different options including amongst others mixtures of coal, saw dust and liquid fertilizer in crop cultivation. Soil salinity in the different project locations has been regularly measured. Location-specific cropping patterns were introduced in dependence of varying salinity.

The Lighthouse Project is continuously experimenting and innovating site-specific adaptation solutions in cooperation with various universities and research institutions like Bangladesh Agricultural University, Bangladesh Rice Research Institute, Bangladesh Agricultural Research Institute, and Sher e Bangla Agricultural University.

Integrated floating farming

The project also supported cyclone-affected marginalized families with Matching Grants for cow and duck rearing. They got a training and ducklings, which proved to be highly adaptive under high salinity conditions. One of the success stories is the story of Fatema (32) in Padma Village, Patharghata District: She earned BDT 95000 (980 €) in two years from selling geese and eggs. In 2014, she got as a start-up package, 10 ducklings, a training and some other inputs.

Families which were trained in home-garden vegetable production also got advice how to produce organic compost or vermi-compost. Hence, most of the project beneficiaries have their own compost pits. Applying compost in saline areas not only increases soil fertility but also reduces soil salinity.
Apart from farm-based income generation, the Lighthouse Project also trained skills of off-farm beneficiaries, especially wives and daughters of fishermen, and provided them with matching start-up grants: 1071 women were trained, amongst others, on tailoring, small trading, cell-phone repairing and handicrafts production. Many of them are now operating their business quite successfully such as Lyzu Begum of Padma Village along with her husband and two children she was displaced by Cyclone Sidr in 2008. Now she is working as a tailor and runs a clothes shop at her own house. After the training, she was supported with BDT 7,000.00 (75 €) by the Lighthouse Project. She bought a sewing machine (worth BDT 10,000.00) and purchased further materials. Her business has expanded, and she invested her earnings in other income-generating activities like cow and duck rearing. Her kids can go to school and she is now using saving schemes of a local NGO to buy a piece of land.

Alternative IGA: Lyzu Begum (29) working at tailoring shop

3.2 Technical Solution and Community Centric Management: an Effective Solution to Fight the Water Crisis

Scarcity of freshwater is one of the major impacts of climate change in coastal Bangladesh. It has become more acute in the areas where fresh water sources are contaminated by salt water intrusion. Sea level rise is a major cause of fresh water contamination. However, there are also other reasons: Reduced water flow of the rivers (due to huge reservoir dams upstream in India) allows increased salt-water intrusion. Huge shrimp aquafarms lead to influx of salt water as well, especially along the southwestern coast. Inadequate maintenance of water regulators, sluice gates, embankments and dams contributes to the problem, too. Last but not least, fresh water scarcity aggravated further after the cyclones Sidr and Aila, which both resulted first in flooding of large areas and later in water logging for years.

The salinization of surface water bodies and underground aquifers have caused fatal consequences, particularly for women and children, who usually fetch water from long distant sources. “They try to use as little water as possible", so they don’t have to go and fetch it so often. Women, the manager of household water supply in rural Bangladesh, often drink far too little or, instead, drink salty water to save water for other family members. This often ends up with serious health problems like hypertension and pre-acclamsia” (BCAS 2008). Hence, any attempt of ensuring drinking water either at community or household level has direct positive impacts on health, nutrition and human security, in particular of women. To make drinking water available in the project areas, the Lighthouse Project has followed four strategies: Harvesting rainwater, both at household and community level, promoting the filtration of communal pond water, managing surface water sources, and de-salinization of saline water.

Rainwater harvesting systems have been introduced widely along the southwestern coast of Bangladesh, especially after cyclones Sidr (2007) and Aila (2009). Although different types of water storage systems are available, above-ground large plastic tanks are the most popular one. So far 200 household-based and two community-based rain water harvesting plants have been established in the project areas on cost sharing basis with their beneficiaries. Water supply from the community-based plants is managed by a committee of the beneficiaries, who ensure water supply timing, service charges, and necessary maintenance.

Household-based tanks are provided to families which live far away from surface water sources (e.g community ponds) and don’t have any member in the family who is able to fetch water from long distance.

For instance, Halima, a mother of two school girls, lives outside the embankment, locally called Bahir Char Embankment [3], at least five to six kilometers away from the nearest fresh water source. Her husband, Belal Hossain, a fisherman, spends at least 10-15 days at a stretch on a single fishing trip, which becomes frequent in peak fishing season. Considering the high vulnerability of Halima's household, the beneficiary group agreed to provide her with a household-based rainwater harvesting plant of 1000l capacity. The tank secures access to drinking water for six to seven months. Availability of safe drinking water has also improved the health of the family, so that the daughters attend school more regularly. It has to be mentioned that the school requires every student to carry one bottle of water as a pre-condition to get fortified biscuits distributed by a WFP supported scheme.

Rain water harvester at Halima's house

The community-based water harvesting plant at the Bahir Char of Char Lathimara Union ensures water security to 36 families. These families were severely affected and displaced by Cyclone Sidr. Again, they are currently living just at the edge of the sea, without any protection in case of another cyclone. Apart from being scared by this risk, they have to struggle with many other difficulties: Dearth of safe drinking water was the most pressing one. Before establishing this community-based water harvesting plant, the families relied on pond water, and

[3]The seaward edge of the embankment exposed to the risk of regular tidal flooding and highly vulnerable to cyclonic disasters.

the women very often used saline water. Now, the plant with 6 tanks of 30 000l capacity secures access to fresh water. The plant was installed in a fortified house on a raised platform to protect it in case of high tidal surges. The beneficiary families formed a committee with eleven members and balanced representation of men and women to discuss and decide on user-fees, maintenance, tank cleaning etc. Currently, each family monthly pays BDT 10 and is allowed to take water on the basis of their family size. The current allocation is 3l per day for each of the family members.

Community based rain water harvesting plant at Bahir Char , Patharghata

Apart from rain-water harvesting, pond-sand filter (PSF) technologies have been introduced in the project areas to clean pond water. Usually, a 70-square-feet (7ft high x10 ft deep) sand-gravel layer is placed in a cemented tank next to a fresh water pond. Water from the pond is pumped by a hand tube-well and filtered through the sand gravel column. The filtered water at the bottom of the layer can be taken for consumption. If someone wants to take a pitcher of filtered water s/he first has to pump the same amount of pond water into the PSF. A community based beneficiary committee looks after the smooth operation of PSF, which includes tidiness of ponds and its management, cleaning of PSF and maintenance of the hand pump tube-well. So far, the Lighthouse Project installed six new PSFs and repaired 49 non-functional PSFs in the project areas. The Lighthouse Project also helped re-excavating sixteen community ponds for PSF installation. Currently, the PSFs provide drinking water to more than 70% of the families in the project areas.

The PSFs are usually managed by a PSF management committee, which belong to Community Climate Resilient Centers (CCRC). The Lighthouse Project supported the CCRC with small funds to periodically maintain the PSFs. The CCRC also receive monthly user fees from the PSF beneficiaries. CCRC deposit both the contribution and subscription at a bank and use the interest gained on deposit for repairing and periodic maintenance of the PSFs. This system is now effectively working in the community.

Women carrying water from PSF

The unique feature of PSF is that they ensure water availability around the year for hundreds of households in their neighborhood. Even families living three to four kilometers away from the next PSF collect water from it. Abu Baker for instance, an eleven years old pupil, fetches water three times a day from the Basali Bari PSF at Padma village, which is 2.5 kilometers away from his house. While his parents are busy with farming and household activities, Abu Bakar took the responsibility of collecting drinking water for his family of six. He developed a simple technology, a wooden frame on three bearings, to carry jar-full water with less physical labor.

To de-salinize saline water, the Lighthouse Project installed a desalinization plant with a capacity of 1000 l per hour in a remote coastal village called Vamia. This plant uses a reverse osmosis process to de-salinize the water. This kind of treatment is required when the salinity is too high to use the water as drinking water. As Vamia has no access to the electricity grid, the plant is currently powered by a solar energy system with 24 photovoltaic panels of 7.2 k watt. “Though the

initial investment for the panels and the battery is high, the system provides a long-lasting solution with minimal maintenance costs and providing the safest possible drinking water compared to any other available option", says Haridas Biswas. The plant has ended the drinking water scarcity of at least 300 people living in Vamia. In months of acute water crisis, other people living in a radius of ten to twelve-12 kilometers come to collect water from this plant. Quite often, local water vendors also collect water from this plant, and sell it to families living far away.

For the smooth functioning of the plant, an 11-member- management-committee has been formed with the local UP chairman as advisor. The committee decides about user fees and business hours in a participatory process. The committee also appoints the plant manager, who maintains the plant, distributes water for six hours a day, and deposits the income in the bank to cover future costs. As of August 2017, the plant has generated a surplus after any charges of BDT 85000.

Community based desalinization plant at Shyamnagar

3.3 Ensure Safe Shelter in Case of Cyclones or Flooding

The increased frequency and intensity of extreme weather events has aggravated the risk exposure of the coastal communities, which were already before considered as the most climate vulnerable people in Bangladesh. Alam et. al. (2009) noted that the increase in localized and low intensity hazards (such as tidal surge, low intensity storms etc.) also leads to higher vulnerability in case of high impact hazards (such as cyclones and flood), as they weaken disaster protection infrastructures. Hence, along with enhancing socio-economic adaptive capacity, it is also required to undertake measures to protect human lives against high intensity hazards like cyclones. Given this context, the Lighthouse Project undertook several interventions, categorized in four areas; a) awareness building on cyclone early warning systems, b) construction of fortified houses protected against storms and low intensity cyclone, c) construction of a cyclone shelter in the high-risk area, and d) construction and rebuilding of roads and embankments.

To improve the early warning system, the Lighthouse Project organized discussions and orientation sessions at community level to sensitize the people to take safe shelter during cyclonic disturbances. The Lighthouse Project also organized trainings for community volunteers on cyclone warning and preparedness. Members of the community resilience centers (CCRCs) were trained as well to serve in case of cyclone warnings, in emergency health services etc.. CCRCs have been equipped with megaphones, first aid kits, essential medicines etc., so that they can ensure quick evacuation of the people at risk to safe shelters.

Training facilitated by CCRCs at Patharghata, Barguna

To fortify houses against storms, the Lighthouse Project developed a model of a low-cost cyclone -fortified house, made out of concrete pillar and corrugated iron sheet. The houses are built on a raised earth plinth with concrete coating. So far, hundred cyclone-fortified houses have been built, mostly in the communities situated at the edge of the sea. Construction takes place on a cost sharing basis and beneficiaries are selected on the basis of risk scores (see above).

The Lighthouse Project also started the construction of a three-storied cyclone shelter in Charlathimara village of Patharghata upazilla, which will be used in normal times as a school. The design, construction plan and location were agreed in close cooperation between the CCRCs and the local Union Parishad. One of the CCRC's members, Md Mostafizur Rahman, donated his private land for the cyclone shelter. After finalization of construction, it will provide safe shelter to around 1500 people living in Padma and Charlathimara village. It will be for the first time that people in this high-risk area have access to a cyclone shelter. The shelter is designed as a multi-purpose building. It will be partly used as a school, and serves purposes like processing of agricultural products, seed preservation, storage of agro machineries and equipment as well as a CCRC's meeting place for agricultural planning and advice, community health service and a business center for agricultural products.

The Lighthouse Project was also successful in motivating the community people to engage more in solving problems on their own. During the risk analysis, CCRC identified those broken roads and embankments, from where saline water is entering during high tide. The Lighthouse Project along with CCRC motivated the affected people to raise fund for repairing the roads and embankments. The project itself as well as the UP also contributed financially. So far, 23 roads and embankments have been repaired. 2500 families benefitted from these measures, and more than 100 hectares of land are now protected against salt water intrusion during high tide.

Cyclone shelter construction at Patharghata

3.4 Strengthening Peoples' Institutions

Climate science provides information on the changing climate conditions and increasing future climate risks. Scientific information is also very important for the design of adaptation measures and resilience-building processes. However, science-based knowledge alone is not enough to build resilience. Local people, their realities and their experiences on the climate and the environment need to be fully taken into account, to build the necessary common ownership. Furthermore, unsustainable land-use planning and management can also aggravate climate risks. Very often, too narrow sectoral development activities, weak governance mechanisms, the expansion of unplanned and/or poorly planned shrimp farms in coastal areas, or the inadequate maintenance of coastal infrastructure and water regulators increase the fragility of local economies and ecosystems.

Therefore, in the context of bottom-up planning, it is important to strengthen local institutions (e.g. peoples' institutions) to effectively generate local knowledge and to better differentiate and prioritize the needs of the poorest and most vulnerable in designing appropriate adaptation responses. While most of the short-term project based adaptation-actions are designed to minimize adverse climate impacts, it is also important to challenge existing development practices and governance mechanisms in order to make them more sustainable in the longer run.

To develop local knowledge, to inform resilience-planning, and to make peoples' voice on climate change impacts and vulnerabilities better heard at the policy level of decision-makers, the Lighthouse Project facilitated the establishment of 'Community Climate Resilient Centers' at village level. So far, five CCRCs have been established in the project areas, three in southwestern and two in south-central coastal districts. The CCRCs are located at places provided by the communities, and are managed by executive committees with 11 to 13 members with different professional and social backgrounds. The CCRC committee members are selected based on consensus and they represent different communities so that a broad range of issues and concerns is considered in resilience planning. While CCRCs primarily function as 'resource centers', they also serve as institutional anchor for the assessment of climate change risks and to develop practical & innovative low cost solutions including technologies for long-term adaptation and disaster risk reduction. CCRC explicitly works to bring community people together and as well as mobilize resources from their own contribution to implement actions especially related to agriculture & water resource management for addressing climate change challenges. One of the major task of CCRC is to develop local adaptation plan with the direct and active engagement of community people. Once a local adaptation plan is developed, CCRCs share the plan with the local Union Parishad and other government agencies, and solicit their cooperation for its implementation.

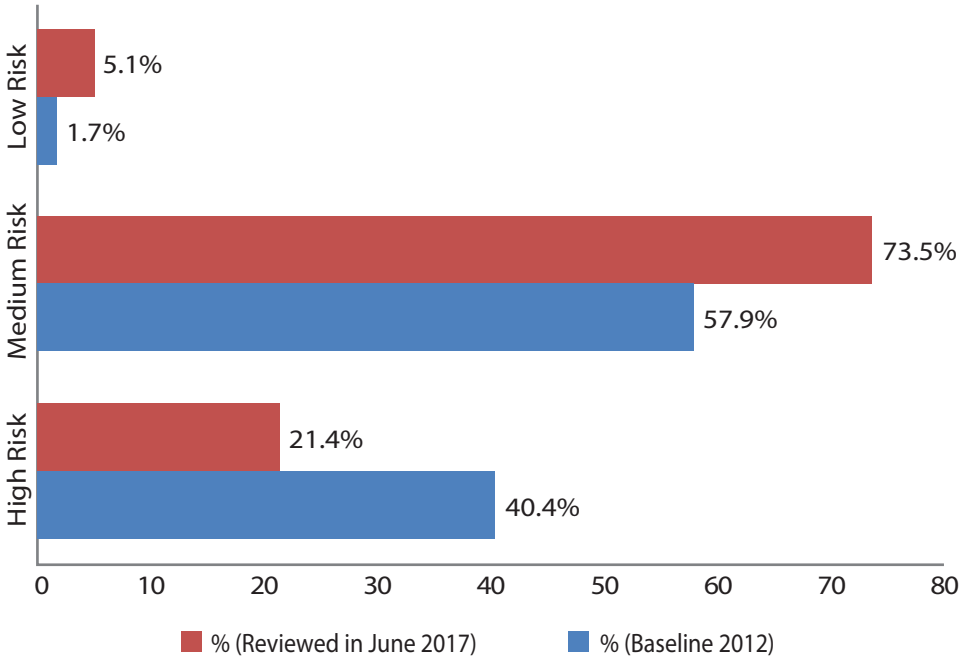
3.5 Lobby and Advocacy for the Implementation of Climate Adaption Action

In terms of lobby and advocacy for the implementation of adaptation action, the CCRCs, so far, have been successful in mobilizing support and resources from the local UPs for repairing roads, embankments and sluice gates. The CCRC at Padma and Char Lathimara village of Sadar Union, Patharghata Upazilla, developed a plan to bring approximately 95 acres of land under multiple crop cultivation, including cultivation of a salt tolerant rice variety. This chunk of farmland has a canal to drain rain water to the nearby sea, keeping the land free from water logging. To keep the land protected from tidal water influx, a sluice gate was constructed at the mouth of the canal. Due to lack of maintenance, the sluice gate became non-functional and saline water flooded in for several years. The influx of salt water, sand and silt gradually blocked the canal, leaving the land permanently water logged. CCRC decided to undertake lobby and advocacy work, calling on the governmental authorities to repair the sluice gate and re-excavate the canal, with support of the people.

The CCRC approached the local Union Parishad (UP) and shared its plan to bring the land under multiple cropping. After several discussions and meetings with the CCRC members, the local UP agreed to repair the sluice gate, but asked the CCRC to mobilize resources from other sources for canal re-excavation. CCRC, with the support of the Lighthouse Project, raised BDT 571,000.00 (5865 €), including a contribution of almost two thirds provided by the farmers. Since a lot of labor was required for the excavation, each household complemented 3 work days in addition to their monetary contribution.

Following a similar approach, the Lighthouse Project reconstructed an embankment of 670 m length in Morelgonj, that protects 60 acres of agricultural land and 175 households from tidal water influx. A 2 km long access road to a cyclone shelter was also reconstructed together with the community, in order to ensure quick evacuation in case of cyclones. In Shymnagar, a 400 m long canal was excavated to terminate water logging of 350 households.

Lighthouse Project: Comparative Risk Reduction Scenario



Following a robust methodology, Lighthouse Project assessed climate risk at household level and developed a baseline in 2012 for 5202 households in three working areas. To measure the outcome of project interventions, the project conducted a review following the same methodology in June 2017. The comparative analysis showed that the percentage of high risk category households reduced to 21.4% in 2017 from 40.4% in 2012 which increased the medium risk category households to 73.5% from 57.9%. The number of low risk categorized households increased up to 5.1% which was only 1.7% during the baseline.

The above mentioned risk reduction scenario is an outcome of project interventions along with government development activities and community people's participation.

4 CHALLENGES AND WAY FORWARD

Being resilient is a multi-facet concept and it involves at least three apparently different but 'all inclusive' elements e.g. disaster risk reduction, adaptation to the current climate stressors as well as future uncertainties of climate change, and poverty reduction, as emphasized in the sustainable development goals. However, programs and projects with different durations, timelines and focus may not essentially include all the elements in an inclusive manner but can complement each other in the transformation towards resilience building.

Hence, leaving the inherent limitations of projects-based activities aside, the Lighthouse Project, though it already contributed in building adaptive capacity, requires further engagement to ensuring a socially just adaptation to be embedded into development policy and practice.

4.1 Continuous Endeavor in up-scaling Adaptation Measures

Since adaptation actions are context and location specific, adaptation requirements may need flexible adjustments in the course of dynamic changes of the social and ecologic context of a given area. Adaptation actions are also time specific – a set of adaptation measures being appropriate today, may not be sufficient or even relevant in future as nature and severity of risks may change over time as well as the adaptive capacity of a community. For instance, the floating gardening, being considered as a re-known adaptation technology of Bangladesh (UNEP, 2014), seems to become an inappropriate intervention in the coastal areas. Though floating gardens are widely cited as successful adaptation technology, particularly in the water-logged areas, its potential for replication remains limited, as long as floating gardens are not further innovated in view of changing ecological settings. In contrast to this, crab fattening in sub-merged bamboo cases has been found a beneficial adaptation technology, which can support local livelihoods. Hence, it is import to maintain a high level of innovation, to constantly identify new adaptation technologies, and to continue up-scaling existing technologies with the changes observed in

vulnerable contexts. Though technology could play an important role in resilience building – as long as it is ensured that they remain affordable for the poor. Hence it is important to continue to develop low cost technologies.

The identification and up-scaling of adaptation measures should also be informed by the site-specific vulnerability context. Hence, it is required to undertake hazard and vulnerability analysis at the end of each project cycle, or periodically at least in 3-5 year intervals. This will help to assess achievements in risk reduction and resilience building against the project outcome indicator. It will also help to identify new project interventions for the next project cycle on the basis of updated knowledge on vulnerabilities. This approach will also contribute to close the adaptation gap step by step, and to make the communities truly resilient.

4.2 Climate Adaptive Governance and Service Delivery

Resilience building involves a complex, continuous process that is constantly influenced by many other social, economic, institutional, cultural and ecological settings. In Bangladesh, climate change adaptation is often found overshadowed by current economic priorities and governance practices. For instance, mere growth-focused development activities e.g. shrimp farming, diverting investments in physical infrastructures and energy projects, as well as inadequate finance for community based adaptation, the privatization of public commons, weak governance in service delivery, and other limiting factors, may even widen the adaptation gap, leading to more instead of less people being exposed to climatic risks.

Hence, apart from strengthening household based adaptive capacity, the Lighthouse Project should also identify and address the demand for climate adaptive governance mechanisms at national and local levels. At the local level, the Lighthouse Project can support the UPs in elaborating local development plans that are aligned with and informed by climate risk analysis. The Lighthouse Project can also undertake advocacy work on local issues or development practices that may aggravate climatic risk factors. So far, the Lighthouse Project demonstrated its high potentials in successfully solving a number of local problems, for instance repairing sluice gates and embankments. This has significantly contributed to resilience building. Such initiatives should be further strengthened.

In the longer run, and based on its experience of community-based resilience building, the Lighthouse Project could develop a set of indicators and a system for measuring, verifying and reporting adaptation actions, as there is so far no such established system available, that measures effectiveness of adaptation in a unified and quantitative way.

With the ongoing changes of the local ecological context, the demand for adaptation services is also changing. The government's service-providing agencies should re-design their services and modalities of work accordingly. The Department of Public Health and Engineering (DPHE), for instance, is mandated to ensure safe drinking water, and it helps in installing hand-pumped tube wells in communities or even at household levels. However, hand-pumped tube wells have become useless in ensuring water security in many coastal areas, because the ground water has become increasingly saline. People in those areas rely on project based water supply through installing PSFs or rain water harvesting plants, and in some cases desalination plants. When projects face out, many of the water supply system face severe management problems and conflicts, which often lead to the collapse of the supply system.

The Lighthouse Project, along with coastal NGOs, could demonstrate lessons learnt with different technologies, and could call on the DPHE to become accountable, and to provide more sustainable solutions, modalities and institutional set-ups. If set up is in the right way, PSFs, water harvesting plants, water reservoirs, and desalination plants could improve and secure access to drinking and irrigation water even in the salinity prone areas. This could include a strategy to make DPHE and UPs responsible for the management and the maintenance of existing water supply structures.

Agricultural research institutes in Bangladesh have developed new rice and other crop varieties, which are more tolerant to salinity, flooding or drought. These varieties and their farming technologies should be disseminated in a much broader and more effective way. The government's agriculture extension department should come up with new approaches and educational materials for technology promotion and diffusion.

4.3 Peoples' Institution for Knowledge Management and Socially Just Adaptation

One of the major challenges of community based adaptation action is the absence of in-built knowledge generation and management systems. We are convinced, that, in essence, bottom-up approaches for resilience building empower and motivate the people in the communities to take the responsibility, analyze their own vulnerability and strength, and make their decision on adaptation actions, resource mobilization and resource distribution as per need and priority. This requires a community-owned institution and a continuous process of knowledge generation, taking the lessons learnt, and sharing them among the stakeholders. Therefore, the Lighthouse Project facilitated the establishment of "Community Climate Resilience Centers". However, they need more capacity-building in terms of knowledge generation and participatory decision making in order to take informed and un-biased decisions It is also important to strengthen the governance structure of CCRCs in future, so that they could function in a transparent and accountable manner while avoiding any management conflicts.

As stated earlier, resilience is a multi-facet concept and it includes many elements. However, in practice adaptation is by far too often considered as a 'business as usual' approach, simply reacting to certain stresses on the basis of own experience and past learnings. Such an approach, to some extent, undermines the notion of socially just adaptation that encompasses both procedural justice (empowering communities to overcome a lack of social capital and institutional barriers to involvement in decision-making), and distributive justice (distribution of income, assets and opportunity). The Lighthouse Project is on a good way to establish a model of 'socially just adaptation' through ensuring that rights become better respected, that services become more targeted and better aligned, and that ultimately more resources (e.g. Kash land) and opportunities (e.g. increase level of entitlement to the social safety nets, insurance etc.) are granted to the most vulnerable communities and people.

4.4 Transformation and Mainstreaming of Good Process and Good Practice

Though Bangladesh is often described as 'Global Adaptation Capital', adaptation and resilience building are still in a 'narrative stage' in national policy frameworks, and yet to be incorporated in sectoral policies and programs. Hence adaptation measures are often of innovative but sporadic nature, limited to and isolated in separated projects, and mostly reactive by nature. However, the multitude of adaptation practices on the ground offers solid experiences and important learnings that should be systematically assessed and then used for long-term anticipatory adaptation planning and action. This would provide a solid fundament for public policies, strategies and plans.

Bangladesh has formulated so far two climate specific plans i.e. the National Adaptation Program of Action (NAPA) in 2005 and the Bangladesh Climate Change Strategy and Action Plan – BCCSAP in 2008. Both were designed in view of expected resource allocations either from multilateral (UNFCCC) or bilateral sources. The National Adaptation Program of Action (NAPA) was linked to the UNFCCC's Special Climate Change Fund (SCSCF) and the formulation of 'Bangladesh Climate Change Strategy and Action Plan-BCCSAP' was set up in view of a multi-donor fund. However, these plans are generally perceived as sidelined documents, because the country's national planning authority, i.e. the Planning Commission, was not involved in this process.

Currently, Bangladesh is again in the process of adaptation planning: A National Adaptation Plan (NAP) is under work, as required by the Paris Agreement. A roadmap for NAP formulation has already been prepared. Though the roadmap entails a centralized planning process, it also suggests to elaborate pilot local adaptation plans, based on site specific climate risk and vulnerability analysis for at least two climate hot spots.

Given this context, the Lighthouse Project should collaborate with the national NAP formulation team, offering its rich on-ground experiences in hazard, vulnerability and risk mapping. It could also promote its people-centered approach in resilience building and make it part of Bangladesh's future national Adaptation Plan.

REFERENCES

Alam, K. et al. (2009). Can community based cyclone preparedness programs explain differential impact of cyclone Sidr in Bangladesh? : Lessons from BCDPC project of Bangladesh Red Crescent Society, with support from the European Commission and the consortium of British, German and Swedish Red Cross. British Red Cross and Think Ahead. Dhaka.

CEGIS, (2006), Impacts of Sea Level Rise in the Southwest region of Bangladesh, Center for Environmental and Geographic Information Services (CEGIS), Dhaka.
Chowdhury, S. R, Hossain, M, S., Shamsuddoha, Md and Khan, S. M. M. H. (2012), "Coastal fishers' livelihood in peril: Sea surface temperature and tropical cyclones in Bangladesh", Center for Participatory Research and Development, Dhaka.

Climate Change Cell, 2016, 'Assessment of Sea Level Rise on Bangladesh Coast through Trend Analysis', Department of Environment, Ministry of Environment and Forests. Retrieved from: http://gobeshona.net/wp-content/uploads/2016/08/SLR-Report_final_July-2016.pdf

Folke, C. (2006) Resilience: The emergence of a perspective for social–ecological systems analyses, Global Environmental Change, Volume 16, Issue 3, August 2006, Pages 253–267

Government of Bangladesh GOB (2016): Seventh Five Year Plan (FY2016 – FY2020), General Economics Division (GED), Planning Commission, Government of the People's Republic of Bangladesh, Final Draft, 11 November 2015, Available at: http://www.plancomm.gov.bd/wp-content/uploads/2015/11/7FYP_after-NEC_11_11_2015.pdf

Government of Bangladesh GOB (2013), "The Millennium Development Goals: Bangladesh Progress Report 2013", General Economics Division (GED), Planning Commission, Bangladesh

Huq, S and Rabbani, G (2011). Climate Change and Bangladesh: Policy and Institutional Development to reduce vulnerability. Journal Of Bangladesh Studies. Volume 13, no, pp 1-10

IPCC, (2014), The Fifth Assessment Report of IPCC, Intergovernmental Panel on Climate Change (IPCC), Paris.

Irfanullah, H.Md. 2013. Could world's 'adaptation capital' be slow adapting? AlertNet Climate, Thomson Reuters Foundation, UK. Available on: http://www.trust.org/item/20130919131025-kt9ei/

McCarthy, J. J., Canziani, O. F., Leary, N. A., Dokken, D.J., and White, K. S. (eds.): 2001, Climate Change 2001: Impacts, Adaptation, and Vulnerability, Contribution of Working Group II to the Third Assessment Report of the Intergovernmental Panel on Climate Change, Cambridge University Press, Cambridge.

MOEF-GOB, (2012), Second National Communication: Adaptation, contribution to Second National Communication (SNC) of GOB, submitted to Ministry of Environment and Forest, GOB, November 2012.

Nelson, D. R., Adger, W. N., and Brown, Katrina (2007): Adaptation to Environmental Change: Contributions of a Resilience Framework; The Annual Review of Environment and Resources is online at http://environ.annualreviews.org

Shamsuddoha, M. and Bijoy, M. R. (2015), Addressing Climate Change in Bangladesh:Policies and Preparedness, Focusing on the Sixth Five Years Plan (2011-2015) of Bangladesh

UNISDR (2004). Living with Risk: A global review of disaster reduction initiatives 1 and 2

Christian Commission for Development in Bangladesh (CCDB) has been working in Bangladesh since 1973 to create a just and caring society where the poor, marginalized and vulnerable people can claim and enjoy human rights and justice for a sustainable livelihood with dignity.

Acknowledging climate change as a priority development issue to be addressed in Bangladesh, CCDB has been implementing several projects to build community resilience to climate change impact since 2007. Moreover, CCDB has taken several initiatives to introduce adaptive technologies in the areas of agriculture, water, etc. Capacity building on climate change adaptation and mitigation is another one of the priority areas of CCDB's climate change program. This initiative is playing a significant role in building skill and knowledge of different stakeholders including NGO professionals. CCDB's Climate Change Unit is also heavily involved in some research on agricultural adaptation, loss and damage, ICT in climate change, etc. In addition, CCDB is in the process of establishing a Climate Technology Park- an interactive climate learning center, first of its kind in Bangladesh to provide solutions regarding adaptation and mitigation technologies since 2016. The ultimate objective of CCDB's climate change program is to promote pro-poor climate resilient low carbon sustainable development in Bangladesh and beyond.

This book "Being Resilient: Addressing Climate Change Evidences on the Outcome and Learning of Bangladesh Lighthouse Project" is an outcome of a research initiated by Climate Change Unit of CCDB.

Christian Commission for Development in Bangladesh (CCDB)
88, Senpara Parbatta, Mirpur - 10, Dhaka - 1216
Phone: 9020170-3, Fax : 880-2-9020227