

CLIMATE CHANGE AND EDUCATION MALDIVES



P. K. Das

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March 2010

Printed by: Genesis (Pvt.) Ltd.

This material has been funded by UKaid from the Department for International Development, however the views expressed do not necessarily reflect the department's official policies.'

CONTENTS

Acknowledgement	
Abbreviations	
Chapter 1	
Introduction	11
Chapter 2	
The Context	21
Chapter 3	
Hazard Profile	27
Chapter 4	
Situation Analysis	37
Chapter 5	
Education Profile and Risk	43
Chapter 6	
Participatory Vulnerability Analysis	47
Chapter 7	
Adaptations and Mitigations	55
Chapter 8	
Costing	71
Chapter 9	
Recommendations	75

ACKNOWLEDGEMENT

National Disaster Management Centre

1. Abdulla Shahid
Ministry of State, Ministry of Housing, Transport and Environment
2. Mohamed Shahid
Director General
3. George Ranjith
Consultant – UNISDR
4. Mohamed Asim
Senior Administrative Officer

Society for Social Services (SSS)

1. Hussain Zamir
Founder member and Executive Officer

Province Offices

1. Thilmeeza Hussian
Ministry of State, Ministry of Home Affairs
2. Umaru Jamal
Ministry of State, Ministry of Home Affairs
3. Ahmed Mujthaba
Ministry of State, Ministry of Home Affairs

Gaafu Dhaal Atoll – Thinadhoo

1. Mohamed Shareef
Deputy Minister, Ministry of Home Affairs
2. Mohamed Zahir
G. Dh. Thinadhoo, Councilor
3. Lamyaa Abdul Haadhee
Principal, G. Dh. Atoll Education Centre
4. Mohamed Ajeeb
Deputy Principal, G. Dh. Atoll Education Centre
5. Mohamed Ali
Chair person of School Board, G. Dh. Atoll Education Centre
6. Sheela Mufeed
Vice Chair person of School Board, G. Dh. Atoll Education Centre
7. Ibrahim Rushdhee
Principal, G. Dh. Aboobakuru School

Raa Atoll – Ungoofaaru

1. Ibrahim Rasheed
Atoll Councilor, Raa – Atoll
2. Ibrahim Naseer
Deputy Principal, Raa – Ungoofaaru



Lhaviyani Atoll – Hinnavaru

1. Mohamed Mahir
Atoll Councilor, Lhaviyani Atoll
2. Adam Yousuf
Island Councilor, Lhaviyani Hinnavaru
3. K. C. Kurayan
Head of School, Lhaviyani Atoll Education Centre

Laamu Atoll – Gan

1. Mohamed Naif
Assistant Administrator, Province Office
2. Zaeema Abdulla
Vice Chair person of School Board, Laamu Atoll Education Centre
3. Ahmed Rasheed
School Board member, Laamu Atoll Education Centre
4. Ibrahim Rasheed
School Board member, Laamu Atoll Education Centre
5. Mariyam Haaroona
Acting supervisor, Laamu – Thundi School
6. Aminath Saeeda
Acting supervisor, Laamu – Thundi School

Other Offices

1. Mohamed Aslam
Minister of Housing, Transport and Environment
2. Dr. Ahmed Shareef
Deputy Ministry of Housing, Transport and Environment
3. Ahmed Shafeeg Moosa
Special Envoy to the President, President Office
4. Shifa Mohamed
Deputy Minister of Education
5. Hussain Rasheed
Deputy Director General, Ministry of Education
6. Dr. Nashiya Mohamed
Deputy Director General, Education Development Centre

UN Country Team

1. Mansoor M. Ali
Representative, UNICEF
2. Shadiya Adam
UNICEF
3. Dr. Jorge M. Luna
Representative, WHO
4. Dr. Jagdish Barot
WHO

ABBREVIATIONS

AEC	Atoll Education Centre
APIT	Advancing Public Interest Trust
AS	Atoll School
Ca	Cost of Adaptation
CAC	Centre for Analysis and Choice
CC	Climate Change
CCD	Climate Change Database
CCIA	Climate Change Impact Assessment
CDMP	Comprehensive Disaster Management Programme
Cm	Cost of Mitigation
DFID	Department for International Development
DMB	Disaster Management Bureau
DoE	Directorate of Education
DRR	Disaster Risk Reduction
DRRE	Disaster Risk Reduction through Education
DRRS	Disaster Risk Reduction through Schools
DSA	Direct Selling Association
ECHO	European Commission's Humanitarian Aid department
EEC	European Economic Community
EMIS	Education Management Information Systems
GDP	Gross Domestic Product
GEF	Global Environment Facility
GHG	Greenhouse Gases
GIS	Geographic Information System
GoM	Government of Maldives
HFA	Hyogo Framework for Action
ICT	Information and Communication Technology
IDP	International Development Partners
IFRC	International Federation of Red Cross and Red Crescent societies
IPCC	Intergovernmental Panel on Climate Change
JICA	Japan International Cooperation Agency
LIO	Local Implementing Organisations
LRRD	Linking Relief, Rehabilitation and Development
M & E	



MDG	Millennium Development Goals
MGFDSS	Ministry of Gender, Family Development and Social Security
MHAHE	Ministry of Home Affairs, Housing & Environment
MHTE	Ministry of Housing, Transport & Environment
MMI	Modified Mercalli Intensity
MoE	Ministry of Environment
MoFDM	Ministry of Food and Disaster Management
MoHF	Ministry of Health and Family
MoU	Memorandum of Understanding
MPND	Ministry of Planning and National Development
MSL	Mean Sea Level
NAPA	National Adaptation Plan of Action
NC	National Communications
NDMC	National Disaster Management Centre
NDP	National Development Plan
NEAP	National Environment Action Plan
NFE	Non Formal Education
NP	National Partner
OCHA	Office for the Coordination of Humanitarian Affairs
PVA	Participatory Vulnerability Analysis
PWD	Power Works Department
R & R	Review and Reflection
RPVA	Rapid Participatory Vulnerability Analysis
SDEJ	Social Development and Economic Justice
SEEDS	Sustainable Economic and Educational Development Society
SIRD	State Institute of Rural Development
SMC	School Management Committee
SSS	Society for Social Services
SST	Sea Surface Temperature
UNDP	United Nations Development Programme
UNEP	United Nations Environment Programme
UNFCCC	United Nations Framework Convention on Climate Change
UNICEF	United Nations Children's Fund
UNISRD	United Nations International Strategy for Disaster Reduction
WHO	World Health Organisation
WS	Workshop

EXECUTIVE SUMMARY

1. The Maldives-a north-south lying constellation of 1,192 islands grouped in a double chain of 26 atolls with a total land area of only 298 square kilometres spread over 107,500 square kilometres in the Indian Ocean-is severely threatened by sea level rise, beach erosion, storm surges and increased rainfall. The area of the largest island is 2.5 square kilometres and only 4 out of 200 inhabited islands have more than 5000 people.
2. More than 120,000 children-about 30% of the current population in Maldives are at the risk of becoming physically and socially vulnerable because of climate change hazards. Physical vulnerability may include death, injury, diseases, and chronic malnutrition. Social vulnerability may include loss of parents and family, internal displacement, risk of being trafficked, loss of property and assets, and lack of educational opportunities. The southern islands have higher risk profile than the northern islands.
3. The greatest danger to the country is from rising sea level. Half the country's population live within 100 metres of the coast line, and 1 metre rise in the sea level will submerge 80% of the country's land area including 135 schools.
4. The tsunami in 2005, though not directly related to climate change, demonstrated a possible impact on education. A total of £ 2.7 million was spent on reconstructing schools and supplying educational materials. Schooling was disrupted for 18 months.
5. However, the risks to education are more complex. Sustaining primary schools and teachers in the smaller islands is difficult. Two third of the secondary school teachers are from neighbouring countries and frequent turn around cause problems in school operations. Climate change hazards add to these problems.



-
6. Adaptation measures could include disaster safe school design and construction, life-long and open-learning opportunities and use ICT for teaching and learning. Building awareness about climate change hazards and possible impacts on lifestyle through school based activities and teacher training could be another effective adaptation measure.
 7. The National Adaptation Plan of Action (NAPA) has quite strongly put forward the case of education. The National Disaster Management Centre (NDMC) is the apex coordinating body of all climate change related policies, activities and communications and closely work with the Ministry of Education. The country is currently developing a detail budget for the NAPA using of the Participatory Vulnerability Analysis (PVA) methodology of the DFID study.

Chapter 1

INTRODUCTION

1.0 CLIMATE CHANGE

The IPCC scientists have provided tangible evidences on climate change due to increased human activities and development. According to the United Nations Framework Convention on Climate Change (UNFCCC) there are two types of responses to climate change; a) mitigation of climate change by reducing greenhouse-gas emissions and enhancing sinks and b) adaptation to the impacts of climate change. Instead of viewing them separately, recently policy-makers have started showing their interest in exploring interrelationships between adaptation and mitigation. However, this is a complex domain and depends upon the countries' economic status, emission level, their commitments to the international forum, etc. The major issues are a) determining the optimum level of adaptation and mitigation, b) time frame and the right combination of adaptation and mitigation, c) who should decide these and based on what criteria should they be decided?

Generally, the mitigation research community has been found to emphasise primarily on technological and economic issues, and has traditionally relied on 'top-down' approach for studying trade-offs inherent in mitigation (IPCC, 2007). In contrast, the adaptation research community has put its emphasis on local and place-based analysis.

In countries such as Bangladesh, Maldives, Nepal, etc., it has been observed that, if adaptation is treated as a top-down, the local communities tend to view them as external impositions by government authorities. Field visits to these countries revealed that the local communities are not comfortable with such approach. It

becomes less acceptable to the communities if the adaptation measures for a particular location are explained to them by outside experts. The bottom up approach brings the lab knowledge of climate change in a simple and understandable format to the community which they do not and cannot be expected to know. Together with this, the local knowledge/wisdom and understanding will help to figure out the best mode of adaptation at a particular location.

If the adaptation, mitigation and the interconnected interventions are monetized, one could draw the above diagram to a scale. In that case, the bubbles would represent the quantum of mitigation, adaptation and interconnected actions of a particular country and would depend upon its life style, emission, nature of production industries, etc. Each country will have a unique pattern of these two bubbles and their overlap. This will change over time depending upon the country's speed of approach towards its set target.

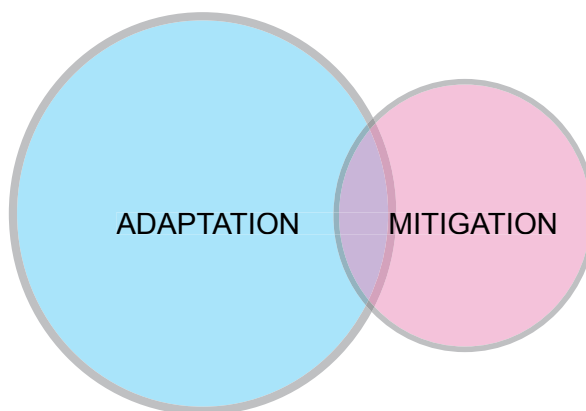


Figure 1.1: The relative sizes of the bubbles representing adaptation and mitigation and the overlap- will differ from country to country depending upon their socio-economic conditions, life style, emission status, etc.

These two bubbles are interconnected since one action will regulate the other. For example, to reduce emission of GHG, a country may use clean development mechanism (mitigation); however, changing the life style (adaptation) will reduce the mitigation actions at the root level. Awareness of the people, investment on projects and programmes on adaptation and mitigation actions, political stability, regional co-operation, etc. will determine the diagram.

While NAPA and similar documents are participatory, they are heavily supported by research based knowledge, which is predominantly

analytic. However, there is a need for synthetic knowledge (Gorsky, 1987) which is based on direct experience such as community wisdom in the context of climate change. The above Figure shows the process of top down and bottom approach.

In summary, it may be said that Climate Change is a reality and there is a need for combating it through planned mitigation and adaptation interventions in a time frame. Climate change has been an issue since long. However, it got the due political importance after Al Gore and the U.N.'s Intergovernmental Panel on Climate Change won the 2007 Nobel Peace Prize.

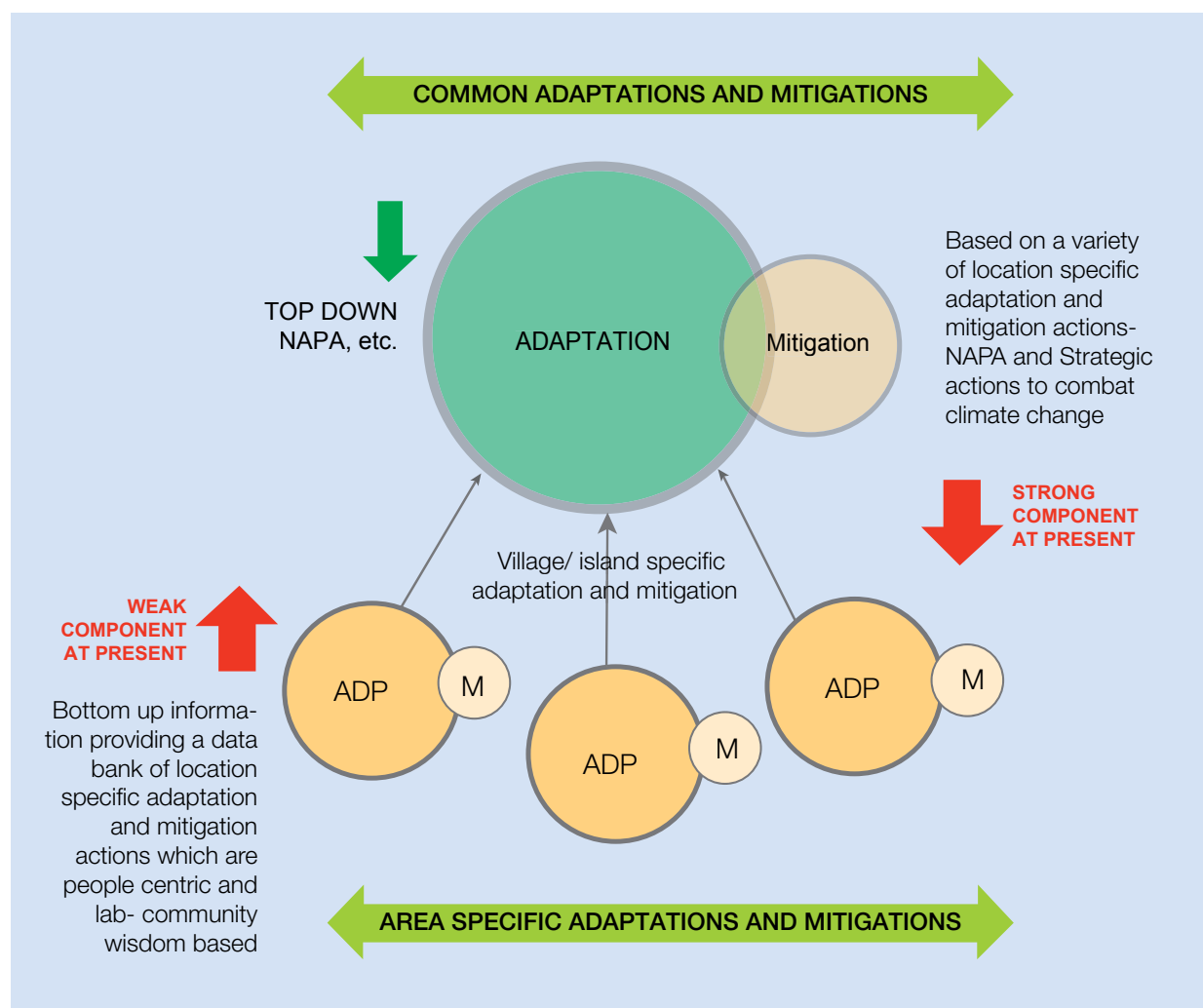


Figure 1.2 : Balanced system of bottom-up and top down

2.0 IMPACT OF CLIMATE CHANGE ON MDG

According to IPCC (2001a), countries such as Bangladesh, Maldives, etc. will be adversely affected by climate change because of their vulnerability due to different categories of disasters. One metre rise in sea level would flood 17.5 per cent of Bangladesh. Rising sea levels could force Pacific islanders to become nations of environmental refugees (Collins, 2006). Developing countries are particularly vulnerable since they are often located in high-risk natural settings and their adaptive capacity is reduced by poor socio-economic development. In many small islands such as Maldives, Coral bleaching, caused by warmer waters, kills coral reefs and puts the tourism industry at risk.

These will pose additional pressure on these countries' efforts towards achieving the MDGs. It may be noted that, there are many ongoing programmes by many institutions across the globe towards preparing for the climate change. For example Adaptation Policy Framework (APF) prepared by the UNDP/GEF (Global Environment Facility) emphasises on Capacity Development and Adaptation Cluster as the Cornerstone of their (UNDP's) Strategy in Adaptation. APF will assist in the process of incorporating adaptation concerns

into national strategies and guide formulation and implementation of projects. UNDP has its focus on MDG in the context of Climate Change. The following table shows the probable impacts of Climate Change on the MDGs.

The Adaptation Principles of UNDP-GEF considers that the adaptation activities should be supportive to the achievement of the MDGs and they must have development-focus. According to UNDP-GEF, the starting point for developing national responses is strengthening adaptive capacity and ensuring the stakeholders' involvement and public participation. One of the key activities is changing existing policies and practices and adopting new policies and practices so as to secure MDGs in the face of climate change and its associated impacts (UNDP 2006). The attempt should be to develop strategies to moderate, cope with and take advantage of the consequences of climatic events are enhanced, developed, and implemented (UNDP 2005).

The target of MDG 2 is interlinked with the other MDGs. Universal primary education is a key issue for the development and enhancement of living standard of the world population. Therefore, there is an urgent need for mitigation and adaptation to climate change in these countries in order to make their primary education systems sustainable.

Table1: Table showing the different MDGs at climate risks

MDGs	CLIMATE RISKS
MDG 1: Eradicate extreme poverty and hunger	Depleted livelihood assets, reduced economic growth, and undermined food security.
MDG 2: Achieve universal primary education	Reduced ability of children to participate in full-time education by loss of infrastructure, loss of livelihoods (forcing children to work), and displaced families.
MDG 3: Promote gender equality and empower women	Additional burdens on women's health and limited time to participate in decision making and income-generating activities.
MDGs 4, 5 and 6: Reduce child mortality; improve maternal health; combat HIV/AIDS, malaria and other diseases availability of potable water.	Greater prevalence of vector- and waterborne diseases, and heat-related mortality, declining food security, maternal health, and availability of potable water
MDG 7: Ensure environmental sustainability	Negatively impacted natural resources and productive ecosystems

3.0 COST OF THE RESPONSE

One of the most important issues in the context of response towards climate change is the probable preparedness costs. The Figure below shows (qualitatively) the interrelation among adaptation, mitigation and impact costs. If there is a low level of preparedness in terms of mitigation and adaptation, the impact-cost due to climate change will obviously be considerable as evident in the Figure below. Further to that, the less preparedness will result in time consuming post-disaster interventions making the distressed people suffer for prolonged periods, which is not acceptable on humanitarian ground. While it is desirable to invest on mitigation and adaptation, this will largely depend upon a country's financial ability, political will and level of awareness. It is important to study the implications of C_a , C_m and C_i (Figure below) in a particular country vulnerable to climate change. This will help in planning for its target towards climate change which is a trade off (adaptation, mitigation, socio-economy, etc.). In the planning stage, it is utmost important to thoroughly examine whether the mitigation and adaptation actions in a context are the right ones. This, along with a method of prioritising the mitigation and adaptation actions will lay the foundation stone for sustainable development. In order to achieve these, there is a need for greater level of regional co-operation and political stability within and around a country.

While the above paragraph covers the basic issues of costs related to combating climate change, most of the literatures state that there is a lack of data on cost of mitigation and adaptation making it difficult to estimate the required funding for disaster response. Personal interviews with the climate change specialists, NGOs, government departments, etc. under this research also confirmed that, relatively little research has been conducted to accurately calculate the costs of climate change for education systems. It may be noted that there are existing data on these issues, mostly based on reactive interventions. At present in countries such as Bangladesh, Nepal, India, etc., there are data on proactive measures as

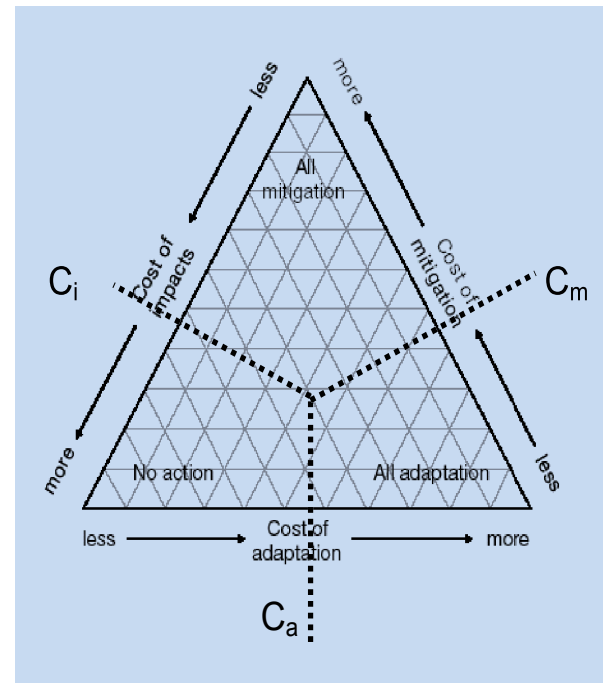


Figure 1.3: Inter-relationships between adaptation, mitigation and impacts, based on Holdridge's life-zone classification scheme (Holdridge, 1947, 1967): as cited by Klein et al (2007)

well. These data could be collated, reframed and analysed to obtain the mitigating and adapting cost towards climate change related increased disasters. The people living in the disaster prone areas have resilience. Their knowledge of combating disasters could be recognised as good source of knowledge that could be used for identifying the right parameters of adaptation and the right way of spending money on proactive measures against climate change related disasters.

It may be noted that the mitigation and adaptation have moving targets. Therefore, the intervention (mitigation+ adaptation) to have a sustainable society is a time bound effort. Therefore, there is a need for regular assessment of the situation in each country at suitable intervals acceptable to the people. This will enable one to assess the gaps and set new targets and carry out revised costing.

4.0 IMPACT OF CLIMATE CHANGE ON EDUCATION

According to Save the Children's 'Legacy of Disasters' and UNICEF's 'Our Climate, Our Children, Our Responsibility' (Back & Catherine, 2008), the children will be the hardest hit by the increasingly frequent and severe weather events, desertification and flooding brought by climate change. Supply side consequences of extreme weather events include: damage to education infrastructure and the resultant rehabilitation costs which drain constrained education budgets, and disruptions to schooling which have a significant impact on learning attainment. On the demand side, the impact of deteriorating livelihoods is likely to have widespread and long-term consequences including: the ability of families to send their children to school, increased levels of malnutrition and increased likelihood for conflict. Previous experiences suggest that these impacts are likely to disproportionately affect girls, raising serious concerns about gender equity.

In countries such as Bangladesh, there are already instances of very negative impact on educational infrastructure due to severe cyclone and flood that had destroyed school infrastructure, disrupting transport, and interrupting teaching and learning. The increased risk of diseases such as malaria, dengue fever and water-borne infections for both students and teachers due to these events further disrupts educational programmes.

Another issue is forced migration due to disasters which can also disrupt education systems (which puts pressure on schools and parents in both sending and receiving communities), civil conflict, and the increased necessity for children's participation in agricultural labour. The resulting social and economic costs therefore include a wide range of development concerns, from malnutrition and ill health to an increased risk of child labour and child trafficking. This seriously undermines existing efforts to increase education provision and to improve both economic and human development.

While much of the existing literature on climate change focuses on efforts at mitigation (e.g. carbon

trading, reduced consumption, etc.), adaptation to climate change is also a key concern. Education plays a key role in both areas. Communities affected by either slow environmental change or more frequent and severe natural disasters will require new sets of skills and knowledge in order to either adapt their livelihoods or to move to new locations. Existing educational infrastructure (including schools, transportation, texts and other learning materials) in these areas is also likely to be heavily affected – making it imperative to consider potential climate change impacts as part of planning processes. Where these issues are not taken into account, investment in education provision will be highly inefficient. The situation is worse in the countries affected by war, civil war, political unrest and instability, etc.

5.0 CONTEXT OF THE PRESENT RESEARCH

The Super cyclone SIDR hit Bangladesh on 15th November, 2007. During SIDR, 596 Government Primary Schools (GPS), 209 Registered Non Government Primary Schools (RNGPS) and 44 community schools (total 849 schools) were reported as completely destroyed in the twelve coastal districts. There was no official data on the extent of damage in the remaining seven types of schools in Bangladesh. SIDR had also partially damaged 2,396 GPS, 1,189 RNGPS and 190 community schools (total 3,775 schools). Apart from that, there was massive infrastructure damage, loss of human and animal lives, loss of fertility of land, spread of diseases and massive food shortage due to SIDR. An on-site damage assessment was carried out in the twelve SIDR affected districts by a team of representatives from DPE, Project Liaison Unit, Local Government Engineering Department (LGED) and DFID. According to the site data, about 1,46,000 students were severely affected in the completely damaged 849 schools (GPS+ RNGPS+ Community).

It may be noted that, prior to the super cyclone 74 schools got completely washed off, 131 schools were severely damaged and 8,686 schools were partially damaged due to flood. This type of disaster is frequent in Bangladesh.



The Department of Education, Government of Bangladesh, undertook the following important activities immediately after SIDR.

1. Making all the schools operational/functional in the 12 affected districts
2. Transition (temporary) arrangement for all the GPS, RNGPS and Community Schools to resume the classes
3. Reconstruction of the completely destroyed GPS by designing them as cyclone and flood shelter as well
4. Repair and upgrading of the partially damaged GPS, RNGPS and Community Schools
5. Supply of books, education aids, play items, post cyclone trauma counselling etc.

About 81 million USD was allocated for replacing damaged buildings in 589 GPS in the 12 SIDR-damaged districts of Bangladesh. The entire process of intervention was fully and intensely participated by Directorate of Primary Education (DPE) and there is a good possibility of continuance of institutional memory to combat future disasters. Right now, a computerised response system comprising human resources with EMIS and GIS data is in place in Bangladesh.

While the main objective of post SIDR intervention was originally aimed at “responding to the past”. the process developed appeared to have adequate merit to facilitate “preparing for the future”. During the course of discussing various issues on disaster and

primary education the experience of “responding” had gradually transformed into “preparing for the future”. The entire work was documented and published by DFID which is a major funding institute towards Bangladesh’s target of EFA.

The 2007 Nobel Prize to IPCC and Al Gore, Stern Review (Stern, 2007), “Save Our Children” (Legacy of disasters, no date)- Bangladesh report and above all the findings of post SIDR interventions had motivated DFID Bangladesh to conduct a study on climate change and its impact on the children (Figure below). DFID Headquarters had decided to fund this and thus the present research “Education and Climate Change in South Asia: Impact and Response” was initiated. The present research aims to learn from the other sectors of responses to climate change and to influence them as well. It will attempt to span between the grassroot and the policy focussing on “the right kind of adaptation and mitigation” and their corresponding “costs” of interventions to enable the government and the development partners to plan for the funding in a sustainable manner.

This work does not attempt to say what is to be done. It is based on what is available as hard data on good examples of communities’ wisdom towards combating disasters. While this is basically a bottom up approach, the scientific knowledge will be integrated with the traditional wisdom to make mitigation and adaptation the right way.

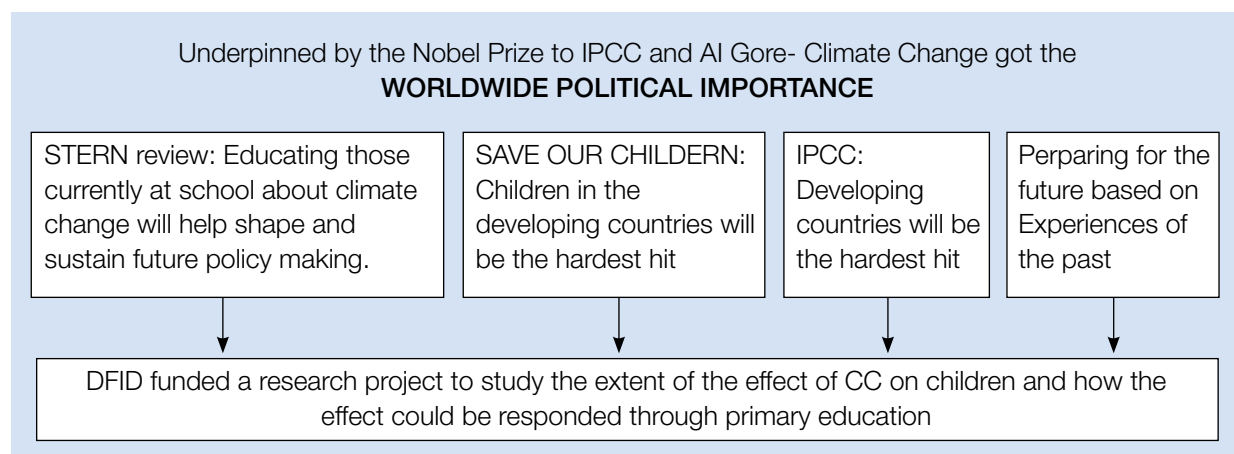


Figure 1.4: Background of the present research

6.0 DOMAIN OF THE PRESENT RESEARCH

In the present study, it has been assumed that the governments cannot be expected to take on the task of adaptation alone. There could be a need for enhancing awareness, willingness and capacity in the government system. The government's all encompassing presence in a country should preferably be together with local knowledge and understanding to figure out the best mode of adaptation and mitigation at grass root level. Primary education network in any country is an appropriate and perhaps the most influencing system to deal with the negative impacts of climate change, especially in the developing countries.

Children and Climate Change

Stern review (2007) proposes that Policy to reduce emissions should be based on three essential elements a) carbon pricing, b) technology policy, and c) removal of barriers to behavioural change. All these could be initiated and propagated through the primary education system in a cost effective manner. Apart from that, propagating adaptation through primary education system to cope with the changed environment will need the least intervention and could help in transforming the young minds towards a climate resilient life style. There are several advantages of this approach since it is;

- easy to teach the children
- established that the children have tremendous capacity to assimilate knowledge
- possible with minimum intervention through teachers' training, text book revision, appropriate pedagogy and examination system through the education and hence, Cost effective

The focus of the present research is the children and their education. Awareness and capacity building on climate change related preparedness could be instilled in the students by adequately

trained and motivated teachers in the classroom as well as by demonstrating the various aspects of this issue through the school building and its campus. Each primary school is situated in a settlement and hence, the teachers could be the protagonists for disseminating awareness on this issue to the communities. This research is based on the following assumptions.

- teachers are the champions who will disseminate knowledge on adaptation and mitigation to the students and the communities
- children are the disseminators at home and in the neighbourhood
- community is a source of knowledge to combat disasters and there are good examples of their abilities to combat different types of disasters, which could be combined with the scientific knowledge
- school building and its campus are the media for campaign on adaptation and mitigation in the context of climate change.

Cost of Preparedness through Primary Education Cost has been the pivotal element in the present research. The effort has been to identify the activities in the context of adaptation and mitigation at grass root level that are feasible and practical for the communities. This has been determined through a consultative process. The emphasis has been on the right way and on right types of activities on a prioritised set of activities.

The objectives of the study are to demonstrate a) impacts of climate change on education and b) responses through education to the impacts of climate change in Maldives and Bangladesh. These two countries have been selected based on the following reasons. The number of countries had to be restricted to two due to time and fund constraint.



Figure 1.5: Background of the present research

7.0 METHODOLOGY

The research is based on the following

- Existing literature reviewed
- Gaps in knowledge and practice identified
- Gaps in knowledge addressed
- Good practice identified
- Making sure that the following have been considered in the present research
- the problem due to climate change: Impacts due to climate change,
- linked to National Priorities, Action Plans, Programmes
- learning component clear
- clearly outline Goal, Objective, and Outcomes
- outcomes explicit
- examining whether the mitigation and adaptation activities are the right way towards the goal and the funding spent the way they should be
- The following Figure shows the assumed pathways of impacts at school and its children due to climate change related disasters.
- Identification and understanding the mitigation and adaptation activities and their interrelations/ interdependencies and priorities in the context of education system starting from the Ministry level down to the school at community level

Participatory vulnerability assessment has been used to identify the mitigation, adaptation and interconnected activities which are primarily bottom up. This has been combined with the top down interventions through NAPA and similar recommendations.

- Participatory Vulnerability assessment/analysis to identify adaptation and mitigation
The following Table is a summary of the different methods used by the development agencies/ NGOs for community-based vulnerability analysis in Bangladesh.

All these tools are similar in terms of utility and efficacy towards community-based vulnerability assessment and action plans. While any one of the above could have been suitable in the present research, PVA by ActionAid was adopted in the present research because of its easy access, the quality and quantity of data and the ease of logistic arrangements with the NGOs for field verifications. ActionAid Bangladesh has already launched a massive programme on Resilient Schools & Education Systems to combat Climate

Change. The following Figure shows the overall process of the present research on Education and Climate Change in South Asia: impact and response through the Primary Education.

One key component of the research is situation analysis at grass root level to understand the level of vulnerability of the communities, especially the school children. Various participatory methods of analysis have been adopted in different countries to understand the vulnerability/risk/hazard situation at community level. In countries such as Bangladesh and Nepal, ActionAid has carried out Participatory Vulnerability Analysis (PVA) at different levels with a focus on the primary school children, teachers and the communities.

PVA is a slow process to suit the temperament of the local people. It facilitates community's increased participation in the process of identifying vulnerabilities at grass root level. PVA brings forward an in-depth

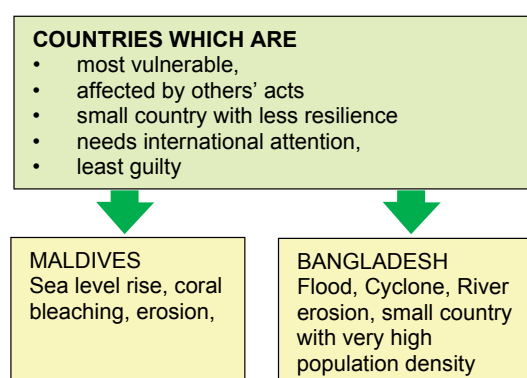


Figure 1.6 : The basis of selecting the countries under the present research

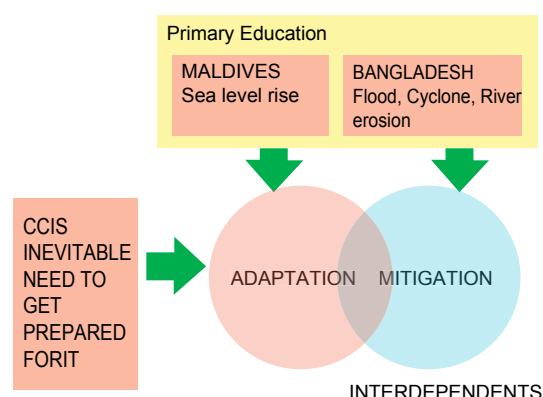
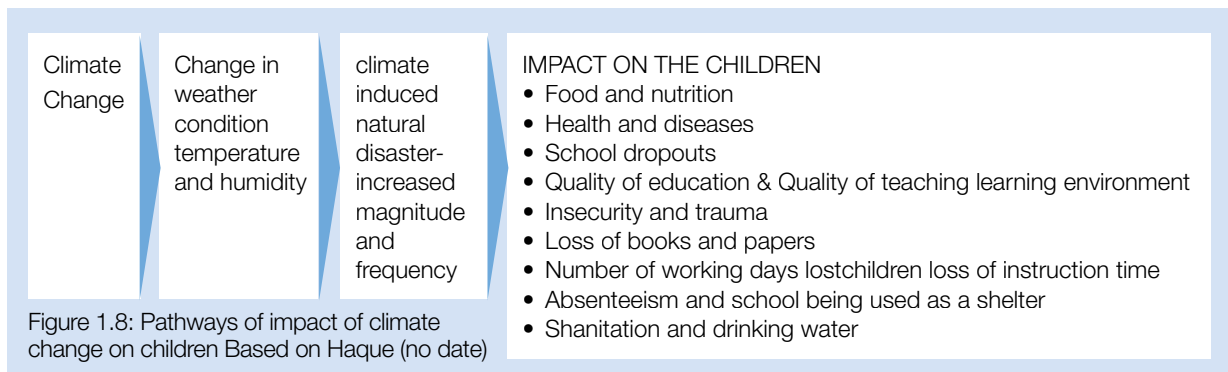


Figure 1.7: The position of school-based adaptation and mitigation in general context



knowledge on the grass root level vulnerability situation. It is an excellent opportunity for getting an access to community wisdom on how to deal with hazards. Such wisdom is based on historical experiences on what had happened in the past, how community dealt with it – the success and failure.

Maldives did not have any such database and hence, a rapid PVA was conducted due to the shortage of time and money. The main objective was to get an idea of the grass root level peoples' perception on their vulnerabilities. Apart from that, rapid PVA was viewed as an opportunity of capacity building for the local NGO, Society for Social Services (SSS). It has been envisaged that SSS will act as the in-country resource for up-scaling PVA across Maldives in future. This will also reduce Maldives' over-dependency on international consultants, which is the general feeling in NDMC at present.

The National Disaster Management Centre, Male was the host of the entire research work in Maldives. The President's office, the concerned Ministries such as, Ministry of Home Affairs, Ministry of Health and Family, Ministry of Housing Transport and Environment, Ministry of Education, etc, were involved in the process. The donor agencies were also involved. Representatives from UNICEF, WHO, UNISRD, etc had direct and indirect contribution to the research.

After carrying out a desktop research with support from NDMC, a National level workshop was convened in Maldives by involving the different Ministries, Development Agencies, NGOs and the State level Ministers (held a key role in organising the field research). This report shows the entire process of recommendations in the context of the present research. One important aspect of the research is

cost of climate change related interventions. While the report does not provide a final cost, it shows the different components of costing. The research has provided adequate information to enable Maldives to assess the financial implications at a later date after carrying out a country wide survey.

There are Nine Chapters in this report. Chapter 2 describes the context introducing the geology, climate, culture, etc. The general hazard profile of Maldives has been described in Chapter 3, which is based on the available research papers. Chapter 4 focuses on the National Communications, NAPA and Millennium Development Goals and presents the current status of actions, programmes and activities of the first two in the context of Climate Change. This Chapter describes the present status and gaps in the MDG which will be affected by climate change in Maldives. Chapter 5 is on the education profile of Maldives along with the number children in different types of vulnerabilities. This is a very important Chapter since the present research is children-focused.

Chapter 6, on PVA, describes the process and types of outputs leading to community level adaptation and mitigation actions. Chapter 7 is on the Adaptation

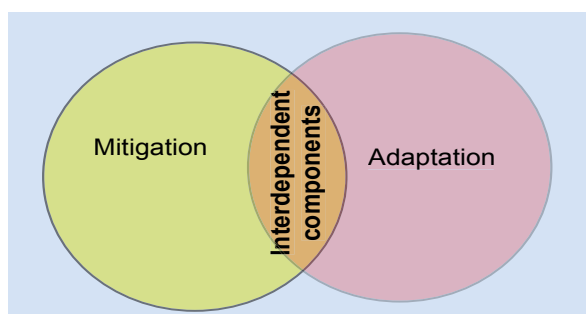


Figure 1.9: Diagram showing the mitigation and adaptation activities and the zone of interdependency

and Mitigation actions/programmes and activities that can be implemented/ promoted through the primary education system of Maldives. This has primarily been based on bottom up exercise. Chapter 8 shows the different components of cost of interventions to cope with climate change in Maldives. Chapter 9 summarises the present study. The core of the database in this research is in Annexure II. The school level PVA reports were recast as a consolidated report first. On the basis of that, the adaptation and mitigation actions have been put forward in this report.

The Annexure II provides school-specific PVA reports which have the area specific adaptation and mitigation

actions. It is envisaged that a computerised system will be developed in future that will link the school specific PVA with the EMIS data. This will provide a practical tool for the DoE to plan for climate change resilient primary education system in Maldives.

It is envisaged that the DoE will prepare a consolidated report on school based climate change related interventions. This will help NDMC to understand and monitor the implication of the inputs at school level programmes and projects. Such audit will enable NDMC to assess the speed of approaching the target of mitigation and adaptation. The following Figure shows the methodology adopted in this research.

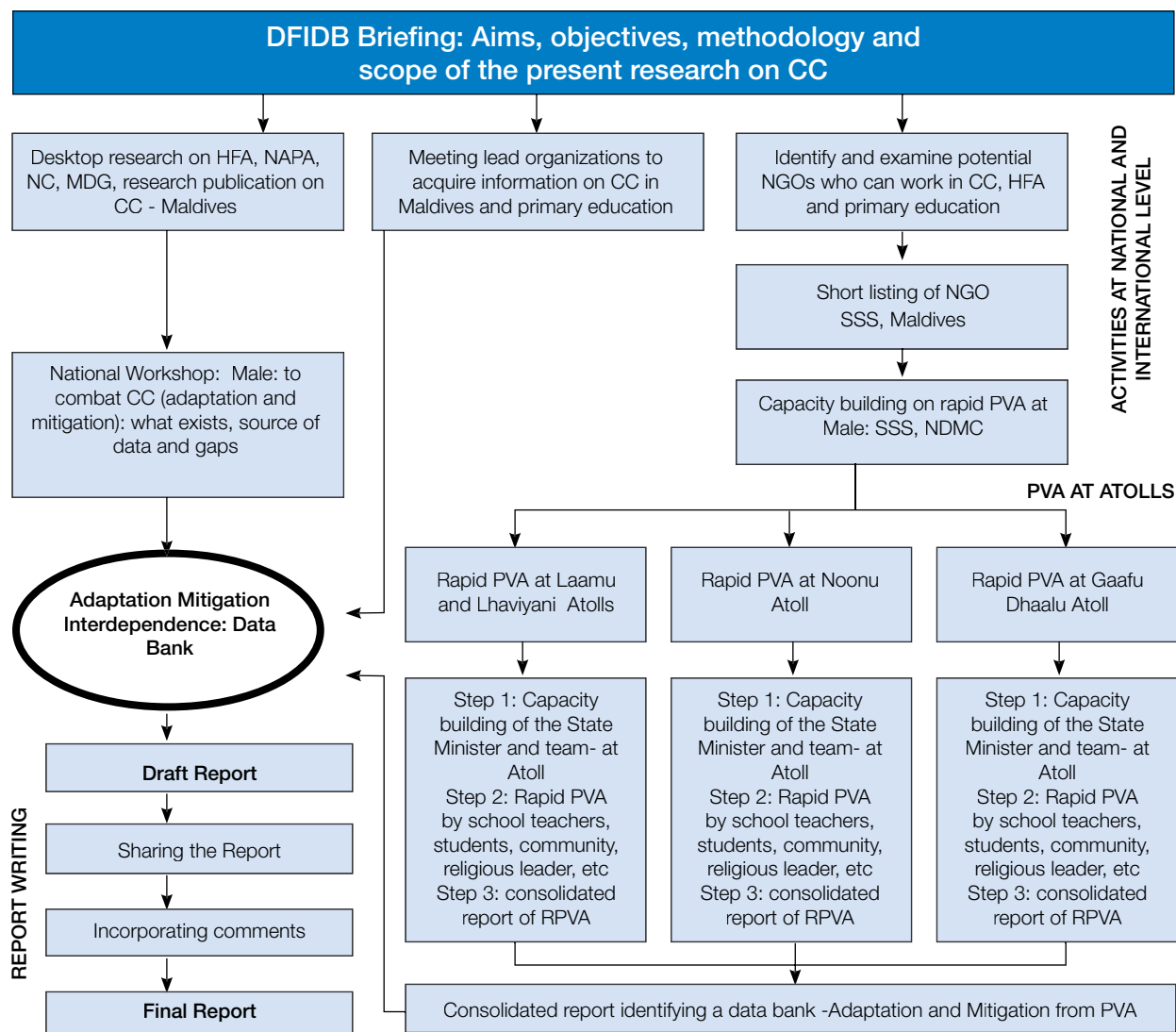


Figure 1.10: Methodology of the research in Maldives

Chapter 2

THE CONTEXT

The main objective of this Chapter is to understand the context of Maldives in order to prepare for Climate Change. The context is briefly covered in this Chapter by describing Geography, Geology, Climate, Culture and Socio-Economy. Following this, the Chapter presents a brief description on environment risk profile of Maldives.

2.1 GEOGRAPHY

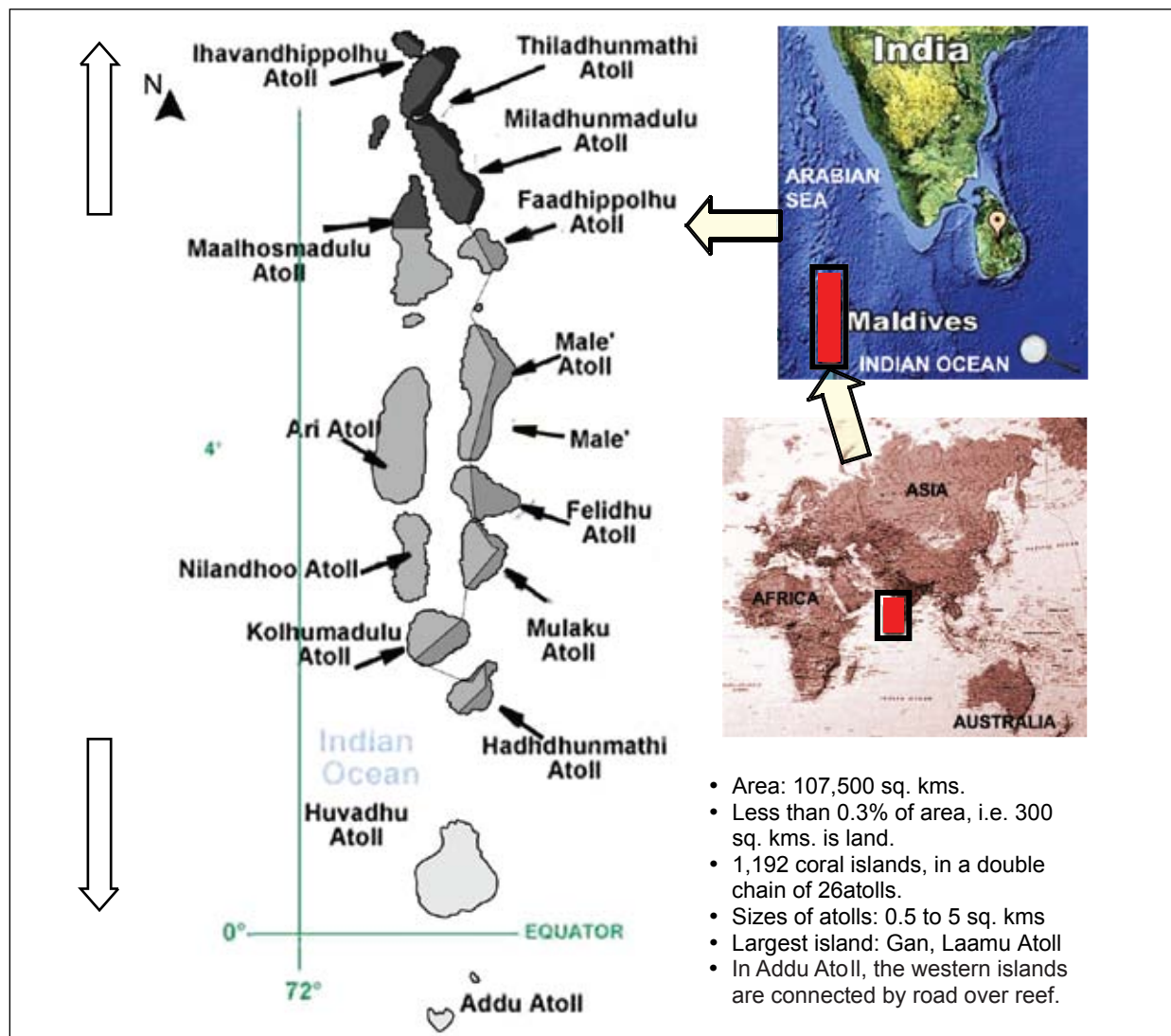


Figure 2.1: The Geography of Maldives

Maldives is composed of live coral reefs and sand bars, the atolls are situated atop a submarine ridge 960 kilometres long that rises abruptly from the depths of the Indian Ocean and runs from north to south. Safe ship navigation from one side of the Indian Ocean to the other through the territorial waters of Maldives is possible only through the two passages near the southern end of this natural coral barricade.

2.3 CLIMATE

- **Daily Temperature:**
 - 31deg C in Day
 - 23deg C at Night
- **Highest Temperatures Recorded:**
 - max 36.8deg C, 19May 1991 – Kadedhdhoo Meteorological Office
 - min 17.2deg C, 11April 1978 – National Meteorological Centre

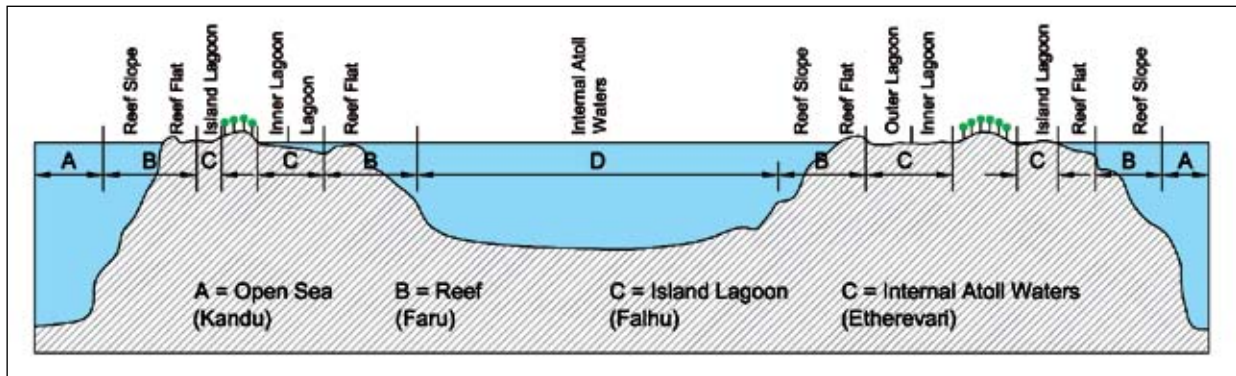


Figure 2.2: Cross Section through typical Atoll in Maldives

The word 'Atoll' comes from the Dhivehi word 'Atholhu'. It can be described as a ring-shaped ribbon reef enclosing a lagoon in the centre. Figure 2.2 shows the typical cross section through Atoll in Maldives.

2.2 GEOLOGY

The coral atolls of the Maldives began forming as reefs fringing a volcanic island. After the volcanic eruption from within the sea, the volcanic islands submerged due to the rising sea level. As the corals could not survive at a depth below 45 metres, they started building successive calcium carbonate encasements on top of one another, at a rate similar to the rate of the rising sea level. The shape and structure of coral atolls of Maldives is thus, determined in part by the underlying shape of the volcanic island or by the effects of wind and wave action, modifying the original. It is also believed that monsoons approaching the atolls from the east and west play a major part in re-shaping the islands.

- **HIGHEST RAINFALL recorded in 24hours:** 219.8 mm, 9July 2002 – Kadedhdhoo Meteorological Office

Maldives has two distinct seasons – dry season (northeast monsoon) and wet season (southwest monsoon). Since Maldives consists of small islands

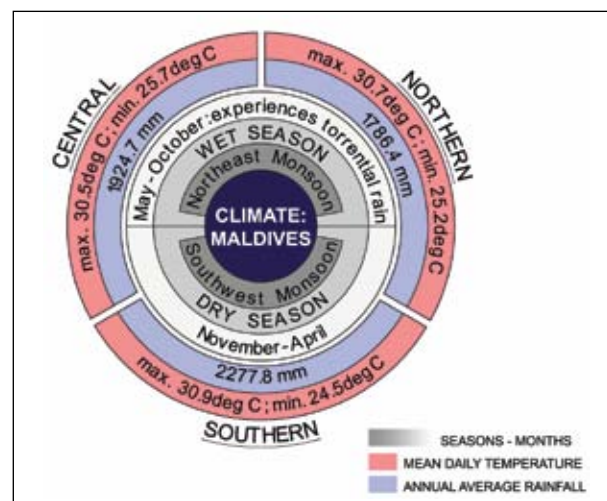


Figure 2.3: Climate of Maldives



Figure 2.4: The Architecture and people of Maldives

surrounded by seas, hot days are often tempered by cooling sea breezes and pleasant evening temperatures. Throughout the year, temperature remains almost the same in the Maldives.

In the wet season, the Maldives experiences torrential rain. Central, Southern and Northern parts of the Maldives receive annual average rainfall of 1924.7mm, 2277.8mm, and 1786.4mm, respectively. The highest rainfall recorded in the Maldives in 24 hour period was 219.8mm, recorded on 9th July 2002 at Kaadedhdhoo Meteorological Office.

Maldives receives plenty of sunshine throughout the year as the country is located at the equator. On an average, southern atolls (Gan) receive 2704.07 hours of sunshine each year, whereas the central parts (Hulhule) of the country receive 2784.51 hours of sunshine per year.

2.4 CULTURE

The rich culture of Maldives has been further enriched as it is located along the trading routes of Indian Ocean and the Arabian Gulf. The earliest traders that settled in the Maldives belonged to South India, Sri Lanka and Southeast Asia. Archaeological evidence suggests that until the 20th century, Buddhism was the main religion, with some Hindu influence also evident. In 1153, Arab and Persian traders approached the islands on the spice route from the Middle East to South East

Asia. Since that time, aside from a short period of Portuguese occupation in the fourteenth century, Islam has remained the predominant religion in the Maldives.

2.5 SOCIO-ECONOMY

Development of infrastructure in Maldives is mainly dependent on the tourism industry and its complementary tertiary sectors, transport, distribution, real estate, construction, and government. Taxes on the tourist industry have been introduced in infrastructure and it is used to improve technology in the agricultural sector.

Fishing is a leading sector in the Maldives. One fifth of Maldivian population depends on the sector (fishing, processing and associated industries) for their livelihood. This industry faces the problem of over-fishing. As a result, fishing output has experienced a dramatic decline with the total catch of 133.1 metric tons in 2008 down by 28.4% from the recent peak of 185.9 metric tons in 2005.

To begin with, agriculture output is limited owing to the smallness of the islands. This is compounded by poor soil conditions, soil erosion from sand and coral mining operations. Apart from that, inadequate marketing and storage infrastructure are the major constraints. About 90% of the food requirement is imported including most of the rice, which is the staple food. A World Bank report noted that “farmer’s lack of access to credit, high

Tourism



- 28% of GDP, more than 60% of country's foreign exchange receipts
- GDP/ capita: 265% (1980s), 115% (1990s)
- Over 90% of government tax revenue flows from import duties and tourism-related taxes.

Figure 2.6: Tourism – the largest industry of Maldives

Fishing



- Economic reform program by Government in 1989 - lifted import quotas and opened some exports to the private sector. It has liberalized regulations to allow more foreign investment.
- Largest export earner with tuna the main catch
- More than 20% of the population depends on the sector (fishing, processing & associated industries).

Figure 2.5: Tourism – the largest industry of Maldives

input costs (such as for fertilizers) and logistical and transportation issues associated with the large number of islands that make up the country are major impediments restraining agricultural production.” The average farm plot is only 0.5 to 1 acre. Most farm plots are leased to individuals for a short period of time and therefore farmers do not invest the time in soil rehabilitation after they harvest their crops. The majority of farmers rely on wells and manual watering for irrigation. Coconut is the main cash crop.

Industry

The Maldivian industrial sector is small. Traditional industries are still in place. For example, women collect cowrie shells (the former national currency) for export. They weave the labor-intensive coir rope from coconut husks, which is a very strong, flexible and waterproof. Male carpenters build the traditional fishing boats (dhonis) from coconut trees, which can last up to 20 years. However, more modern developments have occurred in the Maldivian industrial sector. Maldivian industrial sector accounts for about 18% of GDP.

Agriculture



- poor soil conditions,
 - sand and coral mining,
 - inadequate marketing and storage
 - no soil rehabilitation after harvest as farming plots are leased to farmers.
- limited agriculture output



Figure 2.7: small land areas available

2.6 ENVIRONMENTAL (RISK PROFILE)

Maldives has a fragile low lying small island ecosystem. It is very vulnerable to climate change and its associated impacts – especially the predicted sea level rise. While Maldives' greenhouse gas emission is about 0.001% of the global emission (MHAHE 2001), it will be one of the most affected countries due to climate change. Among the 1,900 islands in the Maldives, only 198 are inhabited. The population is scattered throughout the country, with the greatest concentration on the capital island, Malé. Limitations on potable water and arable land, plus the added difficulty of congestion are some of the problems faced by households in Malé

The Maldives' National Strategy for Sustainable Development Report (NSSDR, 2009) highlighted the dangers that global warming poses to the country. It said "the goal of the government is to make the inhabited islands resilient against the threats posed by global climate change, protect critical infrastructure such as international airports from sea induced hazards and provide innovative coastal protection for selected islands and tourist resorts."

Maldives has the seventh largest reef system in the world. It is among the richest in species diversity. Much of the tourist industry is dependent on the

reefs. According to the NSSDR (2009), 70-80% of tourists are snorkellers. It has also noted that loss or under-utilization of the tourist infrastructure because of "reef degradation" will "devastate" the economy

The global average sea level rose at an average rate of 1.8 [1.3 to 2.3] mm per year over 1961 to 2003 and at an average rate of about 3.1 [2.4 to 3.8] mm per year from 1993 to 2003 (Climate Change Synthesis Report 2007). The Intergovernmental Panel on Climate Change estimated a projected sea level rise of 0.09m to 0.88m from 1990 to 2100 (IPCC, 2001) in its Third Assessment Report. The magnitude of rise in sea level projected the IPCC Report threatens the very existence of life and livelihood in the Maldives. About three-quarters of the land area of Maldives is less than one meter above mean sea level. Thus, the slightest rise in sea level will prove extremely threatening. This is further aggravated by the variation of the tide. Many islands already suffer inundation and shoreline erosion because of its low elevation. In future, the problem of environmental refugees may be crucial to the national problem. The inundation often leads to freshwater shortages and disease outbreaks.

Global climate change and consequent sea level rise (Figure 2.9) are the most serious threats to the three



- All islands of Maldives will be submerged by 2100.
- 42% of the population and 47% of all the houses are located within 100 meters of the coastline.
- In last 6 years - >90 inhabited islands were flooded once, 37 on a regular basis
- Beach erosion ->97% of inhabited islands
- Threat to coral reef-adverse effect on tourism industry.

Figure 2.8: Rising Sea Level is a major concern in Maldives

hundred thousand inhabitants of the Maldives. The scientific evidence of climate change is overwhelming since the past two decades. Sea level rise is expected to exacerbate inundation, storm surge, erosion and other coastal hazards, thus threatening vital infrastructure, settlements and facilities that support the livelihood of island communities. (Climate Change Synthesis Report 2007).

2.7 SUMMARY

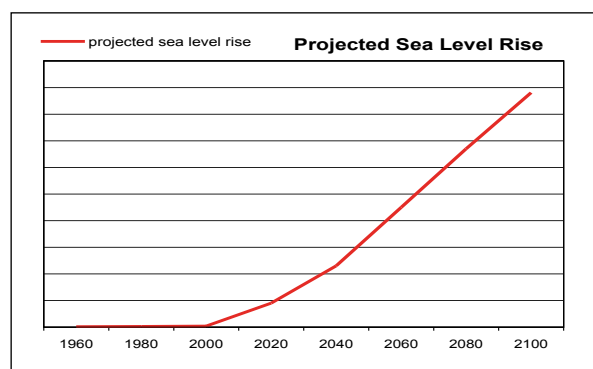
It is apparent from the discussion in this Chapter that the fragile environment of Maldives demands a very serious global attention. The issue of "oil spill" could not be discussed in detail due to lack



of available literature. As mentioned before, the safe ship navigation from one side of the Indian Ocean to the other through the territorial waters of Maldives is possible only through the two passages near the southern end of this natural coral barricade. Any oil spill from the ships around this area will severely damage the corals.

To save Maldives from the negative impacts of climate change, there is a need for strong political will, political stability, regional level cooperation, international level support, etc. One of the most important requirements in this context is to keep a periodic close watch on the interventions and their impacts so the fresh goal setting could be done to make sure that the situation is not deteriorated from its present state.

Primary education has a very important role to play in this regard since it is perhaps one of the most sustainable ways of inculcating lifestyle change to adaptation for the future generation. Therefore, it is important to understand the hazard profile of Maldives. The following Chapter describes the various types of hazards in Maldives.



Projected sea level rise = 0.09m-0.88m (1990 to 2100)

- 3/4th of land area of the country is <1m above mean sea level
- Consequences: life and livelihood threat, inundation, storm surge, coastal hazards, shoreline erosion, lack of safe drinking water, disease outbreak, etc.
- There are limited data, little local expertise to assess the dangers, and a low level of economic activity to cover the costs of adaptation for atolls in countries such as the Maldives, Kiribati and Tuvalu (Barnett and Adger, 2003).

Figure 2.9: Average and Projected sea level rise (1961 – 2100) according to Climate Change Synthesis Report (2007) & IPCC (2001)

Chapter 3

HAZARD PROFILE

This chapter presents different types of hazards in Maldives. The main source of information are the Developing a Disaster Risk Profile (UNDP, 2006), NAPA and other research articles down loaded from the net. Maldives has many hazards which are island specific. Since the country is very narrow and considerably long, types of disasters vary a lot. However, the common hazard which may simply wipe out this country is sea level rise. Over the last decade, increasing scientific evidences suggest that sea level rise is a reality. This has been corroborated by the people at atoll level, who reported that the character of sea has changed considerably in the last 25 years. The State Ministers at Atoll level have noted a significant rise in storm tide, flood and inundation in their islands. The following sections describe various types of hazards in Maldives.

3.1 STORM

Maldives is affected by heavy rains and strong winds during monsoons. Tropical storms or 'tropical cyclones and severe local storms (thunder storms/ thunder squalls) have affected Maldives in the past. At times, tropical cyclones hitting Maldives are destructive since these come along with strong winds, which may exceed 150 kilometres per hour. Apart from that, rainfall of above 30 to 40 centimetres in 24 hours and storm tides that often exceed four to five meters (UNDP, Vol I, 2006) are devastating. Zone-wise surge hazard have been provided in Table 3.1. Data indicate that the probable maximum storm tide in north-eastern islands of Maldives can be about 2.3 metres, which can inundate most of the northern islands. This may increase due to climate change.

Table 3.1: Storm tide and surge in different Zones of Maldives

Hazard Zone	Average Tide Height (m)	Storm Tide Height (m)	Storm surge height (m)
1 (very low)	-	-	-
2 (low)	0.93	1.38	0.45
3 (moderate)	0.93	1.53	0.60
4 (high)	0.98	1.97	0.99
5 (very high)	0.98	2.30	1.32

Source: UNDP, 2006 (VOL I)

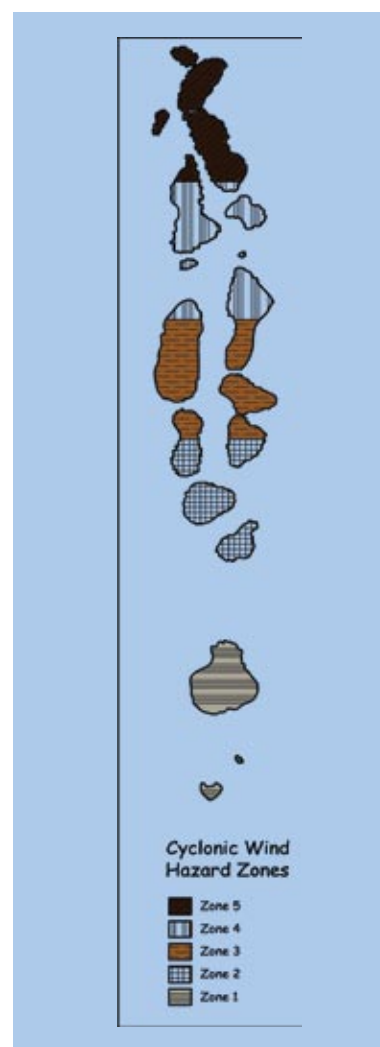


Figure 3.1: Storm Surge Hazard Zone map

3.2 CYCLONE

While the areas on either side of the equator are well known to mariners as the Doldrums on account of its weak winds, Maldives is sometimes affected by cyclones passing through the Bay of Bengal. The most likely months for cyclones are April/May and October/November.

There are five zones in Maldives with varying scales of cyclone hazards. According to UNDP (2006), the five cyclone regions have been created based on a qualitative judgement of the gradient of the storm tracks from north to south (Table 3.2 and Figure 3.2).

Majority of the cyclonic disturbances crossed the northern region. The frequency and wind speed decreases from northern region to southern region. The zone 5 of cyclone (Table 3.2, Figure 3.2) is a matter of concern since this will largely damage the existing buildings and infrastructure. Field visits revealed that many school buildings are highly vulnerable to cyclonic wind and tidal wave. The most vulnerable building component is the roof. The wind suction in case of 179 KMPH will be considerable and most of the light weight roofs will be highly damaged if not blown off.

After the super cyclone in India (1999), SIDR in Bangladesh (2007) and NARGIS in Myanmar (2008) these countries are in the process of upgrading their building codes. A similar effort should be there in Maldives as a precaution for any future eventualities.

Table 3.2: Cyclonic Hazard Zone in Maldives and the Probable Maximum Wind Speed

Hazard Zone	Probable Maximum Wind Speed (kms)
1	0.00
2	103.52
3	128.90
4	155.93
5	179.27

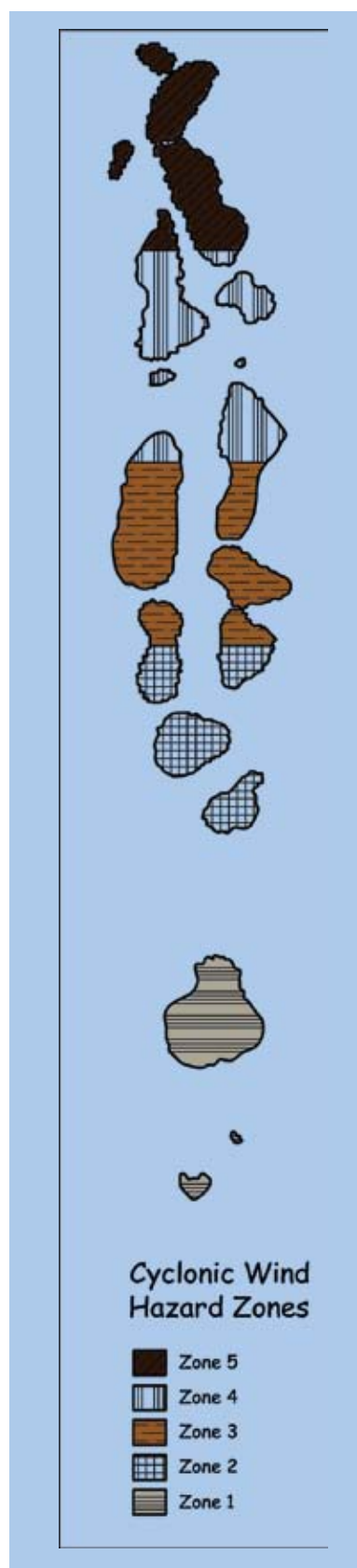


Figure 3.2: Cyclonic Wind Hazard Zone map

3.3 EARTHQUAKE

UNDP (2006) has developed a seismic zoning map for Maldives. It is important to note that Hassan (2006) stated that, one cannot say much on seismicity in Maldives due to the lack of progress in Seismology in this country. In absence of a national level seismic map, the UNDP zoning has been presented in this report.

The seismic zoning map in Figure 3.3 shows that the Atolls around the equator are in zone 5 with PGA 0.18 to 0.32. The zone 5 and zone 4 are in high risk and may cause massive loss of human life and properties if not prepared in advance. The map shows that most of the islands in Maldives are in safe zone from seismic point. However, a fresh investigation on such zoning will be important.

It may be noted that the national building code should ideally develop this map based on internationally accepted methodology.

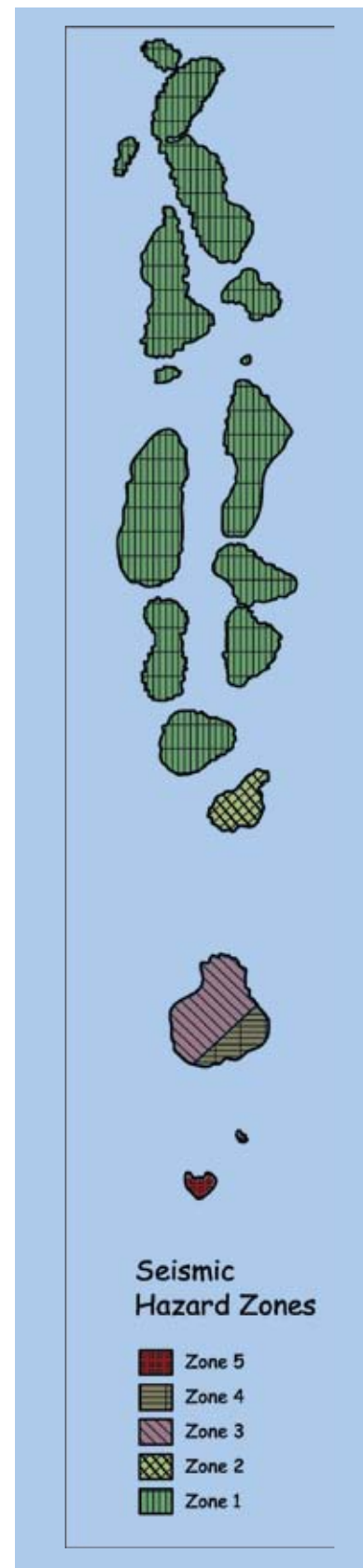
In the context of seismic safety, quality of the buildings is of vital importance. During the field visits, many buildings were found to have cracks in walls. This could be due to expansive soil or inappropriate foundation types. An investigation into this area is necessary as the cracks will reduce building lives especially due to the predominantly saline weather.

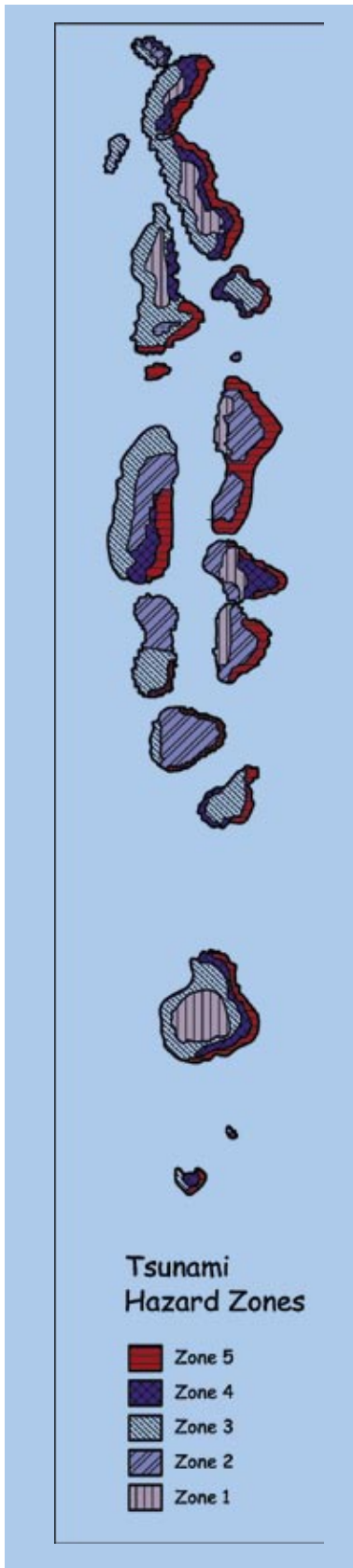
There is a need for in-depth study on the earthquake induced tsunami.

Table 3.3: Probable PGA in each Hazard Zone

Seismic Hazard Zones	PGA values for 475 yrs return period
1	Less than 0.04
2	0.04 to 0.05
3	0.05 to 0.07
4	0.07 to 0.18
5	0.18 to 0.32

Figure 3.3: Earthquake Hazard Zone map





3.4 TSUNAMI

The devastating tsunami (Indian Ocean) in 2004 revealed that the people of Maldives were not prepared for this type of disaster and the country has a low level of resilience. The general notion that Maldives is “safe” from such large scale disasters turned out to be wrong. For the first time Maldives became aware of its vulnerability to high impact due to tsunami. This recognition has urged measures to pragmatically integrate disaster risk reduction and risk management perspectives into the government’s planning and policy agenda.

Maldives faces tsunami threat largely from the east and relatively low threat from the north and south (UNDP, 2006). Islands along the western fringe experience a relatively low tsunami hazard. Historically, Maldives has been affected by three earthquakes which had their sources in the Indian Ocean. Of the 85 tsunamis occurred since 1816, 67 originated from the Sumatra Subduction zone in the east and 13 from the Makran Coast Zone in the north and Carlsburg Transform Fault Zone in the south. The probable maximum tsunami wave height is estimated at 4.5 metres in Zone 5 (Table 3.4).

Table 3.4: Computed Maximum and Minimum Run-ups of the Tsunami of December 26, 2004

Region	Maximum Wave Amplitude (metres)	Shoaling Factor		Run ups (metres)		Remarks
		Max	Min	Max	Min	
Sri Lanka (1400 kilometres from source)	1.32	6.22	-	8.21	-	8.12 metres reported
Maldives (2500 kilometres from source)	1.04	4.12	1.95	4.56	2.16	4.35 metres (max) and 1.98 metres (min) reported

Considering the smallness of the islands, it is most likely that the waves will sweep across the island by causing massive destruction. There is hardly any land cushion to reduce the approaching waves.

Figure 3.4: Tsunami Hazard Zone map

3.5 SEA LEVEL RISE HAZARD

As mentioned earlier, the Intergovernmental Panel on Climate Change (IPCC) projected that global mean sea level is expected to rise between 9 and 88 centimeters by 2100, with a 'best estimate' of 50 centimeters (IPCC, 2001b).

It has been discussed earlier that Maldives is one of the most vulnerable countries to climate change and sea level rise. Over 80% of the land area in Maldives is less than 1 m above mean sea level. Being so low-lying, the islands of Maldives are very vulnerable to inundation and beach erosion. Sea level rise will have negative impact on the social and economic development of the country, as most of the economic activities are heavily dependent on the coastal ecosystem. All of the human settlements, industries and vital infrastructure of Maldives lie very close to the shoreline, within 0.8 to 2 m of mean sea level. Even now some islands are seriously affected with loss not only to shoreline but also of houses, schools and other infrastructure compelling the government to initiate urgent coastal protection measures.

3.6 PRECIPITATION

Currently a daily rainfall of at least 160mm is a relatively rare event at Hulhule, with a return period of 17 years. An extreme daily rainfall of 180mm is currently a 100-year event. It is likely to occur twice as often, on average, by 2050. An extreme three-hourly rainfall of 100mm is currently a 25-year event. It will become at least twice as common, on average, by around 2050. This will significantly affect the drainage system of the islands, which are old and not designed for the changed situation. This fact was brought to the notice of the research team by the islanders during PVA exercises.

3.7 LAND, BEACH AND HUMAN SETTLEMENT

Over 80% of the land area of the Maldives is less than 1m above MSL with a few exceptions such as Fuvahmulah (Gnaviyani Atoll), which has an

elevation of 4m above MSL. As the future sea level is projected to rise within the range of 9 to 88cm between 1990 and 2100, the islands of Maldives would be submerged in the projected worst case scenario.

The small size of the islands forces the people to live next to the sea. At present, 44% of the settlement footprints of all islands are within 100m of coastline. Due to this, 47% of all housing structures and 42% of the population are within 100m of coastline. Homes of people are at severe risk of inundation with higher sea levels.

Over the last 6 years, more than 90 islands have been flooded at least once. 37 islands have been flooded regularly or at least once a year (Shaig, 2006). The series of swells, between 10-15feet, which hit the Maldives on the 15-17 May 2007, impacted on 68 islands in 16 atolls damaging more than 500 housing units. About 1600 people were evacuated from their homes (OCHA 2007). Since the building designs and technologies are not suitable for such flooding, the existing housing stock has high level of vulnerability (UNEP 2005). The existing houses do not have adequate plinth height from the ground and are of poor construction materials. Under such circumstances, higher frequency and increase in intensity of flooding could make these islands uninhabitable.

Coastal erosion has been reported in more than 97% of inhabited islands in 2004, of which 64% had severe beach erosion. Erosion in the inhabited islands has been intensified by inappropriate human intervention in coastal areas. The problem of erosion is not specific to inhabited islands. More than 45% of the 87 tourist resorts reported to have severe erosions. Overcrowding is a significant problem. Already 34 of the inhabited islands do not have additional land for new housing and another 17 islands will reach their carrying capacity by 2015.

Beach erosion is now among the most serious environmental issues faced by the islands of Maldives. On many islands, the sand at the beach and shoreline are being washed off at a greater rate



than before. The general and natural movement of sand and sediment happens during the monsoon, where the sand and sediments are gradually washed off (eroded) from one side of the island and are carried along the shoreline to the other end of the island. This process reverses during the next monsoon, with sand being deposited (accreted) at the previously eroded side of the island. According to the 2004 State of the Environment report, coastal erosion was reported in 109 islands and is visible in most islands. The coastal infrastructure of most islands is vulnerable because of the vegetation line's close proximity to the sea.

Poorly designed coastal infrastructure, poorly engineered coastal protection measures, removal of coastal vegetation and sand mining have increased the vulnerability of land, beaches and human settlements. Human stresses on the reef system such as coral mining, reef entrance blasting, dredging, solid waste disposal and

sewage disposal have affected the health, integrity and productivity of reefs. Unless appropriate coastal protection measures are undertaken, the human settlements will face the threat of inundation. The existing measures are expensive and hence, there is a need for innovation to make it cost effective, which could be achieved by exploring good examples at international level.

3.8 DRINKING WATER

Groundwater aquifers in the Maldives islands normally lie between 1 and 1.5 metres below the soil surface. The proximity of the aquifers to the island surfaces makes them vulnerable to pollution and contamination from human activities as well as saltwater intrusion. In addition, increased population and human development have led to increased groundwater extraction, resulting in depletion of the country's freshwater lenses during the past several years. For all of these reasons, the

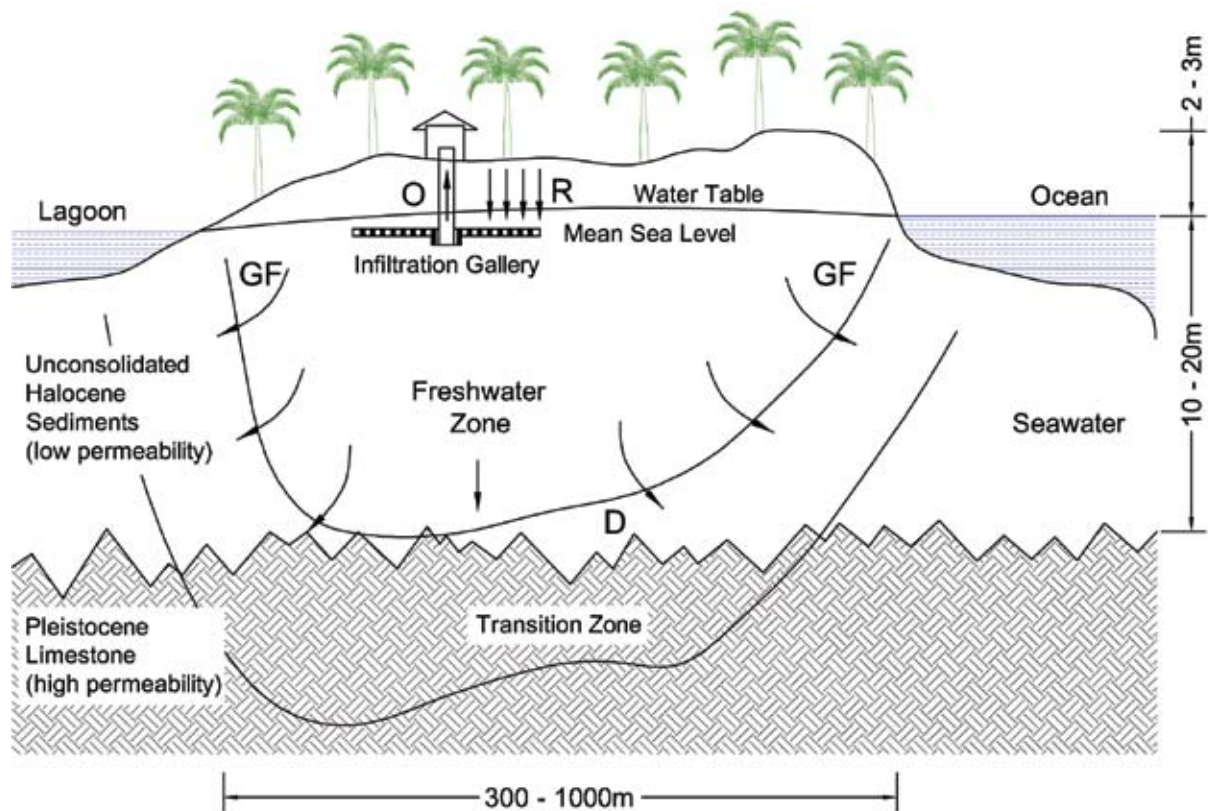


Figure 3.5: Drinking water cycle in Maldives

availability of groundwater as a freshwater resource has been limited.

According to the State of the Environment Report (2004), only 39 inhabited islands had groundwater that was suitable for drinking before the tsunami. Aquifer thickness is dictated by several factors including net rainfall recharge, size of the island and permeability of the soil column. Because these parameters vary from island to island, the quality of the aquifers vary.

Water remains one of Maldives most scarce and precious resources, and access to safe drinking water is a challenge. Most Maldivians (about 75% of the population) collect water from communal rainwater storage tanks or individual household tanks. In Malé, drinking water is obtained by desalination.

Impact of climate change on the groundwater availability is one of the major concerns faced by the Republic of Maldives. The rainwater lenses lie on top of the salt water. As the sea level rises, the thickness of the freshwater lens decreases, thereby decreasing its volume. The sea level rise increases the possibility of storm causing an increase in the incidence of saltwater contamination of the freshwater lenses.

3.9 CORAL BLEACHING

Coral bleaching is a process where healthy corals lose their symbiotic algae (Hoegh-Guldberg, 1999). The bright colours of most corals represent the presence of these symbiotic algae and when they lose the algae, the corals become pale in colour and bleaches. Prolonged bleaching results in the death of affected corals. Corals can bleach in response to many stress factors such as temperature, salinity and others. There is reason to believe that devastating incidents of coral bleaching in recent years is due to increased sea surface temperatures. Warming sea temperatures have caused extensive coral “bleaching” in the Maldives in 1998. Large areas of shallow reefs were affected. It is estimated that 98% of shallow water corals died during the bleaching event (NAPA, 2006).

Coral reefs thrive in a narrow temperature range and are highly sensitive to changes in temperature. Given the current predictions, coral bleaching is expected to rise rapidly and significantly (IPCC 2001). Coral bleaching events occurred in the Maldives in 1977, 1983, 1987, 1991, 1995, 1997 and 1998, with the last being the most severe.

Literature survey and personal interviews with experts revealed that climate change will continue to render coral reefs even more vulnerable to other human-related stresses, such as water pollution, diseases, habitat destruction and overfishing. Climate change is expected to cause irreversible damage by causing coral bleaching.

3.10 SUMMARY OF THE HAZARDS

While earthquake and Tsunami have not been reported to have connection with CC, these issues have been included in the present discussion since some of the interventions under adaptation and mitigation could be opportunities to take care of these hazards.

The cyclone and high wind are alarming. The occurrences of these disasters are less frequent than that of the other types of disasters. However, the magnitude of cyclone is likely to be higher than the present level. The hazard maps shown above indicate that the northern portion of the country is more disaster prone than the south. This regional variation needs to be considered while constructing the school and other infrastructure in the islands. It is therefore, important to assess the level of preparedness and gaps at local level.

In the light of increased hazard due to climate change, the building codes need reviewing and upgrading. The multihazard situation of the country should be reflected in the building codes. There is a need for training of the engineers, architects, contractors and the construction workers to protect the country's infrastructure.

While the assumptions and methods of assessing vulnerability of the UNDP report (2006) needs review, it may be good starting point to go ahead



Table 3.11: Top 20 Islands with Multi-hazard Physical Vulnerability Risk

SL	Island	Atoll	Population(2000)	Multi- Hazard Risk Index
1	Male	Kaafu	74,069	5
2	Foammulah	Gnaviyani	7,528	5
3	Kulhudhuffushi	Haa Dhaalu	6,581	5
4	Hulhudhoo	Seenu	1,439	5
5	Dhidhdhoo	Haa Alifu	2,766	5
6	Dhidhdhoo	Alifu Dhaalu	113	5
7	Kelaa Haa	Alifu	1,196	5
8	Nolhivaramu	Haa Dhaalu	1,556	5
9	Gadhdhoo	Gaafu Dhaalu	1,701	5
10	Naifaru	Lhaviyani	3,707	5
11	Thoddoo	Alifu Alifu	1,071	5
12	Eydhafushi	Baa	2,401	5
13	Kalhaidhoo	Laamu	433	5
14	Vilingili	Gaafu Alifu	2,261	4
15	Maakadoodhoo	Shaviyani	1,606	4
16	Hinnavaru	Lhaviyani	3,212	4
17	Baarah	Haa Alifu	1,270	4
18	Meedhoo	Seenu	1,681	4
19	Kasshidhoo	Kaafu	1,572	4
20	Velidhoo	Noonu	1,866	4

Note: Risk index of 1-5 indicating very low, low, moderate, high and very high risk levels

Source: UNDP, 2006

with further enhancement of the vulnerability atlas. The existing maps should be converted to a multihazard map with location of the school facilities in the GIS. The existing EMIS database needs to be interfaced with the GIS system to find out the degree of vulnerability of all schools in Maldives. The following is a rough estimate based on the UNDP report, which has provided data on Physical and social vulnerabilities of Maldives.

3.11 PHYSICAL VULNERABILITY AND RISK

UNDP report (2006) describes Physical vulnerability as a condition resulting from physical factors and processes that increase the susceptibility of a community to the impact of a hazard. In this study, only buildings and agriculture have been considered due to limited data on other important assets such as fisheries. Assessment of physical vulnerability and risk has been carried out for earthquake, wind, storm surge and tsunami,

and multiple hazards for all inhabited islands in Maldives. Resort islands were not within the scope of the study.

The risk indices have been computed with respect to three hazards i.e. earthquake, cyclone and tsunami. The three hazard-specific indices have also been integrated for a combined risk index for each island. In this study, risk has been quantified for each island based on the following factors:

1. Level of hazard
2. Number of buildings
3. Relative average size of buildings
4. Material of construction used in walls and roof
5. Age of the people
6. Storey height

Island-wise risk index has been computed for earthquake, storm and tsunami hazards for each island by integrating the hazard and vulnerability

indices. The hazard- specific risk values for islands in Maldives have been put in an ascending order and the values have been split into five segments, each representing a Risk Index i.e. 1, 2, 3, 4 and 5. The following table shows the islands which have a high Multi-Hazard Risk Index.

In Maldives, 1,18,029 people are in multihazard zone 4 and 5. This is about 40% of its population. This implies that a large number of physically challenged, senior citizens, children and women are living in very high multihazard zones. Therefore, preparedness through awareness and capacity building at all levels will be necessary to save the country.

3.12 SOCIAL VULNERABILITY AND RISK

Social Vulnerability is defined as a condition resulting from social factors or processes, which increases the susceptibility of a community to

the impact of a hazard. Often the social factors in question are directly linked to physical or economic factors, and may need to take these into consideration as secondary factors or indicators. Social vulnerability in Maldives is a result of the small size of population and its exposure, due to dispersion across small islands. The UNDP (2006) report has assessed social vulnerability in Maldives based on a consideration of a wide range of indicators for various hazards across different inhabited islands.

There are three risks involved due to social vulnerability in Maldives –

1. Vulnerability to life: The highest weight assigned is to vulnerability to life. This is because the prime directive of any disaster mitigation, preparedness or management effort is to save human lives.

Table 3.12: Top 20 islands with Multi-hazard Social Vulnerability Risk

SL	Island	Atoll	Population(2000)	Multi- Hazard Risk Index
1	Thuraakunu Haa	Alifu	74,069	5
2	Berinmadhoo	Haa Alifu	7,528	5
3	Hathifushi	Haa Alifu	6,581	5
4	Nolhivaramu	Haa Dhaalu	1,439	5
5	Alifushi	Raa	2,766	5
6	Hulhudhuffaaru	Raa	113	5
7	Buruni	Thaa	1,196	5
8	Dhiyadhoo	Gaafu Alifu	1,556	5
9	Gadhdhoo	Gaafu Dhaalu	1,701	5
10	Meedhoo	Seenu	3,707	5
11	Hithadhoo	Seenu	1,071	5
12	Feydhoo	Seenu	2,401	5
13	Hoarafushi	Haa Alifu	433	4
14	Dhidhdhoo	Haa Alifu	2,261	4
15	Kulhudhuffushi	Haa Dhaalu	1,606	4
16	Thulhaadhoo	Baa	3,212	4
17	Isdhoo	Laamu	1,270	4
18	Fua-mulah	Gnaviyani	1,681	4
19	Maradhoo	Seenu	1,572	4
20	Hulhudhoo	Seenu	1,866	4

Note: Risk index of 1-5 indicating very low, low, moderate, high and very high risk levels

Source: UNDP, 2006

-
2. Lack of coping capacity: The aspect of local coping capacity is of great importance within social vulnerability. Reduction of social vulnerability through building of social capital is the primary measure for reducing disaster risk as part of a community based disaster management process. This aspect has been assigned the second highest weight.
 3. Vulnerability of injury, food insecurity and lack of livelihood resilience: Each of these three factors has been assigned the third highest weight. The three factors have devastating effects, and can have immediate impact on the affected community in terms of shocks or long term impacts in terms of stresses.

Island-wise risk index has been computed for social vulnerability. The hazard- specific risk values for the islands in Maldives have been put in an ascending order and the values have been split into five segments, each representing a Risk Index i.e. 1, 2, 3, 4 and 5. The following table shows the islands which have a high Multi-Hazard Risk Index.

As mentioned earlier, the method of risk and vulnerability assessment (UNDP, 2006) needs a review before further planning for a proactive mode

of responding to the CC in Maldives. The situation in Maldives is worrying considering the smallness, isolation and problem of accessing a small group of people quickly. Evacuation in case of emergency is a problem at present. The difficulty of physical communication system was realised while doing the field visits, in spite of the fact that these were organised by the high profile Ministers – bad weather, limited number of sea planes, slow boat communication, etc. were the reasons behind such difficulty.

This Chapter has shown that Maldives is a highly hazard prone country with very low level of resilience. It has high magnitude of physical (buildings) and social vulnerability due to multihazard. It may be noted that the most vulnerable ones will be the women, physically challenged people and the children. After understanding the hazard profile of Maldives, it is important to know the level of its preparedness. The next Chapter examines the National Communications (NC), National Adaptation Plan of Action (NAPA) and the Millennium Development Goals (MDG) to understand the present status of its preparedness to combat CC.

Chapter 4

SITUATION ANALYSIS

As mentioned before, most of the islands in Maldives are too small and isolated. Only four islands have populations of 5,000 or more and only 10 islands are larger than 2.5 sq.km. As a result, the government finds it difficult to sustain the teachers, doctors, govt officials to look after a small population of an island, especially the ones that are too small.

The challenges that Maldives is facing is very unique since the people have nowhere to go in the event of sea level rising significantly. The last Chapter has described the types of hazards in Maldives which are likely to increase in magnitude and frequency due to climate change. In this Chapter, the level of preparedness to cope with CC in Maldives will be examined.

4.1 MALDIVES' DISASTER PREPAREDNESS

From the last Chapter, it is apparent that Maldives is highly vulnerable to the impacts of climate change for reasons external to it and also because of lesser resilience due to the smallness of the islands associated with difficult physical access from island to island. This may have some impacts on the targets of MDGs of Maldives. It may be noted that NAPA and National Communications of the government of Maldives are meant for combating the impacts of climate change. The Disaster preparedness of Maldives for Climate Change is in line with Hyogo Framework for Action. The Maldives have always been one the UNFCCC's greatest advocates and has been one of the very first signatories of both the Framework Convention and its Kyoto Protocol. It was also one of the countries that put efforts into raising awareness of the human dimension of climate change during the 2007 UNFCCC Conference of the Parties in Bali. The efforts led to the adoption of the United

Nations Human Rights Council Resolution 7/23 on "Human Rights and Climate Change" which, for the first time in an official UN document, states explicitly that climate change has implications for the full enjoyment of human rights.(Source : Permanent Mission of the Republic of the Maldives to the United Nations Office at Geneva, Human Rights and Climate Change. 2008. Retrieved on: 11 June 2009)

This Chapter will carry out a discussion on the MDG, NAPA and NC in the context of climate change. The following section reviews the preparedness of Maldives to combat the impacts of climate change.

4.1.1 The Millennium Development Goals

The Ministry of Planning and National Development has published MDG status of Maldives (2007). This report is based on the latest data from Census 2006 and other reliable sources. The report tracks the progress of Maldives on MDG targets and assesses whether they could be achieved by 2015. According to the report, the results are highly promising. Rapid progress has been made on poverty, education and health targets. Significant improvement is seen on empowerment of women as well. The report informs that the major challenges are in sustaining the achievements, and in reaching the nutrition target and environment targets. The Contents page of the report shows that the least progress is in Goal 7 (Ensure Environmental Sustainability). This is followed by Goal 3 (Promote Gender Equality and Empower Women) and Goal 8(Develop a global partnership for development).

The causes of the significant environmental threats to Maldives are beyond its control and occur outside its national boundaries. Apart from campaigning



on mitigation at international level, the option for the Maldivians to tackle global climate change and sea level rise is adaptation. As highlighted in the Maldives Partnership Forum held in June 2007, the Government of Maldives needs substantial additional assistance to make the islands of the Maldives safe against future sea level rise.

Goal 1- Eradicating Extreme Poverty and Hunger

Vulnerability of the country to the effects of climate change is becoming more pronounced. The rapid urbanization of the capital Male' poses a major challenge for the future. The growing income disparities between Male' and the atolls are an increasing cause for concern. At a minimum, these increases in inequalities may cause a further acceleration of migration to the capital worsening the existing congestion and related social issues in Male'.

There is a substantial dynamism in poverty in Maldives. Many of the currently non-poor had fallen back into poverty. Policies to reduce the falling back of the highly vulnerable non-poor should go hand in hand with poverty alleviation measures. An effective social safety net scheme needs to be established to protect the chronically very poor families and the transitorily poor households from sudden shortfalls in income caused by shocks beyond their control.

Although labour force participation rates have increased from 1997 to 2004, there are rising problems of unemployment. The proportion of unemployed people increased from 10 to 14 percent over the same period. In Maldives, a person is considered to be unemployed if she/he is not studying, and is unable to find suitable work, but willing to work and available to do so at short notice.

One of the most worrying aspects of the current employment situation is the level of youth unemployment. About 40% of the young women (15 to 24 year age group) and over 20% of the young men (15 to 24 year age group) are presently unemployed. The situation is acute in Male' where one out of five young women is unemployed, and for young men, the proportion is one in six. The

problem is even worse in the atolls where one-third of young people are without work while willing and available to work.

Therefore, efforts to establish regional growth centres in the North and in the South that provide an alternative to Male' should be strengthened and improved because they have been less successful so far. Many young secondary school graduates are not aiming to return to their islands to work in traditional sectors like fisheries. They are ambitious and have high expectations. Urbanization combined with increasing unemployment may lead to unfulfilled expectations and disillusion, especially among the youth.

International experiences show that hazards directly affect the livelihood of the people, especially the poor. People, whose livelihoods are dependent on the natural environment such as fishing, agriculture, etc., are the most vulnerable to disasters, which are likely to increase due to climate change. Primary education is adversely affected if peoples' livelihoods are affected. In Bangladesh, every cyclone, flood, river erosion affects the primary education adversely in terms of long absenteeism, dropout and quality of education.

Goal 2: Achieve Universal Primary Education- Challenges

It may be noted that the achievements in primary education is very close to the target. However, the multiple shift schools and lack of trained teachers are the major gaps for quality education. Some of the key challenges to improvement in education quality are the high number of untrained teachers; shift systems in schools due to lack of adequate classroom space; and lack of basic infrastructure facilities such as libraries, science laboratories and equipment. In 2005, out of the 5,616 teachers in service, 3,948 were trained while 1,668 were untrained (MoE, 2005). 75% secondary school teachers are expatriates. 80% schools lack basic learning and teaching facilities (MPND 2007).

Providing access to primary education for children with special needs is also a significant challenge.

A disability survey undertaken in 2002 showed that there were 546 students in the age cohort 6 to 16 years who were not attending school due to a disability (MGFDSS 2002). Children with special needs are dispersed across 196 islands, making provision of primary education to them difficult and costly. The issue of the children with special needs in the context of CC must be a very high priority in the education system. The concept of barrier free environment in the school is a major issue and needs special attention.

In the Maldives there is automatic promotion system and thus most of the students who begin at Grade 1, reach Grade 7. The Ministry of Education's statistics shows that in 2004, there were 14,371 enrolled in Grade 7. The following year there were 12,600 students enrolled in Grade 8 showing a difference of 1,771 students.

While the overall achievement in MDG 2 is good, maintaining and sustaining the good progress may be problematic due to climate change. The increased frequency and magnitude of different hazards in Maldives may turn out to be disasters. This will adversely affect the primary education system, which suffers from lack of adequate trained teachers, physically challenged children and inadequate infrastructure. The field investigations revealed that the school infrastructures are grossly inadequate to withstand the natural forces due to poor quality of construction. Most of the buildings in the schools visited had massive cracks in walls and roofs. If the climate related disasters are intensified in future, vulnerability of the small children in the schools will increase. In fact the schools should be of superior strength since they can act as disaster shelters for the communities.

Goal 7 Ensure environmental sustainability

While Maldives is a highly vulnerable country to sea level rise and other environmental issues, the achievements of the country in the context of Goal 7 is rather low as compared to the other MDGs. Therefore, there is a need for examining the reasons for the situation and also to explore how much the primary education can do to improve it.

The use of firewood poses two environmental issues that should be addressed. The first is the loss of vegetation in the islands from where firewood is collected. The second is indoor air pollution caused by poorly ventilated kitchens. The upper respiratory diseases causes significant disease burden to the population of the Maldives. Hence, it is recommended that advocacy, awareness raising and marketing of alternatives to firewood be targeted at those atolls where more than 15% of the households use firewood for cooking. Data from the census can be used to determine the particular islands where such activities need to be targeted.

The Target to halve, the proportion of people without sustainable access to safe drinking water and basic sanitation by 2015 is a major challenge. In Male', where more than one third of the total population live, all have access to safe drinking water. However, it has to be noted that desalinated water is produced by burning diesel oil and the heavy dependency on imported fuel for desalination is an issue that needs consideration from an energy security and sustainability perspective.

In the atolls, where two third of the population live, the key challenge is to ensure the quality and safety of drinking water. Presently the capacity to test and monitor the quality of drinking water is limited in the atolls. There is an urgent need to establish standards for rainwater collection, storage and use. There is also the need to increase the rainwater harvesting and storage capacity in Baa, Noonu, Dhaalu, Raa and Seenu Atolls.

Ground water contamination from leakages caused by improper construction of septic tanks is a significant problem in the atolls. Many toilets still discharge sewage and human waste directly into the ground water. Since ground water is still used in many islands for washing, bathing, cooking and even drinking, improving the sanitation situation in the atolls needs to be given high priority. It is recommended that adequate tertiary level sewage treatment options be evaluated for the island of the Maldives.



Summary of Observations: MDG

There is a need to do much more than what exists at present to make the islands of the Maldives safe against future sea level rise. The existing level of inequalities may cause a further acceleration of migration to the capital. A significant number of unemployed young women and men exist in the 15 to 24 year age group. The presence of multiple shifts and lack of trained teachers are the major gaps for quality education. There is a lack of adequate classroom space; and basic infrastructure facilities such as libraries, science laboratories and equipment. The issue of the children with special needs in the context of CC must be a very high priority in the education system. The concept of barrier free environment in the school is a major issue and needs prioritised actions.

There is a lack of basic data that is necessary to carry out environmental impact. The Target to halve, the proportion of people without sustainable access to safe drinking water and basic sanitation by 2015 is a major challenge. Apart from that, the ground water contamination from leakages caused by improper construction of septic tanks is a significant problem in the atolls.

4.1.2 NAPA and National Development

NAPA presents a coherent framework to climate change adaptation that enhances the resilience of the natural, human, and social systems and ensures their sustainability in the context of predicted climate hazards. NAPA covers the climate change-related hazards for the Maldives such as vulnerable systems, the sustainable development outcomes, the structures and processes that interact with the systems to influence adaptation, and the barriers to implementation. In the selection and prioritization of adaptation activities NAPA uses development goals Vision 2020, Seventh National Development Plan (7NDP) and the Millennium Development Goals (MDGs). The following Figure shows the objective and process of NAPA.

For the safety of the islands, Maldives has undertaken several actions. Since the commencement of sea wall construction around the capital Male' in September 1988, the government has implemented several projects aimed at adaptation to environmental threats. Community consultation and awareness raising activities were held for representatives from seven atolls of the Maldives and the capital Male'.

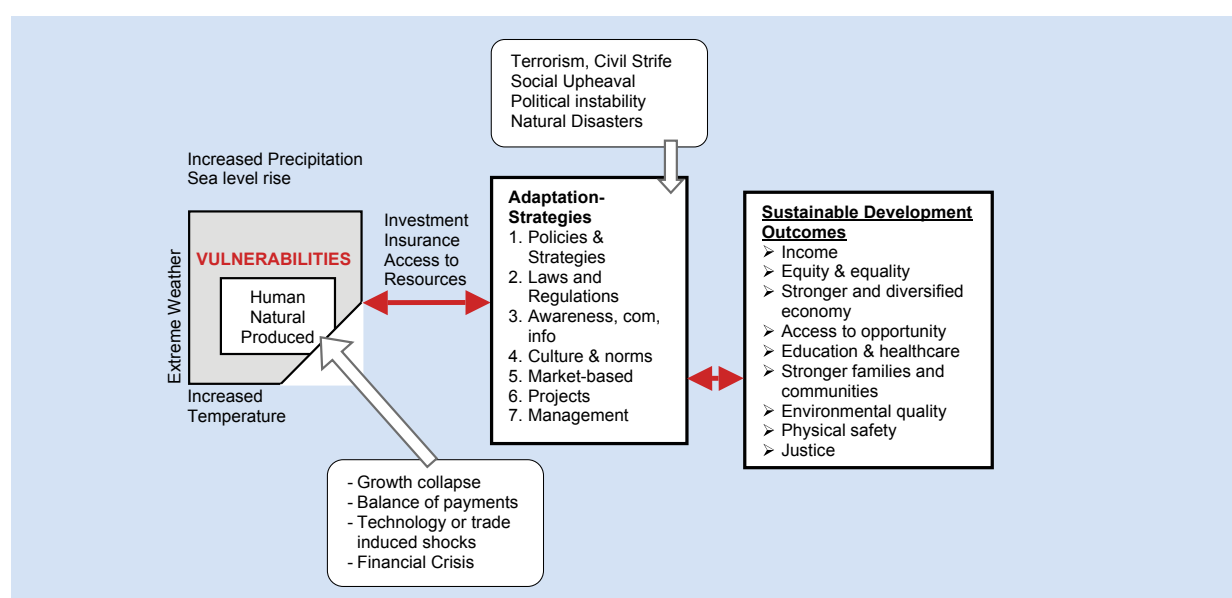


Figure 4.1: Conceptual Framework of NAPA illustrating climate change
Based on Source: NAPA (2006)

One key issue to combat climate change is cost effectiveness of the interventions - be it mitigation or adaptation. Based on existing resources, no government or people can address all the required interventions to completely eliminate the impacts of climate change on the environment fostering the human society. One has to choose the most urgent ones within limited money and time. This issue has been highlighted under the Section 6 "Identification of Key Adaptation Needs and Prioritisation of Adaptation Activities" in NAPA (2006). Under this head, the objective 4 is on cost effectiveness, which is as follows.

- Degree to which adaptation measure is socially accepted.
- Degree to which the adaptation measure is financial feasible.
- Degree to which the measure is technically feasible.

All the above three could be supported through a community-participated and school-based vulnerability analysis in a cost effective manner. The objective is to instill a culture of adaptation and mitigation in the students' life style. This will be largely facilitated through the revised course curriculum, appropriate pedagogy, teachers' training, etc. The experience of conducting Participator Vulnerability Analysis in a limited number of Atolls in Maldives tends to suggest that the first bullet point (above) could make the most important input to NAPA. Contributions of the communities on the second and third bullet will enable the national government, research institutes and international experiences to evolve sustainable solutions to adaptation and mitigation which are cost effective, technically appropriate to the contexts and socially acceptable.

4.1.3 National Communication

Maldives was and the first country to sign the Kyoto Protocol and is a party to the United Nations Framework Convention on Climate Change (UNFCCC). Maldives has completed its first National Communication to the UNFCCC through the Enabling Activities Programme, funded by Global Environment Facility (GEF). This is the

beginning of a process to meet the reporting obligations of the country under the Convention. The first National Communication incorporating the National Strategy and Action Plan was developed after intensive consultations among government and nongovernmental organisations. It contains the results of technical studies, observations and findings of assessments conducted through field studies, and scientific studies undertaken with guidance from experts. Everyone involved in the preparations of this Communication believed the process to be extremely useful, and highlighted the need to continue the managerial and technical capacity building exercise in future.

The first National Communication of Maldives will serve as a basis for concrete future actions. It is expected to pave the way to assist the nation to adapt to climate change impacts in a sustainable and consolidated way. The Maldives is fully committed in implementing the policies and measures identified in its National Strategy and Action Plan to mitigate climate change.

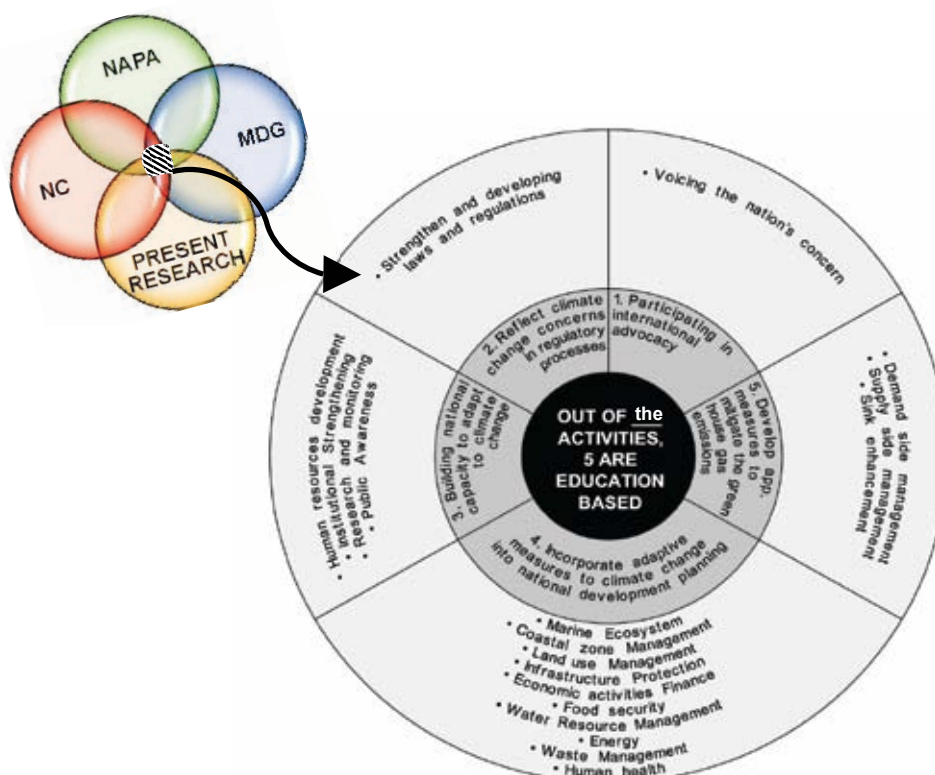
The National Communications has laid out actions/programmes/activities matrix with time frame. The primary education related interventions proposed in the matrix have been taken out and tabulated in the Annexure VI. This has been considered as the premise of this research in order to make sure that all school level interventions are in line with the national planning and commitments at International level.

4.2 SUMMARY

Based on the matrix provided in the National Communications, the related issues in MDG and NAPA have been tabulated in the Annexure VI. In each row the last column shows how the primary schools may help the national actions/programmes and activities. The following figure shows the summary of common actions proposed by the four sources in the context of Maldives. The education related issues were extracted from the four major sources in Maldives. This is represented by the four bubbles in Figure 4.2. The common set of the four bubbles in Figure 4.2 have been presented in the circular diagram.



Figure 4.2: The common actions/programmes/activities for addressing climate change policy matrix: NC, NAPA, MDG and the present research



Development Partners

In 2005, the country benefited from €2.7 million in humanitarian aid (post tsunami) for the installation of water tanks in households, community buildings, IDP camps and damaged schools, repairs to small-bore sewage systems, restoration of cold rooms and freezers in damaged hospitals, repairs to houses, support for cash for work schemes and restarting of livelihoods. From the Rapid Reaction Mechanism, €1 million was allocated for 19 of 33 reconstructions of houses on one or more 'safe islands'. In 2005 and 2006, €2 million was identified for restoring livelihoods and €1.4 million for the development of 'safe islands'. Particular attention was paid to Linking Relief, Rehabilitation and Development (LRRD).

Several international agencies are working in Maldives in DRR, such as IFRC, UN, Mercy Malaysia, SEEDS Asia, World Bank (through the government), Islamic Development Bank, Qatar Fund, Kuwait Fund (Tsunami Reconstruction).

Annexure VI shows the actions/programmes/activities for addressing climate change policy of which some will need technical and financial supports from the international agencies. It is suggested that this report be shared with them and have convergence to avoid duplication of interventions and facilitate cross learning. This will also reduce the possibility of any clash between the national goals of Maldives and donors' interventions in the context of combating climate change in a sustainable way.

In the light of the last Chapter and considering the level of preparedness of Maldives to cope with CC, it is evident that the children of this country are already highly vulnerable. In the event of CC related intensified and frequent disasters, they will be even more affected hampering the future of the country. In order to understand this issue it is important to know the primary education system in Maldives. The next Chapter is focused on the education profile and the risks of the country.

Chapter 5

EDUCATION PROFILE AND RISKS

5.1 BACKGROUND

There has been a long history of semi-formal religion-based education for the masses in Maldives, which exists even today. Traditionally, the children gathered in homes called 'Edhuruge' to learn Dhivehi language and the Arabic script and to learn to recite the Holy Quran. Apart from that there were special classes for navigation, languages, and for Muslim theology. While a new system of formal education has almost replaced the traditional system, it has contributed towards achieving many educational objectives – the most important of which is the relatively high rate of literacy and the preservation of national culture and tradition.

Maldives assigns high priority to education and approximately 15% of the total government expenditure was on education in 2006. Education system in Maldives is also based on aid from international donor agencies.

In 1978 it was decided that a unified national system of education will be adopted and an equitable distribution of facilities and resources will be promoted. The policy was focused on providing Universal Primary Education for All in Maldives. To facilitate that, a unified curriculum for Grades 1-7 was formulated and improvement of teachers' training and the establishment and upgrading of new schools in the atolls were done. Two government schools, one Atoll Education Centre (AEC) and one Atoll School (AS) were established in each atoll and today these schools provide high quality basic education for the children at local level.

The government of Maldives has provided access to primary education (grades 1-7) to all the Maldivians. The secondary and higher secondary education are also being expanded. Apart from

that, locally arranged and overseas tertiary education programmes have been initiated by government and private sector.

The primary schooling in the country starts from grade 1 at the age of 6 years, lower secondary (grade 8-10) at the age of 13 and higher secondary (grade 11-12) at the age of 16 years. While higher secondary schooling is completed at the age of 18 years, the Census data on school attendance reveals the presence of over-age students in the school system even up to the age of 25 years

The Maldivian population consists of a high proportion of children, with 9% of its population under 5 years, and 31% below 15 years. Provision of education to over one-third of its population is a great challenge for a developing country like the Maldives. Despite this, all children in the Maldives have access to the first seven years of formal schooling.

Figure 5.1 shows the distribution of types of population in Maldives (data provided by the NDMC in 2009). The number of children in Maldives is high and hence, the preparedness at school level will be appropriate and cost effective.

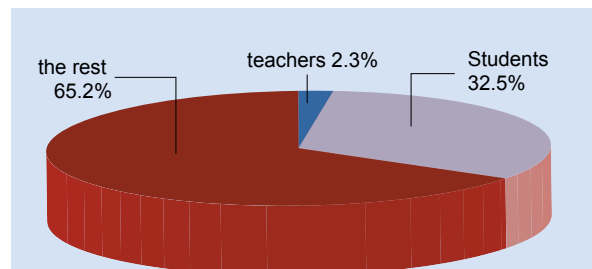


Figure 5.1: Distribution of students, teachers and rest of the population in Maldives
Data supplied by NDMC, 2009

5.2 Vulnerable Children in Maldives

Table 5.1: Showing Physical and Social risks of the school children
(Risk index of 1-5 indicating very low, low, moderate, high and very high risk levels)

Name of Atolls	Multi-hazard Index	Risk	no of teachers	population	Pre Primary			Primary			Secondary			Higher secondary			Pre + primary students	Secondary + students
					Girls	Boys	Total	Girls	Boys	Total	Girls	Boys	Total	Girls	Boys	Total	TOTAL	TOTAL
Male/Kaafu		5			2,719	2,672	5,391	6,588	6,939	13,527	4,806	4,348	9,154	796	813	1,609	18,918	10,763
Haa Alifu	4 & 5	4 & 5	400	13,495	345	377	722	1,414	1,450	2,864	776	751	1,527	14	29	43	3,586	1,570
Haa Dhaalu	4 & 5	5	449	16,237	479	458	937	1,633	1,841	3,474	1,072	965	2,037	34	59	93	4,411	2,130
Shaviyani		4	362	11,940	232	255	487	1,146	1,284	2,430	707	730	1,437	18	39	57	2,917	1,494
Noonu		4	311	10,015	198	223	421	918	1,000	1,918	582	550	1,132	18	18	36	2,339	1,168
Raa	1 & 5		464	14,756	368	396	764	1,524	1,632	3,156	911	817	1,728	19	48	67	3,920	1,795
Baa	1 & 4	5	311	9,578	200	202	402	781	961	1,742	522	560	1,082	52	74	126	2,144	1,208
Lhaviyani		4 & 5	201	9,190	207	205	412	759	767	1,526	487	478	965	42	45	87	1,938	1,052
Kaafu		4 & 5	248	15,441	279	269	548	780	898	1,678	427	407	834	0	0	0	2,226	834
Alifu Alifu	1	5	157	5,776	82	74	156	436	521	957	209	227	436	0	0	0	1,113	436
Alifu Dhaalu	1	5	219	8,379	135	154	289	602	715	1,317	373	418	791	0	0	0	1,606	791
Vaavu	1		58	1,606	16	18	34	98	125	223	76	86	162	0	0	0	257	162
Meemu			123	4,710	72	87	159	347	364	711	211	219	430	0	0	0	870	430
Faafu	1		121	3,765	125	122	247	440	473	913	263	219	482	0	0	0	1,160	482
Dhaalu			143	4,967	141	118	259	402	497	899	248	269	517	11	16	27	1,158	544
Thaa	1 & 5		229	8,493	113	158	271	746	784	1,530	404	475	879	0	0	0	1,801	879
Laamu	4	5	350	11,990	285	291	576	1,183	1,307	2,490	620	644	1,264	20	7	27	3,066	1,291
Gaafu Alifu	5	4	257	8,262	201	190	391	862	1,014	1,876	388	380	768	6	7	13	2,267	781
Gaafu Dhaalu	5	5	318	11,013	358	337	695	1,075	1,173	2,248	568	520	1,088	17	7	24	2,943	1,112
Gnaviyani	4	5	222	7,636	301	272	573	730	799	1,529	457	453	910	24	20	44	2,102	954
Seenu	4 & 5	5 and 4	467	18,026	547	570	1,117	1,585	1,677	3,262	903	891	1,794	115	118	233	4,379	2,027
Republic Total	97,024				7,403	7,448	14,851	24,049	26,221	50,270	15,010	14,407	29,417	1,186	1,300	2,486	65,121	31,903
Republic Total girls	47,648				Girls	Boys	Total	Girls	Boys	Total	Girls	Boys	Total	Girls	Boys	Total		
Republic total boys	49,376				Pre Primary			Primary				Secondary		Higher secondary			Pre + Primary	Secondary + HS

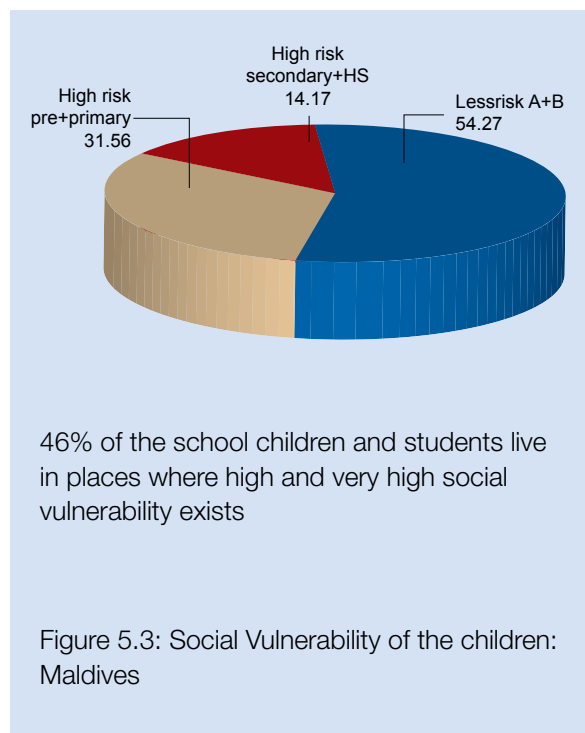
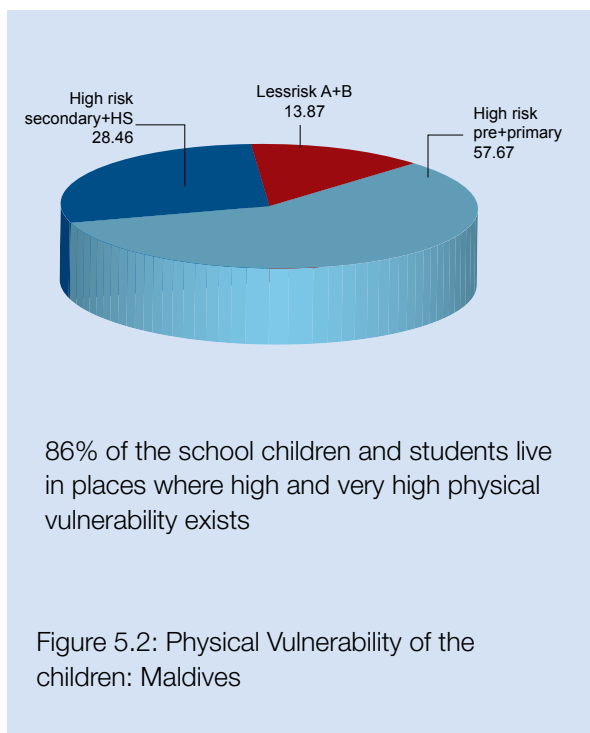
Note: The portions in colour indicate very high and high risk areas: Based on UNDP 2006 and NDMC supplied data on schools in 2009

Chapter 3 has shown the different types of hazards in Maldives. As mentioned before, the maps have been prepared based on “Developing a Disaster Risk Profile” (UNDP, 2006). Apart from the sea level rise, which is a slow killer, Maldives is vulnerable to a number of natural disasters, which are likely to increase due to climate change as reported by NAPA (2006) and other related documents. The impact of the 2004 tsunami had significantly damaged the Maldivian economy and destroyed or damaged its educational infrastructure in some islands indicating lack of preparedness and capacity to respond to disasters. With this background, it is apparent that a large number of Maldivian school children will be very highly affected due to climate change, especially the girl children and the physically challenged ones.

The DoE data on school children has been collated with Atoll-wise risk assessment study conducted by UNDP (2006). While it has been mentioned earlier that the assumptions and methodology of such assessment needs review, in absence of any other authentic source of data, the UNDP study report has been adopted in this research.

The NDMC supplied school level data and the assessed risks of UNDP report have been combined in Table 5.1, which summarises the education profile along with physical and social vulnerability. However, it may be noted that risks have wide variation between the islands and hence, the facts and figures must be more accurate by making island-wise risk and vulnerability assessment. This is very crucial for islands that are in multi hazard zone with the least coping capacity due to their smallness, accessibility problem and small population.

Figure 5.2 and Figure 5.3 show the percentage of students living in places where physical and social vulnerabilities exist. It may be reiterated that the methodologies for determining the physical and social vulnerabilities should be reviewed before undertaking the full study to assess the overall requirements for adaptation and mitigation actions in the context of CC in Maldives.



5.3 SUMMARY

The above mentioned figures are highly worrying not only to the Maldivians – it is equally disturbing to the humanity. In the event of disasters, children in vulnerable physical situation will be completely defenceless. With very little resilience of the Maldivians, it will be difficult for the school children to go to a safe abode during and after a disaster. The situation will worsen with the impact of climate change. Therefore, in order to avoid any future catastrophe, the Maldivians have to be highly proactive. Internal assistance will be required urgently in mitigating and adapting to the highly vulnerable environment for the primary school children, the old people and physically challenged people.

While Maldives has top down preparedness to deal with climate change, there is a lack of grass

root level situation analysis to examine the social relevance and suitability of the national level interventions. The present research had carried out a limited study to examine whether such attempt can bring forward participatory bottom up support to the NAPA and NC, MDG. In this connection, a national level WS was conducted at Maldives by involving government, private sector and the NGO. The participants of the Workshop suggested that a study be conducted at a few Atolls to get some idea on the impact of climate change on education.

Based on the recommendations of the national level workshop, Participatory Vulnerability Analysis (PVA) was conducted in a few Atolls. PVA involves community in vulnerability assessment, makes them aware of their rights and also share their wisdom with the planners and the administrative people who make the policy decisions. The following Chapter presents the process of PVA.

Chapter 6

PARTICIPATORY VULNERABILITY ANALYSIS

6.1 BACKGROUND

Climate Change is perhaps the greatest threat to the viability of the Maldives' communities in the 21st century. Although Maldives is an insignificant emitter of greenhouse gases that drive global warming, the region is faced with the predicament of being amongst the most vulnerable to the impacts of climate change. This is partly due to limitation in the land area, largely coastal dwelling populations and almost complete dependence on natural resources for subsistence living and economic development. With the reality of hazards increasing due to climate change in the Maldives, it is imperative that its communities should be prepared to deal with adverse impacts that it will bring about.

The Chapter on the situation analysis shows essentially a top down preparedness of the government of Maldives, the donor partners and the NGOs. However, there is a need for a bottom up feedback to combat disasters in the context of climate change and to address this issue in a sustainable manner. For example, absolute micro level information such as the intrusion of sea water into the water table (due to sea level rise) cannot be provided through the existing top down data and maps. Participatory Vulnerability Analysis is one of many methods that can acquire this kind of data at grass root level in a cost effective manner. International experience shows that the reliability and efficacy of data obtained through PVA are very

high. Under this research work, a national workshop was convened in Maldives in 2009 to understand the impact of climate change on the children in the country. NDMC facilitated the workshop. The workshop was participated by the Ministries, Donors, NGOs and the State Ministers from the Atolls. When PVA was discussed in the workshop, the participants felt that it will be an appropriate tool to understand local level vulnerabilities for the following reasons.

- it is people centric
- based on community wisdom
- it is a simple and replicable system of vulnerability assessment by the community

In order to assess the level of risks at school level, three zones were identified looking at the variation in type and intensity of hazards. This was done by the NDMC in consultation with the state level ministers who had participated in the national workshop. The purpose of the field level study was also to gather community wisdom on adaptation.

Unlike Bangladesh, Nepal, etc. Maldives did not have such grass root level data on community based vulnerability analysis. Therefore, ActionAid's PVA was adopted in Maldives to maintain consistency with similar exercise undertaken in Bangladesh under this research. However, looking at the time and fund constraint, a rapid PVA was developed and conducted in Maldives. The following is the list of schools where rapid PVA were conducted.

Table 6.1: List of the schools selected for rapid PVA

Sl no	Name of the school	Name of Atoll
1	La Gan	Lamu
2	Funadhoo	Lamu
3	thundi	Lamu
4	Hinnavaru	Lhaviyani
5	Ungoofaru	Noonu
6	Abbubakkru	Gaafu Dhaalu
7	Thinnadhoo	Gaafu Dhaalu

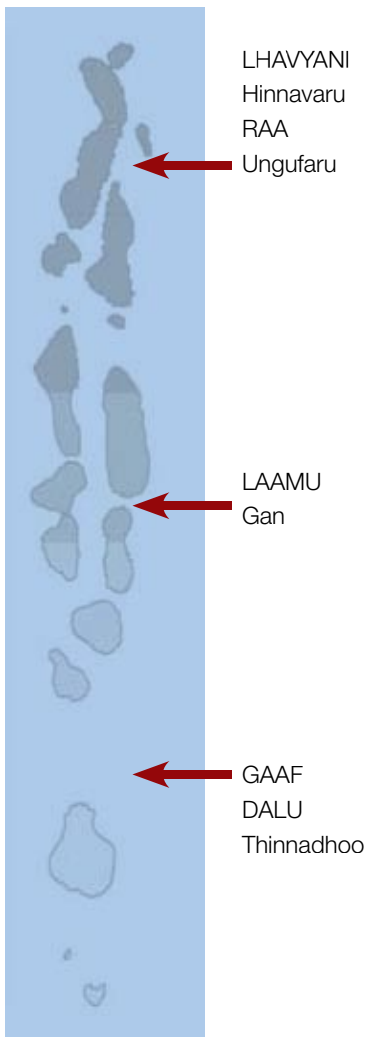


Figure 6.1: Locations of the schools selected for rapid PVA

After the sites for rapid PVA were selected, the NGO, SSS and NDMC personnel were trained at Male on how to conduct the exercise. Every detail was discussed including the logistic arrangements. Prior to the PVA at Atoll level, the State Minister and her/his teams were also briefed about the process of PVA. The following Figure shows the rapid PVA organised at Atoll level. The people who took part in the exercise were;

- Islanders
- Students
- Teachers
- Parents
- Island govt. officials
- Clerics
- State Ministers with team

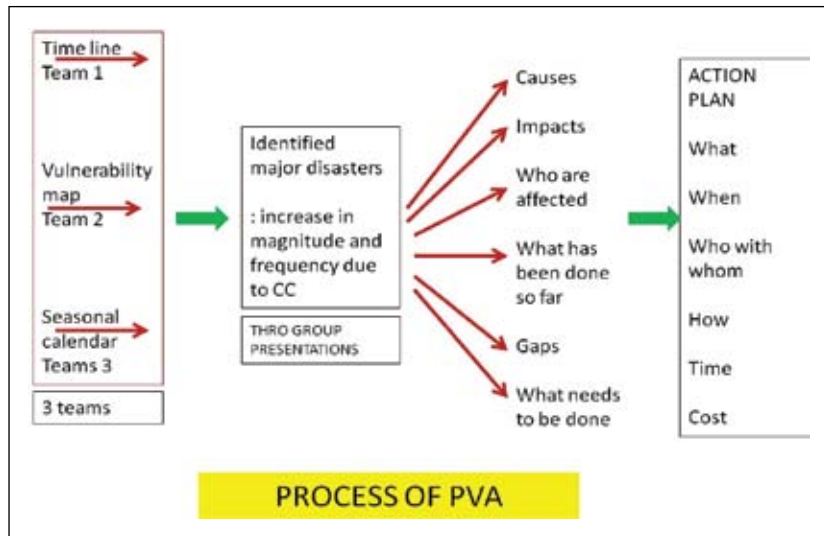


Figure 6.2: The process of PVA

Figure 6.2 shows the process of rapid PVA adopted at Atoll level. PVA is a stakeholder centred process. It not only helps in understanding the context at micro level, the best of community's wisdom is revealed in the process. The past and present exercises showed that community is a storehouse idea for dealing with disasters. Therefore, the top down and bottom up data will lead to sustainable system for combating climate change. The following is a brief description of the PVA experience in Maldives and the detail report has been put forward in Annexure II.

6.2 THE PROCESS OF PVA: MALDIVES

The Participatory Vulnerability Analysis (PVA) is the result of a process undertaken on the various atolls of Maldives to document local impacts of climate change and to devise appropriate adaptation measures that local communities can implement themselves.

The PVA was conducted in three phases as shown below. The detail process of PVA is available in <http://www.ActionAid.org/assets/pdf/PVA%20>

Phase 1: Preparation

- Country level awareness-raising
- Defining purpose (TORs)
- Stakeholder analysis
- PVA team preparation

Phase 2: Understanding the Analytic Framework

Step 1: situation analysis

Step 2 analysis of causes

Step 3 Analysing community action (Adaptations)

Step 4 drawing action from analysis

Phase 3: Multilevel Analysis

- Community level analysis - conducting PVA in the selected areas using the step-by-step framework
- District level analysis — analysing vulnerability at district level using the Step-by-Step framework
- National level analysis — analysing vulnerability at national level using the step-by-step framework
- International level analysis — feedback from national level analysis and action planning

final.pdf. Out of the three phases, this Chapter will focus on the Phase 2 because that deals with the most micro level data regarding school based preparedness for climate change.

6.3 PHASE 2: UNDERSTANDING THE ANALYTIC FRAMEWORK

6.3.1 Step 1: Situation Analysis

The following were identified in this step

- Prevalence and extent of vulnerability
- How different people are able to cope
- Analyze present threats/vulnerabilities

The Method

- Introducing the concept of vulnerability
- Using a focus group discussion. Getting the community to discuss and give examples
- PVA was conducted with different groups, e.g., students, teachers, community, PTA etc.
- The first exercise was social mapping followed by timeline analysis and seasonal calendar.

The Outputs of the process are a) Social mapping, b) seasonal calendar and c) timeline. The following is a brief description on the outputs.

Social Mapping

Mapping is a very useful tool in determining the spatial distribution of certain aspects of our environment, may it be traditional boundaries, homesteads, agricultural areas or fishing grounds. This tool is useful in aiding the community to develop, record, organize and present information about their surroundings. Maps can be a simple and quick way of illustrating an issue and may be used as a planning tool. They are also particularly useful all community participants can take part and check the information is accurate.

Purpose: To collect information and develop a community map of resource availability, infrastructure, disaster prone areas and areas of cultural significance.



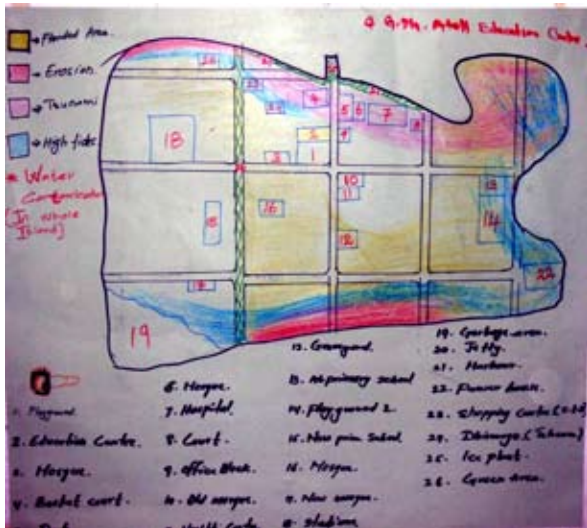


Figure 6.3: Community involvement in atoll mapping

Seasonal Calendar

A seasonal calendar is a tool for documenting regular cyclical periods (i.e. seasonal) and significant events that occur during a year and influence the life of a community. The seasonal calendar provides a general picture of important environmental, cultural and socio-economic

periods throughout the year. The Seasonal Calendar is of particular value as it allows local people to represent their understanding of seasons from their culture. These are often different from 'official' seasons and the International calendar.

Purpose: To develop local community seasonal calendar for the atolls of Maldives.

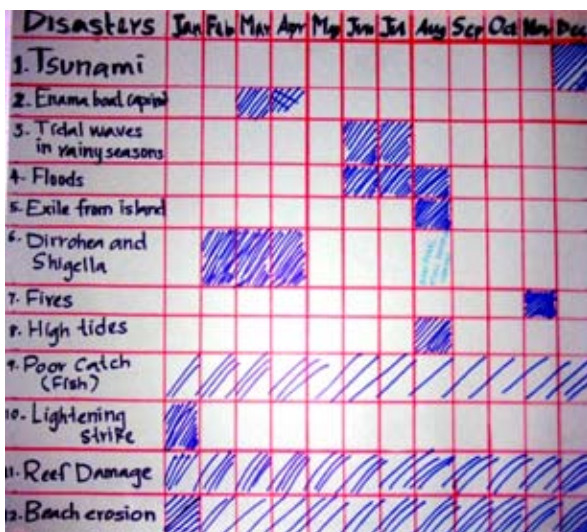


Figure 6.4: Community involvement in preparing the Seasonal Calendar



HAZARDS/ DISASTERS	WHEN	EFFECT	WHAT WERE THE CAUSES	WHAT IS TO BE DONE
1. TSUNAMI	26-12-2004	LOSS OF LIFE, PROPERTY, DAMAGE TO INFRASTRUCTURE, CLIMATE CHANGES	SEA LEVEL RISE, PLANT IS, THERE WAS A CLIMATE CHANGES	REPAIRING (REPAIRS) AND BE BUILT IN PROTECTIVE PLANS AND SECURE AND ARRANGEMENT OF DRINKING WATER
2. TIDAL WAVES	FROM JAN. AND EVERY YEAR	LOSS OF LIFE, PROPERTY, DAMAGE TO INFRASTRUCTURE, CLIMATE CHANGES	SEA LEVEL RISE, PLANT IS, THERE WAS A CLIMATE CHANGES	REPAIRING (REPAIRS) AND BE BUILT IN PROTECTIVE PLANS AND SECURE AND ARRANGEMENT OF DRINKING WATER
3. FLOOD	EVERY YEAR AND ANNUALLY	LOSS OF LIFE, PROPERTY, DAMAGE TO INFRASTRUCTURE, CLIMATE CHANGES	SEA LEVEL RISE, PLANT IS, THERE WAS A CLIMATE CHANGES	REPAIRING (REPAIRS) AND BE BUILT IN PROTECTIVE PLANS AND SECURE AND ARRANGEMENT OF DRINKING WATER
4. DROUGHT	EVERY YEAR AND ANNUALLY	LOSS OF LIFE, PROPERTY, DAMAGE TO INFRASTRUCTURE, CLIMATE CHANGES	SEA LEVEL RISE, PLANT IS, THERE WAS A CLIMATE CHANGES	REPAIRING (REPAIRS) AND BE BUILT IN PROTECTIVE PLANS AND SECURE AND ARRANGEMENT OF DRINKING WATER
5. FLOOD DAMAGES	EVERY YEAR AND ANNUALLY	LOSS OF LIFE, PROPERTY, DAMAGE TO INFRASTRUCTURE, CLIMATE CHANGES	SEA LEVEL RISE, PLANT IS, THERE WAS A CLIMATE CHANGES	REPAIRING (REPAIRS) AND BE BUILT IN PROTECTIVE PLANS AND SECURE AND ARRANGEMENT OF DRINKING WATER
6. FIRE	EVERY YEAR AND ANNUALLY	LOSS OF LIFE, PROPERTY, DAMAGE TO INFRASTRUCTURE, CLIMATE CHANGES	SEA LEVEL RISE, PLANT IS, THERE WAS A CLIMATE CHANGES	REPAIRING (REPAIRS) AND BE BUILT IN PROTECTIVE PLANS AND SECURE AND ARRANGEMENT OF DRINKING WATER

Figure 6.5: Community involvement in preparing the Timeline

Timeline

A timeline is a listing over many years of key incidents or hazards in the history of a community or area. The timeline facilitates community discussion and examination of past trends, actions, problems and achievements. It is useful in resource planning and decision making to think back on these past events and experiences and look at how they influence present attitudes and actions.

The events which are recorded on the time line may include spiritual and cultural events, movements of people, introduction of new technology, natural disasters, political events or decisions, development projects and so on. In developing a timeline community members record back as many generations as villagers can recall. Group discussions of the time line provide a good opportunity to ask elders about previous happenings and traditional community responses.

Purpose: To help the community better understand what natural and human events have influenced the lives of the communities in the atolls of Maldives.

6.3.2 Step 2: Analyzing Causes of Vulnerabilities

This step had enabled the participants to identify causes and effects of the different types of

vulnerabilities at micro level. It is always important to allow communities to identify its own needs and arrive at possible solutions. This tool provides a simple but systematic way to help the community to identify and refine the specific issues. It helps them to define the 'causes' of the incidents or hazards that concern them most and to look for possible ways to solve or address these by identifying their 'effects'.

Method

A list of Causes and Effects can be generated in several ways. The list might include items generated from many sources, including meetings, brainstorming sessions, individual discussions, small group exercises, transects or theatre sessions. The list should be retained in the community and continually revised to include more information as it comes forward. The output of this process is a diagram that is the result of cause-effect analysis, focus group discussion, and impact diagram.

Purpose: To organize community climate change related incidents / hazards and consider options that should help address them.

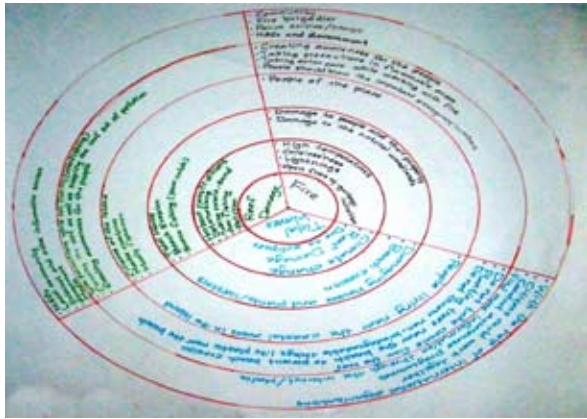


Figure 6.6: Cause and effect diagram (left). Community involvement (right)

6.3.3 Step 3: Analysis of Community Actions (Adaptation)

This step establishes the existing strategies, resources and assets used to reduce vulnerability. In short, what has been done so far and where the gap is with regard to disasters specific to the settlement. This step analyses whether there is any need for external assistance to reduce vulnerability at local level.

This step starts with a summary of what the local level vulnerabilities, their causes and what is the community doing about their vulnerabilities (identified in step 1 and 2). List the coping mechanisms discussed in step 1 and some

more are added if something has been missed out. Central to this activity is compilation of the adaptation actions in a circular diagram. The circle is divided by a line at its equatorial level. There are concentric circles each representing a level, i.e., school, island, atoll, province, national and international. In the upper half of the circle, the future adaptive actions are written from absolute local to international level. The lower half shows those adaptations which are already in place. For each type of vulnerability, there will be one such circle with concentric circles. The innermost circle is labelled with the particular vulnerability under consideration.

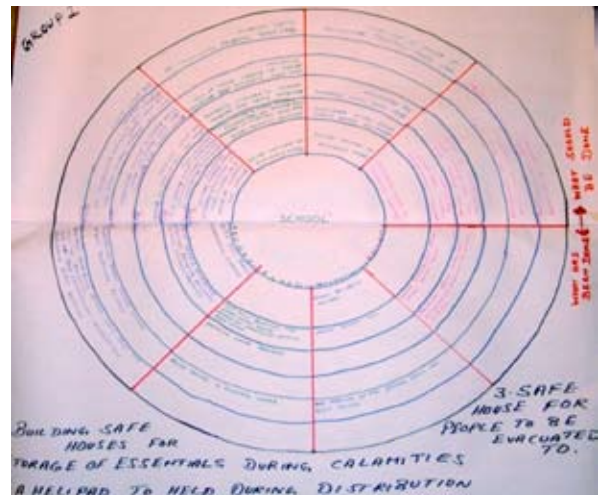


Figure 6.7: Community involvement (left). Diagram (right) shows adaptations for one type of vulnerability

Purpose: To assist communities in deciding which specific actions will be taken or undertaken by the communities at local level in Maldives to adapt to the impacts of Climate Change.

6.3.4 Step 4: Drawing Action from Analysis

The main objective of this step is to organize tasks and resources such that a community is able to implement the identified climate change adaptation options suited at local level. The following process was adopted to carry out this step.

- Ask community members to list the actions or adaptation options that they have agreed to. Record them on a large piece of chart paper in view of everyone. Ask the group to rank these from the highest to lowest priority in terms of putting them into action
- Start and focus on the action of highest priority. Divide into groups and brainstorm a number of tasks which need to be undertaken to make that action work or to be put in place
- Draw a horizontal line across a long separate piece of chart paper. Ask the group to set a date on when the community wants all the tasks to be completed and the adaptation action in place. Write the date at the far end of the line.
- Ask the group to review and evaluate the tasks listed. As they agree with the tasks, post them up along the time line. As they are posted, the

group should check to see that they are placed in logical sequence. If there are fixed times for completion of certain tasks write them above the tasks on the time line

- After the tasks are all posted, go through the cards asking who will be responsible for each task. Write their initials on the card. Ask again for each card what resources are required to carry out this task. List the resources needed on a separate card and attach to the 'task' card. If gathering those resources requires special tasks, then make additional cards and place them along the time line. Go to the next adaptation action and repeat the process
- When all the adaptation actions listed have been completed, review the action plan. If everyone agrees that the list of tasks is complete and in order, transfer the information to a simple table listing WHAT the task is, WHO will be responsible for it, WHAT resources will be needed and by WHEN it is expected to be complete

The rapid PVA report has been put forward in Annexure II. The outputs of the PVA exercise carried out at Maldives have been analysed and the adaptation, mitigation and interdependent (explained in the next Chapter) actions have been determined. The summary of this has been put forward in the following Chapter.



Activities	Who should do it.	With whom	When	Indicators
1. Water Conservation ① Proper Sewerage System should be built. ② Desalinated water should be supplied.	• Government • Local community + Government	• Foreign aid • Source of water	• 2012 (as soon as possible)	• Built + plan completed • plant water to find out water level in region
2. Flood ① Road should be paved. ② Drainage System	• Government + local community • Government	• Government • Foreign aid	• As soon as possible	• Drainage system built • Drainage System in place
3. Beach Erosion ① Plant some trees near the beach. ② Sea wall and other structures should be built along the beach	• Government + local community • Government	• Source of local + neighboring islands • Foreign aid	• 2012 + 2015	• New plants which protect soil erosion have been done • Sea wall and other structures will be built

Figure 6.8: The final output: Action plan for adaptation and mitigation

“Climate Change”, one of the most discussed issues of the twentieth century, has been the focus of many deliberations. Being a team member for the Disaster Risk Reduction activities in the country, when I had an opportunity to bring in a pilot study to Maldives with the help of DFID, I was excited and with the permission of the Honourable Minister of State, Mr. Abdulla Shahid, NDMC along with the local NGO “Society for Social Services” initiated the study.

The decisive question we faced was not whether to adapt, but on what to adapt, when and how. With very good support and assistance from the Province State Ministers – Ms. Thilmeeza Hussain, Mr. Ahmed Mujthaba and Province Deputy Minister Mr. Mohamed Shareef, the team had very successfully conducted the research in the selected small islands. One of the key facts observed in this research was that the island communities were clear on the adaptation measures. Therefore, the PVA outputs based on their suggestions could make a valid contribution to the national strategy. Each of the dispersed islands of Maldives had unique problems with socially relevant solutions. The enthusiasm shown by the children and the evidence presented in this review confirm the centrality of children and their unique vulnerabilities in Maldives.

Finally, after the initial pilot study and discussions with the Honourable President, as a team member I am confident that a future full fledged study can give defined direction to the adaptation strategies in the country. It was a wonderful experience to work with the DFID team leader which also gave me an opportunity to learn and study practical climate adaptation action plans which are site specific.

Ranjith George, Consultant UNISDR at NDMC, Male, Maldives

Chapter 7

ADAPTATIONS AND MITIGATIONS

7.1 STOCK TAKING: IDENTIFIED AT THE NATIONAL LEVEL WORKSHOP

The NC, NAPA, etc. have attempted to address the issue of CC in Maldives. These are the top down interventions through various sectors, Ministries and agencies (national and international). Under this research a study was conducted in a limited number of Atolls to understand the grass root level situation of vulnerabilities, preparedness and gaps in the context of climate change. Based on the top down and the grass root level information, this Chapter has identified those aspects of responding to CC in Maldives which can be addressed through primary education system.

In May 2009, a national level workshop was convened at Maldives after carrying out a desktop research to take the stock of what is available and where the gaps are in the context of adaptation and mitigation to cope with climate change in Maldives. This was followed by a grass root level data collection through Participatory Vulnerability Analysis in three Atolls. The main objective was to get a bottom up finding based on which future actions could be suggested. It may be noted that the bottom up field data analysis revealed that the Islanders are storehouses of innovative and practical ideas to cope with the negative impacts of CC. The bottom up along with the top down will lead to a strategy and action plan of responding to the CC through primary education in Maldives.

Table 7.1: Things Available in the context of CC: identified at National Workshop

Description	Remarks
It was learnt that there are school catchments maps showing population of catchments, number of households, etc with the MoE	Not yet received
NDMC has got some data on the past disasters, however there is nothing on the past interventions- the process of gathering past data has been initiated	Needs strengthening and a data collection mechanism to be in place
Data on the number of people living in disaster prone areas- disaster type-wise population distribution in Maldives are available at Atoll level	The methodology to be reviewed and the data to be updated
The health and nutrition status of the children in the country are available with the MoHF	
Data on common ailments e.g. in diarrhoea, cough, fever, etc., are available with MoHF	
There is migration problem in the country that is increasing	
There is an advisory panel on climate change with local and foreign experts (presidential)	Data to be updated and made available
The National Environment Action Plan (NEAP) is the comprehensive policy framework that is used in a six-yearly cycle to ensure environmental protection and sustainable development in the Maldives.	

Table 7.2: Gaps identified by the participants in the national workshop: Maldives

1	Building code needs updating and incorporate the requirements of DRR
2	Meteorology department to collect data pertaining to CC so that they will help in planning the adaptive and mitigation actions.
3	Capacity building in most of the sectors
4	Identifying and strengthen the inter-linkages between climate change – health – education
5	Assessment of schools to for vulnerability towards disasters. (structural and operational evaluation to climate preparedness. e.g.; Energy efficiency, structural integrity, retrofitting needs
6	No research has been done on impacts of climate change on children and schools in Maldives. According to the participants, the impact on the children will be significant due to climate change
7	While a few islands were studied with the assistance from UNDP(Disaster Risk Profile), 2006, detailed disaster risk mapping for individual islands and schools should be carried out
8	No comprehensive GIS mapping on disaster, resources exist at present
9	There is a lack of coordination and data sharing between the resource institutions
10	Data on primary education, i.e., EMIS data along with Latitude and Longitude of each primary school to be made available- data on condition of the existing buildings and facilities to be part of the EMIS. Computerised EMIS needs to be in place immediately
11	While there are attempts of reclaiming land, there is no evidence of concrete planning to address the fact that some islands will be completely inundated in the next fifty years
12	Education sector not directly involved in NAPA and NC

While there is preparedness in the context of climate change it needs strengthening. There are gaps in the context of CC as well. The government may review the issues identified in the national workshop to mend the gaps and make full use of the preparedness to protect its own people as well as to meet its commitments to the international forum. This exercise is of vital importance towards setting the target of mitigation and adaptation and implementing them in terms of short, medium and long term achievable objectives.

7.2 VULNERABILITY TO CLIMATE CHANGE

According to the IPCC, vulnerability is the degree to which a system is susceptible to, or unable to cope with, adverse effects of climate change, including climate variability and extremes. Vulnerability could be reduced by adaptation and mitigation interventions in a planned way.

The government of Maldives, public and the private sector, as a whole need to acknowledge the reality of climate change and associated sea level rise. As mentioned earlier, Maldives is one of the most vulnerable countries in the world in the context of climate change. It needs to incorporate effects of climate change in national development plans. There is a need for developing new policies and strengthening of the existing policies. According to the NC of Maldives the following is a list of high priority vulnerabilities of the Maldivians to climate change.

- Land loss and beach erosion
- Infrastructure damage
- Damage to coral reefs
- Impacts on the economy
- Food security
- Water resources
- Human health

While these have been corroborated by the PVA conducted at island level, the latter has provided a much deeper understanding of the grass root level problems and solutions that are feasible in the local context and socio-culturally relevant and hence, sustainable.

In order to minimise these vulnerabilities there is a need for appropriate mitigation and adaptation actions. The following paragraphs carry out a discussion on Mitigation and Adaptation and show the top down- bottom up connection.

7.3 MITIGATION OF GREENHOUSE GAS EMISSIONS- NC

Mitigation (IPCC, 2001a) is an anthropogenic intervention to reduce the sources or enhance the sinks. It is very important to state right in the beginning that the National GHG Inventory of the Maldives shows that the contribution of Maldives to global emission of GHGs is insignificant. GHG emission can be further reduced by using high efficiency generators, increasing awareness on the use of high energy efficient appliances, increasing the use of renewable energy sources, using solar energy for desalination, etc.

Reducing CH₄ from landfills and sewage discharges is another possibility. This can be achieved through improving of the solid waste disposal methods, management practices and by providing treatment of sewage discharges. In 1999, it was estimated that daily generation of solid waste is 0.66-2.48 kilogram per capita. The annual municipal solid waste was estimated to be at 0.18 million tons (Shapkota et al, no date). Using IPCC (1996) methodologies for the development of GHG inventories, it was calculated that 1.142 Gg of CH₄ was emitted from the disposal of municipal solid waste in Maldives.

The enhancement of the natural GHG sinks by increasing the vegetation cover and improving the health of the coral reef has been considered as possible mitigation option. Owing to the non availability of data on land-use and its changes, forestry and the existence of natural and managed GHG sinks, these were not accounted for in the GHG inventory.

The emission of GHG can further be reduced by adopting less CO₂ intensive construction technologies and appropriate designs that reduce the air-conditioning and electrical loads throughout the whole life cycle of the buildings. This could be demonstrated by building all future schools in this line and retrofitting of the existing ones. The use of deep sea water as coolant in air-conditioning or similar approaches could be explored and be modified to suit the conditions of Maldives.

Increase in sink can be promoted through educating the children, increasing awareness of the islanders and using the school as a demonstration unit. The school can act as a resource centre in this respect. In order to make it a reality, the teachers should believe by heart that there has to be a constant campaign to keep the awareness alive. This requires a thoughtful teachers' training component that deals with right kind of materials and pedagogy. However, motivation of the teachers and political will are the two fundamental pillars of the success towards combating CC. Following is a summary of the mitigating actions that could be promoted and practised through schools. The matrix reflects the lines of thinking by NC, NAPA, MDG, the outputs of the National Workshop and the outputs of PVA.



Table 7.3: Primary education related Mitigations at different levels: (red indicates immediate actions according to the National Communication, Maldives)

NATIONAL COMMUNICATION	NATIONAL ADAPTATION PLAN OF ACTION	MILLENNIUM DEVELOPMENT GOALS	THE PRESENT RESEARCH	
			SUGGESTIONS: NATIONAL WS	SUGGESTIONS: PVA
INTERNATIONAL 1. collective voice for all small island states at international forum for reducing GHG by developed countries	1. Reduction of climate change hazards through coastal afforestation with community participation.	1. Needs substantial additional assistance	1. Pressure on the developed countries for reducing carbon emission 2. carbon neutral, shifting to renewable energy in 10 yrs	1. Presenting the PVA reports at international forum- pressure on the developed countries for reducing carbon emission
NATIONAL				
1. Strengthen measures of increasing vegetation cover 2. Acknowledge coral reefs as carbon dioxide sinks 3. Consider greenhouse gas emissions in national solid waste management	1. Finance Human Resource	1. Desalination - energy security and sustainability perspective 2. Alternatives to fire wood	1. Develop appropriate measures to mitigate greenhouse gas emissions 2. Construct and maintain with less CO2 emission and low energy intensity 3. Reduce GHG due to transportation 4. Update building codes	1. Policies to construct schools with less emission and low embodied energy intensive technologies
PROVINCE				
1. Co-ordination	1. Co-ordination	1. Co-ordination		
SCHOOL/ ISLAND			1. School based demonstration of promoting social forestry and plantation	1. Construction with less embodied energy and CO2 emission and school as medium to promote social forestry + plantation

7.4 ADAPTATION TO CLIMATE CHANGE

Adaptation refers to “adjustment in natural or human systems in response to actual or expected climatic stimuli or their effects, which moderates harm or exploits beneficial opportunities”. This essentially means getting accustomed to, get used to, acclimatizing, adjusting, etc. towards climate change.

Though possible adaptation strategies have been identified as a top down approach, Maldives lacks the capacity to adapt both financially and technically. Therefore, in order to respond to climate change successfully and implement the appropriate adaptation strategies there is an urgent need for financial resources and technological capability, including human resource development in various fields to deal with climate change.

Under human resource development project, 63 local residents have been trained in monitoring and assessing the changes in their island environment (NC, 2001). The lack of available data and data management has been identified as one of the main issues when assessing the vulnerability of the Maldives to climate change. This calls for institutional strengthening in Maldives.

There is a need for establishing a standard procedure for data collection and management in all concerned agencies to provide easy access to required information. This will avoid omissions,

duplication and repetition in data collection. This will require educational and training support for professional and technical support staff. As climate change is a global issue, coordination and cooperation programs at international and regional level are also viewed as an integral part of institutional capacity building.

Programmes on Public awareness and education are in place in Maldives. According to the NC, several actions have been undertaken for the past 15 years. Environmental Studies have been incorporated in the primary and middle school curriculum to create environmental awareness in children. The President’s Environmental Award Programme is an annual award recognising outstanding contributions made by individuals and groups involved in environmental protection. World Environment Day is celebrated on June 5th every year; by organising activities such as tree planting and clean up programmes. The World Clean-up Day Programme, the Clean Maldives and the Independent Maldives campaign are designed to involve people in the cleaning up of litter. A large-scale tree planting programme (the “Two Million Tree” Programme) has been launched in 1996 with the strong involvement of schools. Following is a summary of the adaptation actions that could be promoted and practised through schools. The matrix reflects the thinking patterns of the NC, NAPA, MDG, the National Workshop and the islanders (through PVA).

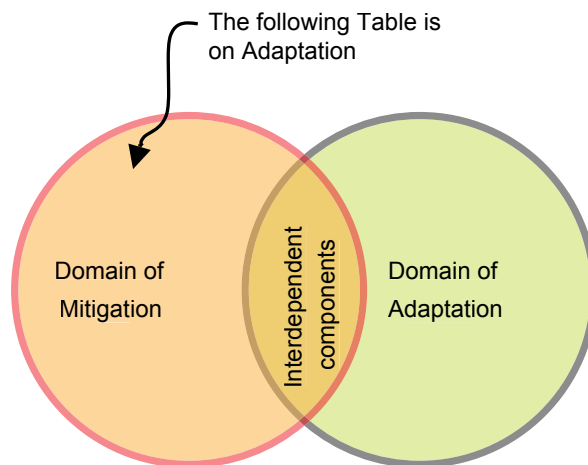


Table 7.4: Primary education related Adaptations at different levels: (red indicates immediate actions according to the National Communication, Maldives)

NATIONAL COMMUNICATION	NATIONAL ADAPTATION PLAN OF ACTION	MILLENNIUM DEVELOPMENT GOALS	THE PRESENT RESEARCH	
			SUGGESTIONS: NATIONAL WS	SUGGESTIONS: PVA
INTERNATIONAL				1. Evacuating islanders to bigger and safer islands
NATIONAL				
1. Involve all stakeholders for coral reef management 2. adaptive measures to CC into national development planning 3. national capacity for emergency relief & disaster management 4. feasible engineering solution for coastal protection 5. incentives to reduce the use of coral in construction	1. CC adaptation into national disaster management 2. ban on coral mining 3. alternatives to coral and sand 4. Improve building designs to increase resilience	1. MoHF prepare for epidemics enhance health facilities 2. Data on natural vegetation, renewable energy , etc 3. Make provision for disabled children in the schools 4. Provide adequate classroom space; basic infrastructure		1. Planting/ breeding Corals 2. Alert through media, SMS 3. PVA to support national capacity building 4. School preparedness & safety plan, mock drill 5. Use timeline and seasonal calendar 6. PVA data for island specific situations 7. Use indigenous wisdom to deal with climate change
PROVINCE				
1. Co-ordination	1. Co-ordination	1. Co-ordination		
SCHOOL/ ISLAND				
1. Protect the available groundwater resources 2. Water resource management strategy based on impact of CC 3. Develop and maintain emergency relief measures throughout the country	1. Protect and preserve natural water catchment areas 2. Introduce new irrigation technology 3. Traditional food preservation and storage , capacity for emergency food storage	1. Ensure the quality and safety of drinking water 2. Stop groundwater contamination due to inappropriate human activities and planning		1. Educate on water conservation 2. Save Environment club 3. Safe school for storage of essentials. 4. School as a disaster shelter 5. Conduct PVA at all the schools of Maldives and prepare action plan

Table 7.5: Interdependent interventions – Adaptation-Mitigation (marked red means immediate action)

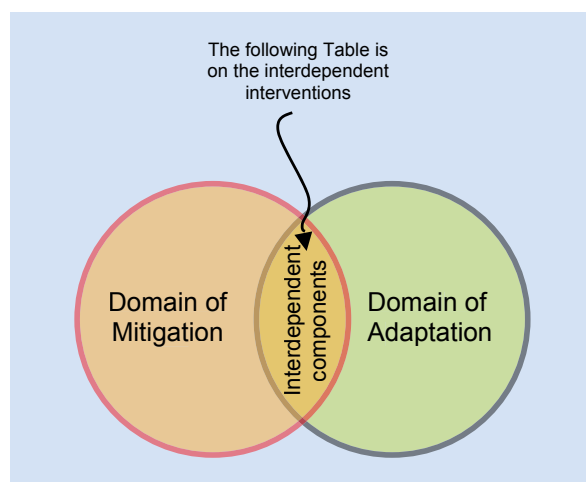
NATIONAL COMMUNICATION	NATIONAL ADAPTATION PLAN OF ACTION	MILLENNIUM DEVELOPMENT GOALS	THE PRESENT RESEARCH	
			SUGGESTIONS: NATIONAL WS	SUGGESTIONS: PVA
INTERNATIONAL			1. Participate in international advocacy	
NATIONAL				
1. Reflect CC concerns in regulatory processes 2. CC implications into present environment impact assessment processes	1. Enhance capacity for waste management-prevent marine environment pollution	1. Reduce inequalities (poverty)	1. Reflect CC concerns in regulatory processes;	1. Environmental impact assessment of school construction

7.5 INTERDEPENDENT INTERVENTIONS (ADAPTATION-MITIGATION)

The interdependent activities are the once which involve both adaptation and mitigation. For example, inclusion of CC in teachers' training, text book revision, etc. are expected to create a favourable environment for reducing CO2 emission, increase in sink and adaptation to CC. The interdependent interventions have been separated out to create the base work for the Maldivian government to set the priorities of interventions through a participatory process.

The following table is a list of interdependent activities that can be promoted and implemented through the primary schools. It is important to note that the interdependent activities are difficult to isolate out from adaptation and mitigation. Therefore, the list put forward in this document needs wider world consultation, especially with the government and the research institutions. There is a need for general consensus at the top level with regard to the interdependent.

Section 7.3, 7.4 and 7.5 have put forward three lists of mitigation, adaptation and interdependent activities as responses to climate change in Maldives at different levels. These have some direct or indirect connections with the primary education system, which has its presence across the country and is the lowest level of the government interface with the people. And hence, it is a very powerful institutional component that can promote adaptation and mitigation actions to combat climate change in a cost effective and sustainable manner. The activities in Table 7.3, 7.4 and 7.5 will enable the



NATIONAL COMMUNICATION	NATIONAL ADAPTATION PLAN OF ACTION	MILLENNIUM DEVELOPMENT GOALS	THE PRESENT RESEARCH	
			SUGGESTIONS: NATIONAL WS	SUGGESTIONS: PVA
INTERNATIONAL				
NATIONAL				
3. Review education curricula 4. Enhance data collection and monitoring capacity 5. Develop guidelines for land reclamation projects 6. Continue ongoing population consolidation programs 7. Advocate safeguarding properties from CC 8. Reduce dependency on tourism	2. Strengthen capacity for planning and design to ensure sustainable infrastructure 3. Land-use planning as a tool for protecting human settlements 4. Consolidate population and development 5. Human Resource development	1. Reduce inequalities (poverty)	2. Guidelines and capacity building for waste management at island level- trainings & ICT materials 3. Training of engineers and masons for disaster safe school, safe water and sanitation, etc. 4. Multi hazard safe infrastructure 5. Teachers' training and text book revision – to include climate change	2. Toilet and drinking water waste management – model for the community 3. Revise curriculum 4. Refer to PVA reports 5. Repeat PVA every year 6. Refer to PVA reports 7. Examine the justification of a school in an island 8. Disaster safe school infrastructure 9. Income generating construction systems
PROVINCE				
1. Co-ordination	1. Co-ordination	1. Co-ordination		
SCHOOL/ ISLAND				
1. Public awareness campaigns on CC 2. Environment friendly technologies for household, etc.			1. CC campaigns in school and training teachers 2. Co-curricular activities towards climate response 3. Include CC in evaluation 4. Establish nature club, etc	1. Conduct PVA in all islands every year 2. School adopting environment friendly technologies 3. Train teachers and CC in curricula 4. PVA Encourage to reuse and recycle

planners to consider all the required actions in the context of climate change. The last two columns of Table 7.3, Table 7.4 and Table 7.5 show the interventions identified under the present research, i.e., the national workshop and the PVA exercises in the case study areas. These are based on the process and products of the PVA, which have been presented in the Annexure II.

7.6 PVA OUTPUTS: GRASS ROOT LEVEL SITUATION

The activities at International, National, Province and school/island levels can be understood better if one gets an in depth view of why they are necessary. As described before, climate change is primarily due to global warming. The possible increased vulnerabilities identified by the NC are a) Land loss and beach erosion, b) Infrastructure damage, c) Damage to coral reefs, d) impacts on the economy, e) Food security, f) Water resources, g) Human health, etc. These will be negatively affected by the increased frequencies and magnitudes of different types of hazards. Therefore, it is of utmost importance to understand the causes of the hazards, nature of their impacts and the actions taken to manage them.

Figure 7.1 shows the different types of hazards in the islands where PVA was conducted. It shows that Abbubakru has the highest number of hazards and Thundi has the least. If PVA is conducted in all the islands, the above Figure will provide valuable information for sustainable education system planning from climate change point of view. This will also suggest the type of preparedness that should be developed through revised text books, pedagogy and teachers' training.

Figure 7.2 shows the frequency of occurrence of different types of hazards in the case study areas. The above Figure shows that flood and tidal wave/surge are the most common and fire, exile from islands, etc. are the least common. However, this will change drastically when PVA is conducted in all the habitable islands of Maldives. The above Figure will not only show the commonness of a few types of hazards, it will also provide a data bank of the types of hazards in the country. This could be a valuable tool for sustainable and climate resilient primary education system in Maldives.

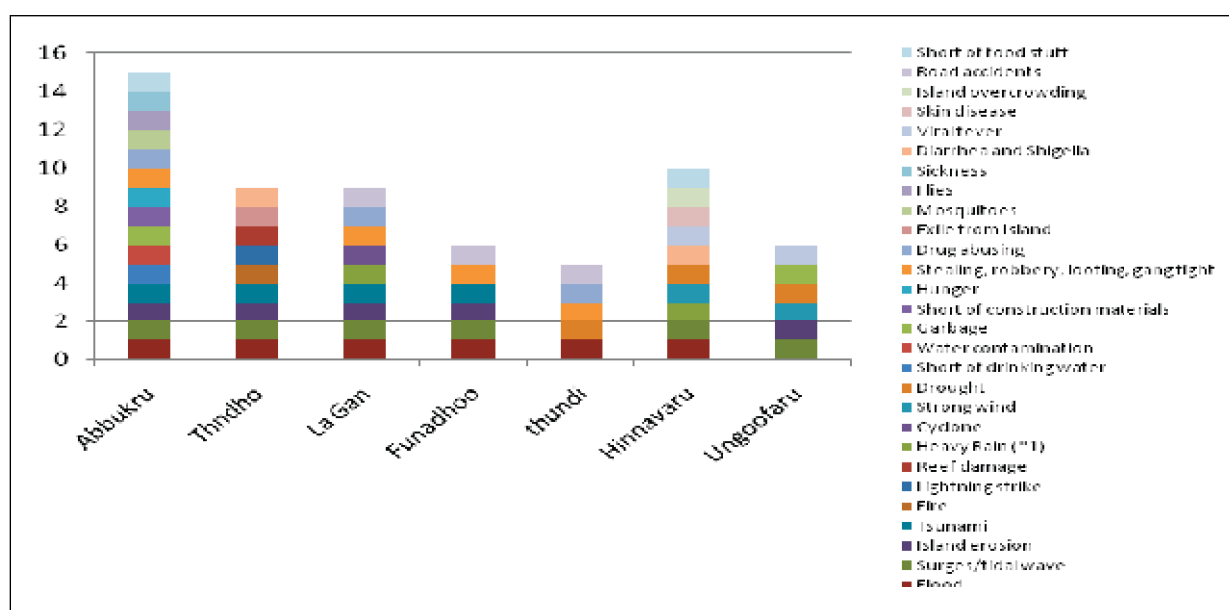


Figure 7.1 Types and occurrences of Hazards in the Islands Surveyed: Y axis represents the number of hazards- X axis represents the school names

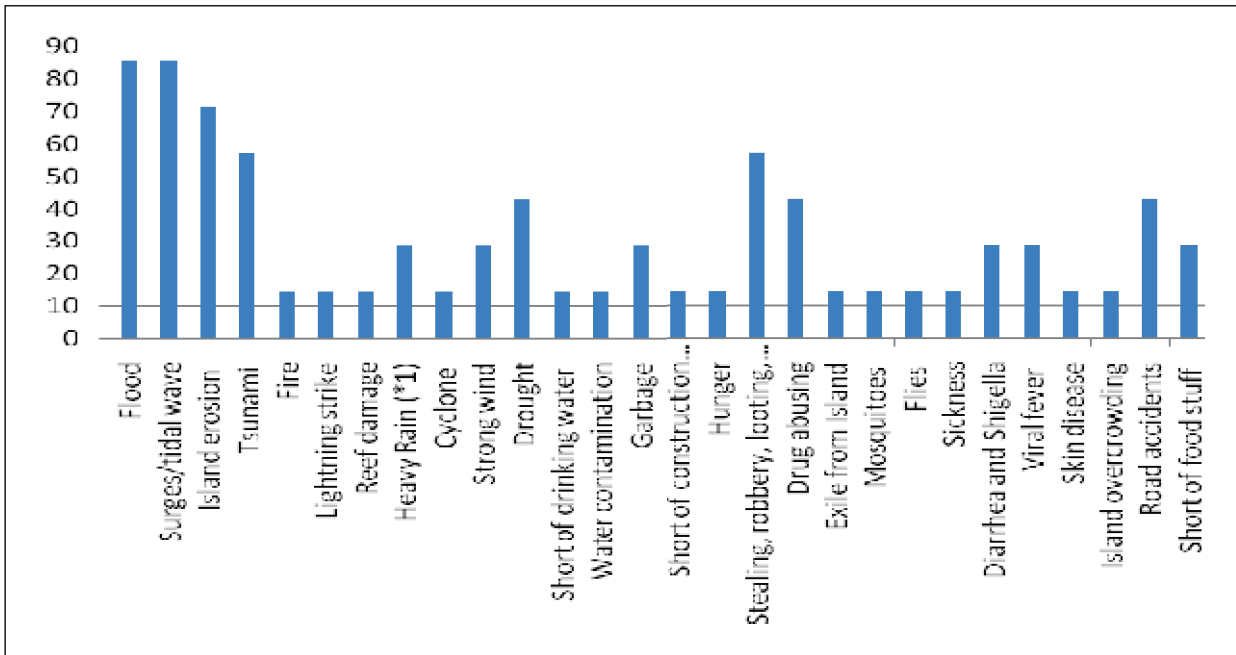


Figure 7.2 Frequency of Hazards in the Islands Surveyed: Y axis represents the percentage occurrences of hazards- X axis represents the hazard types

The PVA exercises in a limited number of islands revealed that the communities have in-depth knowledge of the types of hazards and are store houses of ideas on how to deal with them in a cost effective and socially acceptable way. Having said that, it must also be noted that community wisdom to cope with the hazards are based on their traditional knowledge and there are examples where the wisdom failed. For example, the traditional wisdom of locating the villages at a safe distance from the river erosion had worked well till about ten years back in Bangladesh (District Kurigram). Recently such efforts have failed in many places in Bangladesh. Several schools were located based on community wisdom that were envisaged to be safe for fifty years. Within five years, some schools have gone into the rivers, which could be due to climate change. Therefore, there is a need for lab to land knowledge transfer along with bottom up knowledge.

Based on the PVA exercises in a limited number

of Atolls, the following is an analysis of the types of hazards, their causes, impacts and actions to address the problems. A wider study will make it more robust and reliable to combat the negative impacts of climate change. In fact, a data bank of problems and pragmatic solutions could be generated by conducting PVA exercise across the country in all the schools. The community wisdom is the most useful source to cope with climate change since they face the hazards regularly and device survival techniques on their own. Figure 7.3 shows that the communities have provided adequate practical ideas on what are the most effective ways of managing the problems of climate change in Maldives.

Figure 7.3: Community wisdom: showing the causes of hazards, impacts, the adaptation/mitigating actions and people who should do it

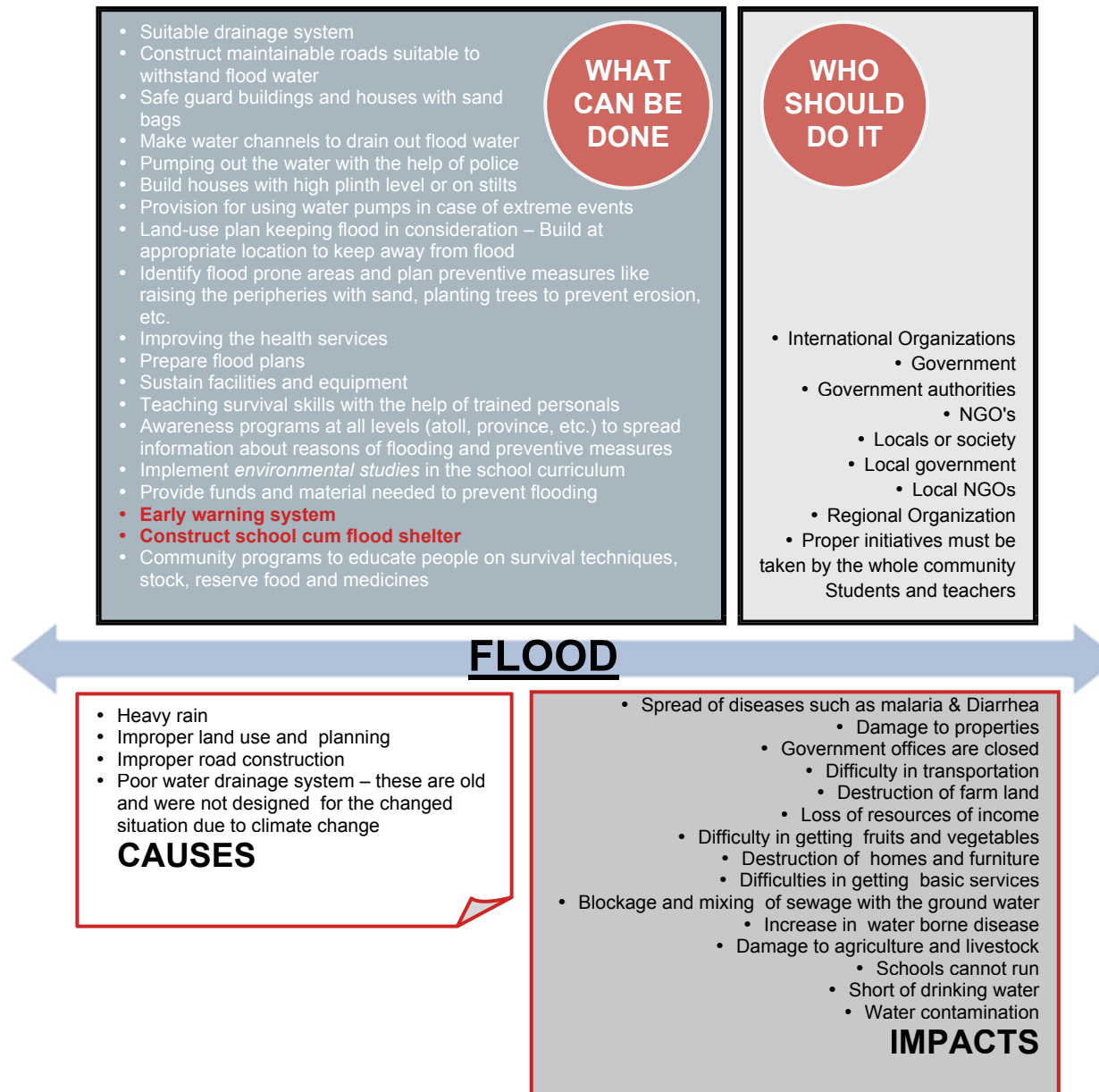


Figure 7.3 contd...

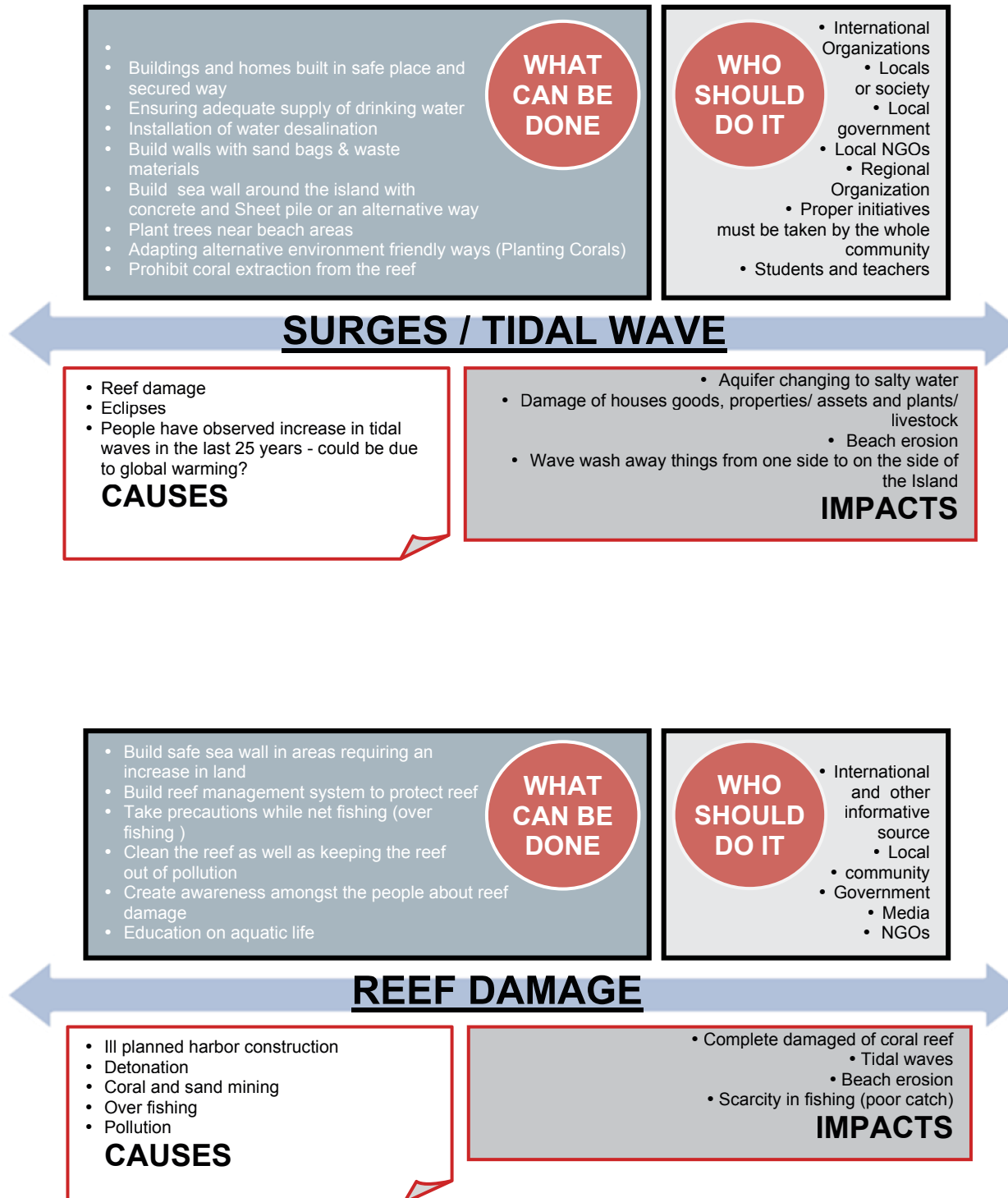


Figure 7.3 contd...

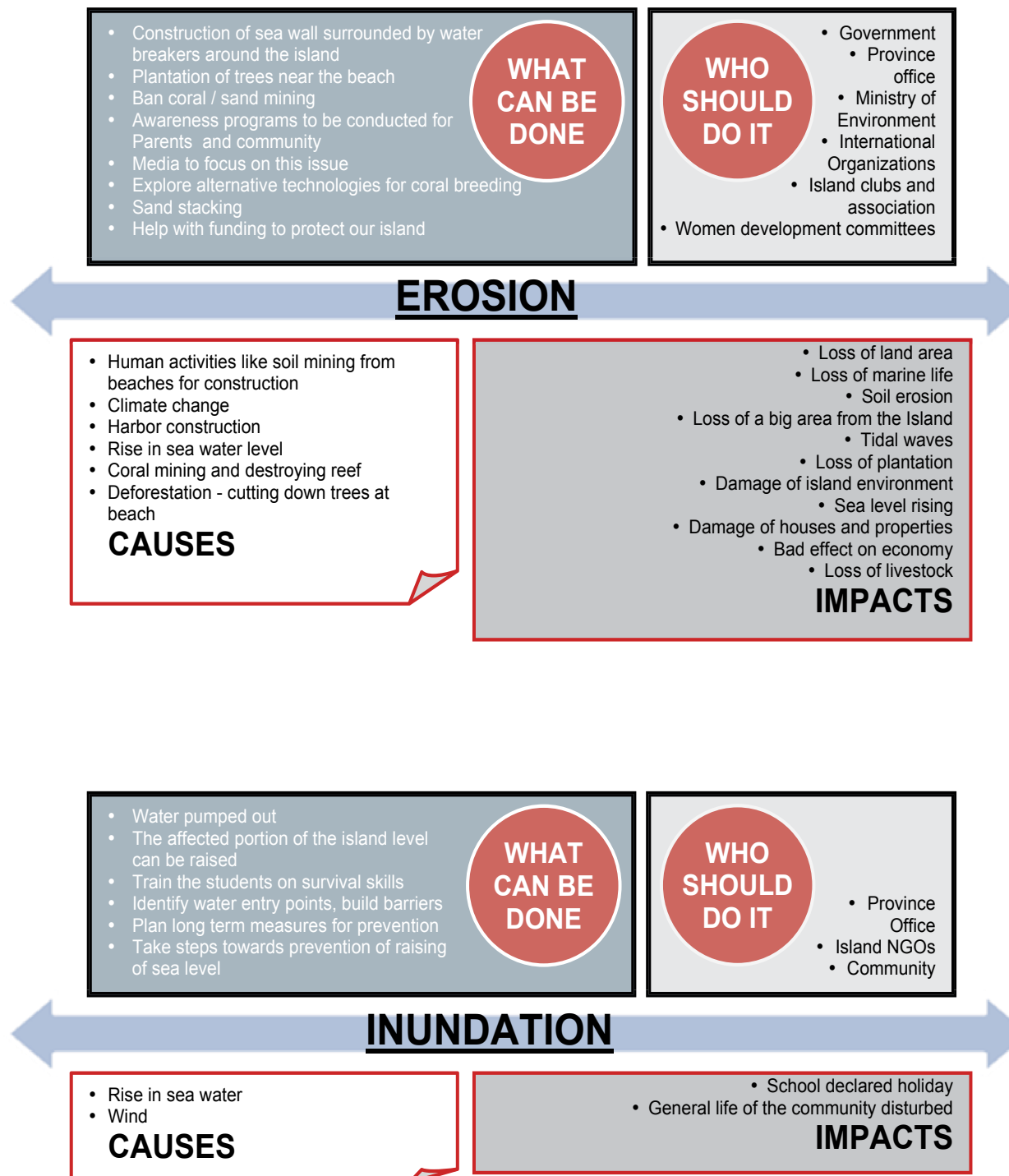


Figure 7.3 contd...

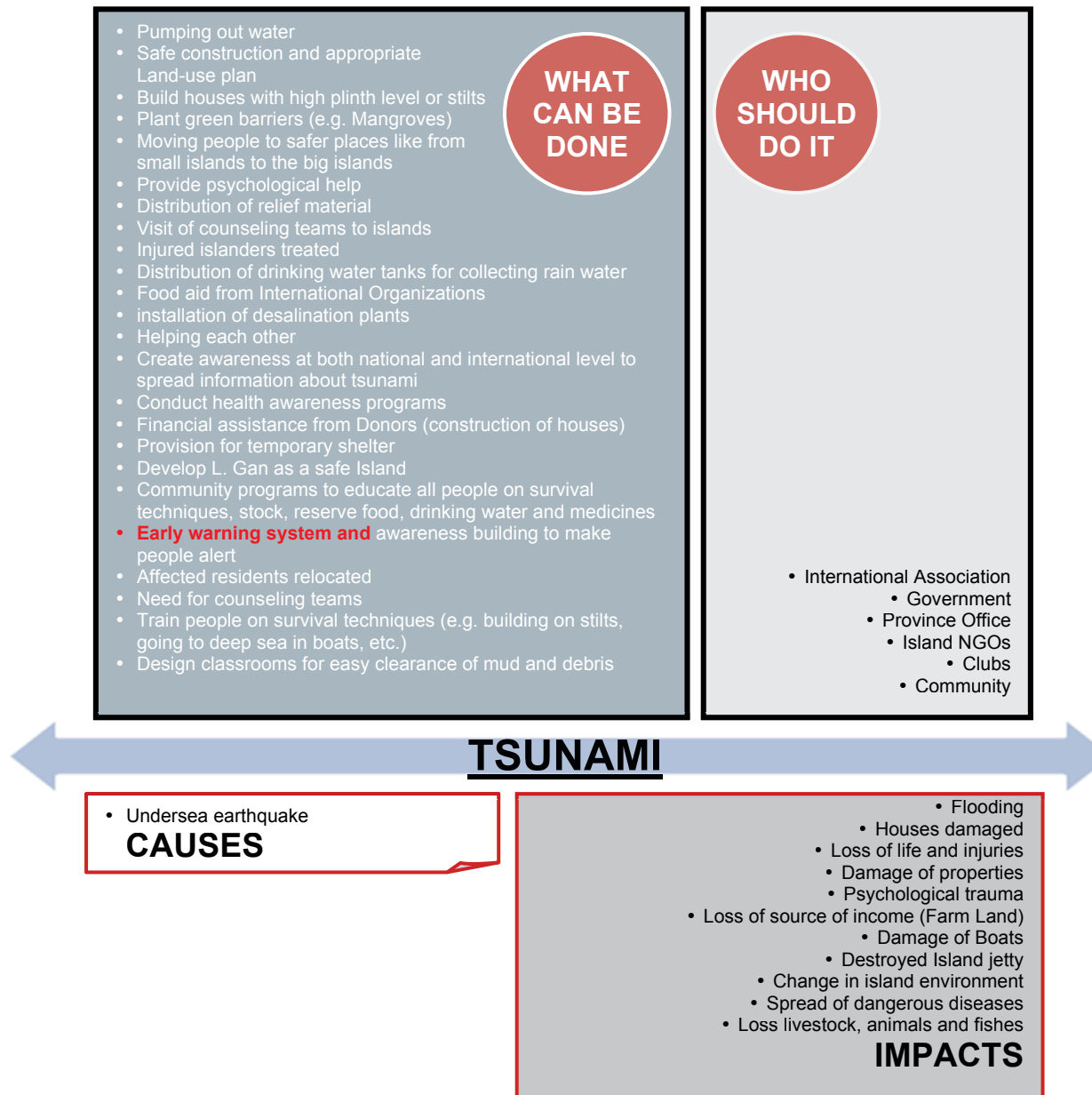


Figure 7.3 contd...

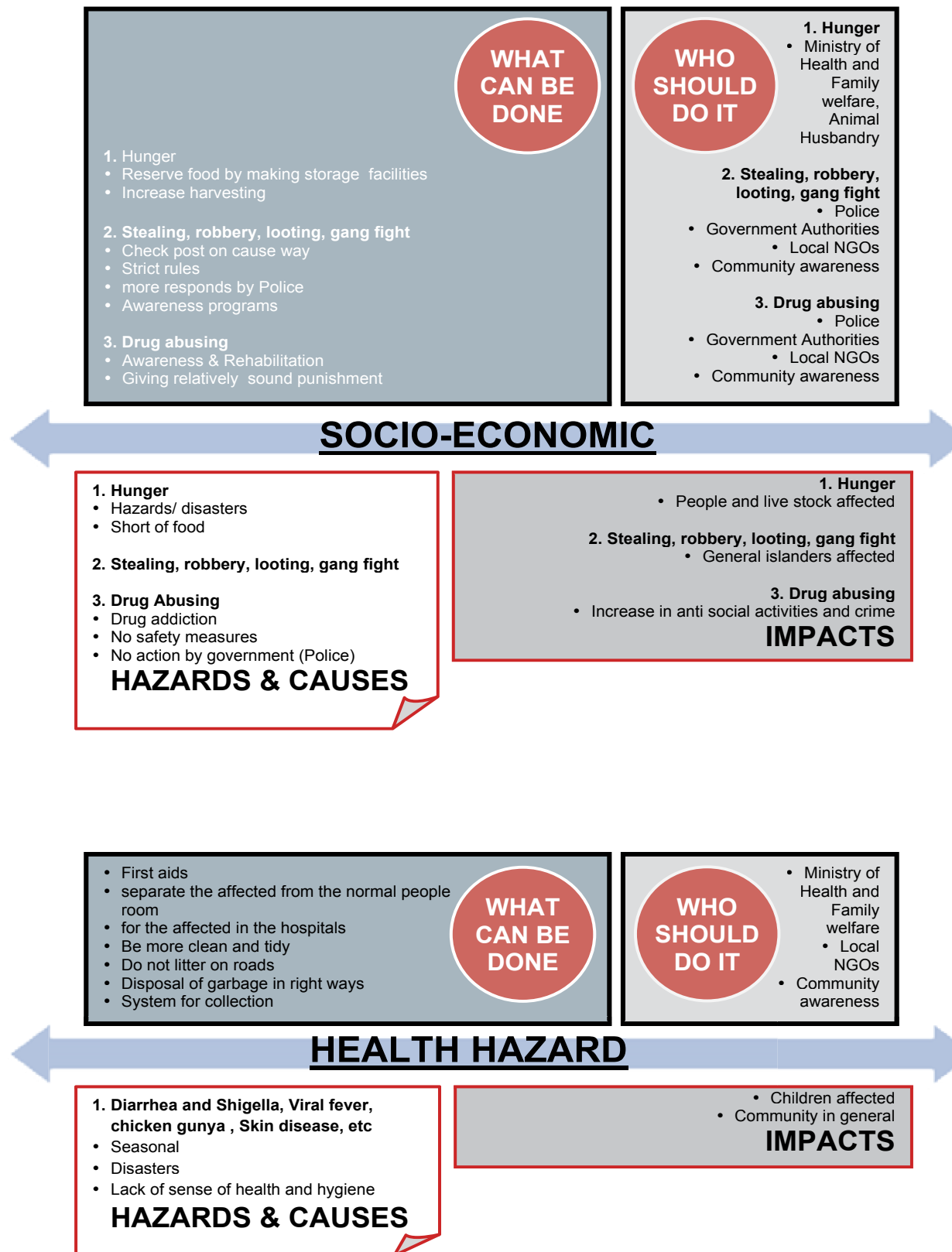


Figure 7.3 is a detail list of the adaptations under each type of hazard. The causes of the hazards, the impacts and the proposed adaptation actions will provide the full range of information on the cause and actions leading to the preparedness for climate change. The impacts (Figure 7.3) will act as the future reference to examine whether the interventions are leading towards the target and at what speed. The evaluation of the interventions will take place at a periodic interval which could be every year for Maldives with less resilience compared to the other countries. The evaluation table has been put forward in Annexure V. These are according to the communities' perception which could be improved upon at lab level.

In summary, it may be said that while the Tables 7.3, 7.4 and 7.5 show the overall plan of action/ programmes/ activities to respond to climate change in Maldives. Figure 7.3 will help in designing the hazard specific adaptations at grass root level. There are overlaps and common items between the mitigation, adaptation and interdependent actions since the Figure 7.3 is a subset of Tables 7.3, 7.4 and 7.5.

In this Chapter, the probable appropriate interventions to deal with climate change have been discussed. The next chapter will examine the issue of costing of preparedness for climate change. It has been envisaged that the government of Maldives will come up with the final cost figures based on the Tables 7.3 to 7.5 and Figure 7.3. The latter is a bit more specific than the former and hence, provides a sound basis for costing the response. It is highly recommended that a nationwide PVA be undertaken to make the Tables more robust and thus will update the present table to make it reliable enough for cost estimation.

It may be noted that the process of PVA is the first step towards preparing for climate change through the primary education system. Therefore, Maldives needs to have an idea on the cost of the whole process of PVA. It is onetime major investment followed by less expensive yearly exercises with the help of the developed human resources. The following chapter focuses on the costing of PVA exercise.

Chapter 8

COSTING

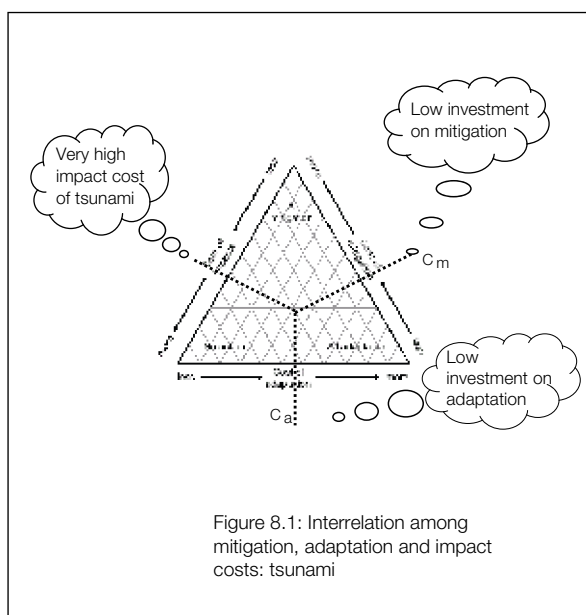
8.1 RESPONSE COST

Figure 8.1 shows that the impact cost will be high if the investment on mitigation and adaptation are kept low. The response to the tsunami may be cited as an example of this kind. Tsunami made it apparent that if the adaptation and mitigation are ignored one has to pay heavy price for it in terms of loss of life, properties, etc.

8.2 PREPAREDNESS COST

In the last Chapter, a list of Mitigation and Adaptation actions has been put forward in the context of climate change in Maldives. It has also provided a list of actions to be undertaken to minimise the impacts of the hazards that are likely to increase in magnitude and frequency due to climate change. While the starting point of this research was NC, NAPA and MDG, the suggested interventions have primarily been based on the PVA exercises carried out in a limited number of islands.

At this stage, the government of Maldives needs to examine the outputs of the present research followed by a detail PVA exercise across the country. Following that, the Island-specific adaptation and mitigation actions can be promoted/ implemented through the education system, in which the DoE will take the lead role along with NDMC. While Figure 7.3, Figure 7.4 and 7.5 show the immediate actions according to the priority set by NC, there is a need for getting community opinion in this regard during the future PVA exercises. NC may consider the ranking of the identified Mitigation and Adaptations by the communities and make a final list of prioritised actions that will be categorised into Short, medium and long term interventions. These should be island specific because of the variation in



micro level situation in different parts of the country. One of the crucial issues in the context of climate change is the probable cost of the interventions. This research provides adequate information on the answers to the following questions. However, this should be examined by the government of Maldives and PVA results to be acquired to make the answers in a sustainable manner.

- What are the targets and by when to achieve them?
- Who and with whom and how should they be done?
- What are the indicators to know whether proceeding in the right direction and at right speed?
- How much to spend?

Among the above questions this chapter will focus on the last point, i.e., the issue of cost. Although

it has been stated in the above paragraph that a consultative process and a nationwide PVA to be carried out in Maldives, this research has brought forward adequate information to discuss the domain of costing. Among the cost of interventions, the last chapter provides adequate points to have a rough estimate of the adaptation and mitigation actions, which the government should be able to carry out. This chapter will focus on the cost of PVA exercise in Maldives that has been based on ActionAids' programmes in Nepal and Bangladesh. The following is a brief note on that.

PVA starts from bottom level first so that the top level people could be convinced about the problems

at grass root and people's perception and wisdom on what could be done to cope with climate change in a sustainable manner. The programme starts with developing a cadre of master trainers who will be the future resources for carrying out PVA for the teachers, students and the community. ActionAid has been carrying out PVA in several countries and they have a reasonably accurate costing for such exercises. In line with ActionAid's main format the following pages show the probable cost of PVA exercise in Maldives. Following the Bangladesh model of carrying out PVA, the costing of this exercise has been done for 200 schools. However, the exact number of schools to be surveyed will vary and will depend upon the Atoll level inputs.

Table: 8.1: MALDIVES: Budget: Participatory Actions towards Resilient Schools & Education Systems to combat Climate Change

SI	Head of Expenditure	Unit	Unit Rate	Duration	Funding agency to procure	Year 1 MRF 2009	Year 2 MRF 2010	Total MRF	Total 18 Months in USD
A	Programme Cost (Cost Direct inputs)								
1	Personnel Cost (Salaries & Support Cost of Implementing personnel)								
a	Programme Manager (Cluster Consortium-Lead Agency)	1	82,875	21.5	N/A	6,21,563	12,74,618	18,96,180	1,48,720
b	Programme Officer - Cluster Consortium-Lead Agency (Project Support)	2	21,875	21.5	N/A	3,28,125	6,72,875	10,01,000	78,510
c	Programme Officer - Cluster Consortium-Lead Agency (Documentation & Monitoring)	1	21,875	21.5	N/A	1,64,063	3,36,438	5,00,500	39,255
d	Finance Officer - Cluster Consortium-Lead Agency	1	21,875	21.5	N/A	1,64,063	3,36,438	5,00,500	39,255
e	Project Coordinator (Concern Worldwide-NP1)	1	38,250	21.5	N/A	2,86,875	5,88,285	8,75,160	68,640
f	Project Officer (NP1)	2	22,950	21.5	N/A	3,44,250	7,05,942	10,50,192	82,368

Table: 8.1: contd....

SI	Head of Expenditure	Unit	Unit Rate	Duration	Funding agency to procure	Year 1 MRF 2009	Year 2 MRF 2010	Total MRF	Total 18 Months in USD
g	Finance Officer (NP1)	1	25,785	21.5	N/A	1,93,388	3,96,573	5,89,961	46,271
h	Coordinator (National Partner-NP2)	1	30,600	20	N/A	2,14,200	4,28,400	6,42,600	50,400
i	Project Officer (National Partner-NP2)	2	20,400	20	N/A	2,85,600	5,71,200	,56,800	67,200
j	Finance Officer (National Partner-NP2)	1	26,775	20	N/A	1,87,425	3,74,850	5,62,275	44,100
k	Upazilla Officer (20 personnel of 10 Local Implementing Organisations- LIO)	20	15,300	20	N/A	21,42,000	42,84,000	64,26,000	5,04,000
l	Finance Officer (10 personnel of 10 Local Implementing Organisations- LIO stationed at the intervention areas)	10	12,750	20	N/A	8,92,500	17,85,000	26,77,500	2,10,000
m	Support Cost of Implementing personnel	-	N/A	-	N/A	-	-	-	-
m1	Recruitment of human resources of ActionAid	-	N/A	-	N/A	-	-	-	-
m2	Recruitment of human resources of implementing organisations	-	N/A	-	N/A	-	-	-	-
m3	MoU signing between implementing Organisations and lead (Lead Agency)	-	N/A	-	N/A	-	-	-	-
Sub -Total						58,24,050	1,17,54,618	1,75,78,668	13,78,719

The above cost of 9.7 million USD for the PVA exercise is not a onetime investment. It may be noted that PVA is a continuous process and hence, there is a need for cost effective way of continuing the process by involving the local resources developed under the present programme.

The detail estimate is presented in Annexure III. The financial need of PVA in Maldives is very high primarily due to the cost of physical access and

general high cost of living than that of Bangladesh and Nepal. However, it should be noted that the past experience of huge cost of damage in 2004 tsunami was due to lack of preparedness. Therefore, it will be cost effective to invest on preparedness by conducting PVA and organising the other interventions suggested in Figure 7.3 and Table 7.3 to 7.5. This is needed to save the children of Maldives.

Table: 8.1: contd....

SI	Head of Expenditure	Unit	Unit Rate	Duration	Funding agency to procure	Year 1 MRF 2009	Year 2 MRF 2010	Total MRF	Total 18 Months in USD
2	Project Related Travel & DSA	-	-	-	-	1,71,70,000	3,51,40,000	5,23,10,000	41,02,745
3	Training, Compilation, Validation, sharing & Coordination Cost	-	-	-	-	1,83,01,000	71,73,749	2,54,74,749	19,98,020
4	Material Production & distribution/ Research & Dissemination	-	-	-	-	35,96,990	1,14,10,760	1,50,07,750	11,68,843
5	Cost Of Review, M&E and Impact Assessment	-	-	-	-	10,00,000	24,21,000	34,21,000	2,68,314
6	Office equipment directly supporting the project	-	-	-	1865000	18,65,000	-	18,65,000	1,46,275
7	Communication directly supporting project				-	12,000	24,000	36,000	2,824
	Total A				8,65,000	4,77,69,040	6,79,24,127	11,56,93,167	90,65,739
B	Project Support Cost (Cost Indirectly) --								
1	Admin & Logistics support	-	-	-	-	19,14,226	31,38,103	50,52,329	73,757
2	Financial Management Cost	-	-	-	-	4,55,000	4,55,000	9,10,000	71,373
3	Rental Office Space	-	-	-	-	12,60,000	25,20,000	37,80,000	2,96,471
4	Telecommunication	-	-	-	-	2,40,000	4,80,000	7,20,000	56,471
5	Office Supplies	-	-	-	-	3,45,000	6,90,000	10,35,000	71,985
6	Utilities	-	-	-	-	2,55,000	5,10,000	7,65,000	60,000
	Total B					44,69,226	77,93,103	1,22,62,329	6,30,055
	GRAND TOTAL				18,65,000	5,22,38,266	7,57,17,230	2,79,55,496	96,95,793
							Amount (MRF)	%	
						Total A	90,65,739	90	
						Total B	6,30,055	10	
						Total	96,95,793	100	
						Exchange Rate 1 USD = 12.75MRF			

RECOMMENDATIONS

9.1 THE SUGGESTED MODEL

Figure 9.1 shows the pathways of impact of climate change on the children. It shows the context specific (Maldives) findings. As mentioned before, NAPA, NC and MDG formed the premise of the present research which is a top down approach. This report showed that the grass root level findings go hand in hand with the national level approach to combat climate change. In addition, the PVA exercises have been able to gather together a series of adaptation and mitigation actions that are practical and suitable to the contexts.

PVA has provided a deep insight into the realm of response through the primary education system. Very specific recommendations on adaptation and

mitigation have been put forward by the school teachers, students and the communities. The island specific hazards were identified during the PVA exercises. The causes of such hazards, the impacts and the possible interventions were also identified by the communities.

One of the important outputs of this research is a detail discussion on cost of the interventions to minimise the negative impacts of climate change on primary education. The last Chapter has shown the cost of PVA exercise for the whole of Maldives. The following Figure 9.2 shows the overall process of identifying the different components of adaptation and mitigation as a response of primary education system to climate change in Maldives. It is impossible for Maldives to invest on all adaptation and all mitigation interventions. Hence,

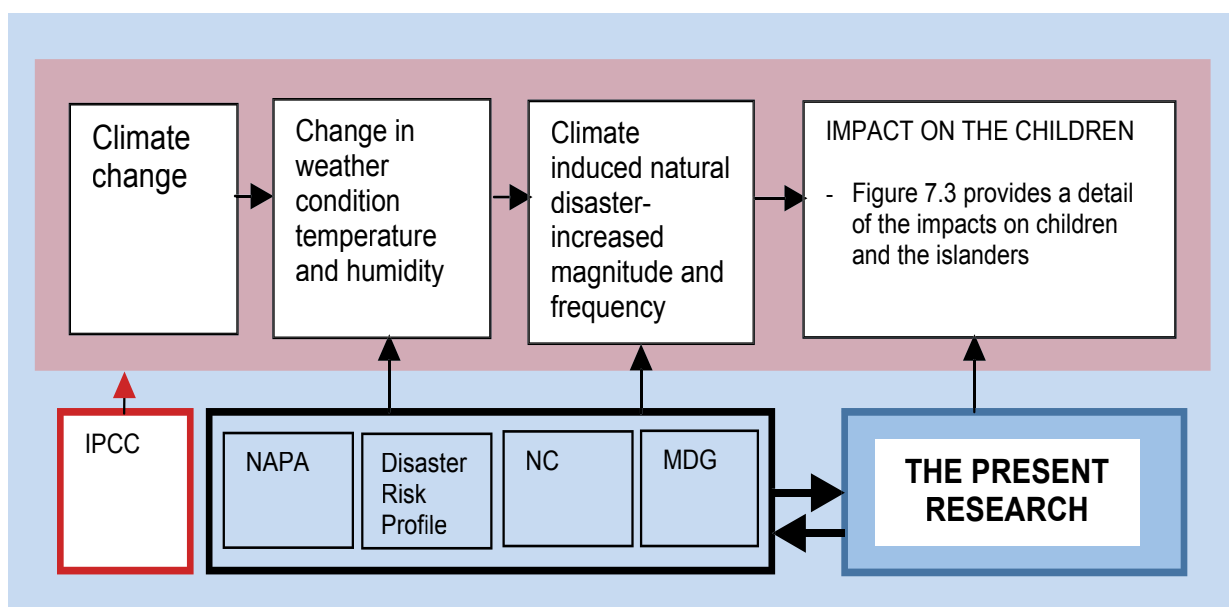


Figure 9.1: Pathways of impact of climate change on children in Maldives

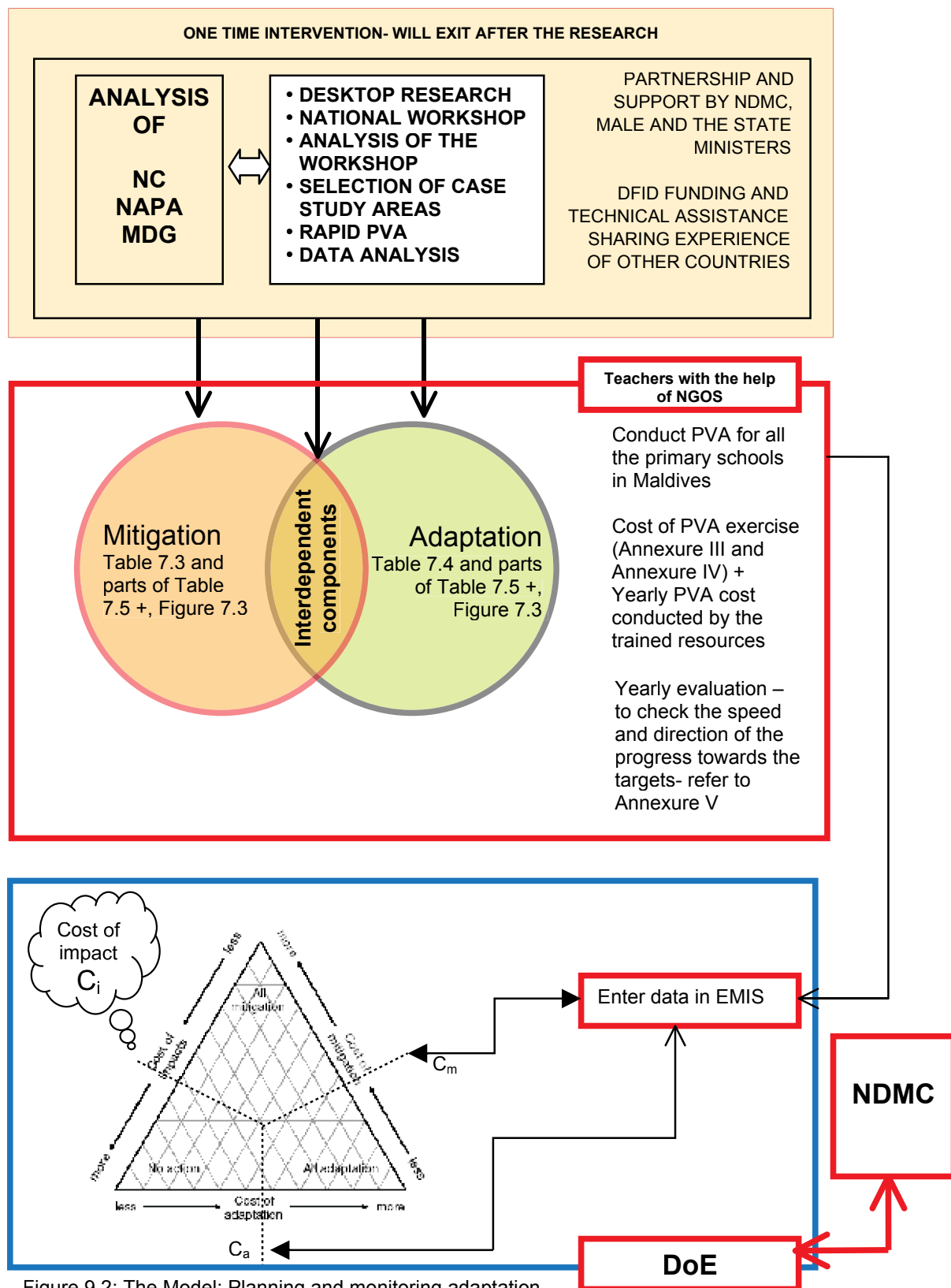


Figure 9.2: The Model: Planning and monitoring adaptation and mitigation actions

the costs of high priority adaptation (Ca) and mitigation (Cm) interventions (Figure 9.2) should be considered for investment. This will enable the country to identify the unattended interventions to combat climate change. Based on that the cost of impacts could be forecast and proactive measures could be designed.

The above Figure is the suggested model to combat climate change in Maldives through its primary education system. The activities in the top most block are one time investment and the activities below that will continue as a constant endeavour of the government of Maldives towards climate change.

9.2 RECOMMENDATIONS

The following is a list of recommendations. The contents of the recommendations and their ranking should be debated to come to a consensus by the stakeholders in the domain of primary education and climate change. The list is not exhaustive and the stakeholders may add or amend, if needed. This exercise will be led by the Ministry of Primary Education, government of Maldives. The list of recommendations will be robust and may change if more data on vulnerabilities are acquired.

Regarding the response of Primary Education to climate change, the focus needs to be on the grass root level preparedness based on communities' requirements and the most local level situation analysis. This report has demonstrated that PVA could be one of the feasible and cost effective tools that can identify suitable adaptation and mitigation actions in a context. PVA, which is people centric, will enable the education planners to share traditional wisdom on how people deal with disasters.

The field experience reveals that, in school-based institutional system, the teachers will play a very important role in combating climate change. Their training and motivation will be critical for the success of developing a cadre of human resources

who will make Maldives climate resilient. This is expected to transform the young students by inculcating a life style change in them. The teachers will also be a constant support to the community's awareness and capacity building in climate change. This is an ongoing process since circumstances may change from time to time. Consequently, there will be need for periodic evaluation of the speed of approaching the targets by context specific adaptation and mitigation actions to combat climate change. The following is a list of recommendations for consideration of the DoE, government of Maldives.

- Review NC, NAPA and MDG in the light of present research and set targets and priorities in primary education sector towards adaptation and mitigation – climate change.
- Make Climate Change Impact Assessment (CCIA) mandatory for all education programmes
- Need for strong political will and commitment.
- Promote political stability to combat climate change
- Regional co operation and knowledge sharing needed
- Involve the community members including the religious leaders in PVA
- Provision for non monetary Incentives to the students and teachers to promote and demonstrate adaptation- best school award could be introduced.
- Need for paradigm shift in Teachers' training, curriculum development, Pedagogy, behaviour change, learning and skills and examination system. It is cost effective to include climate change in the primary education through its curricula and extracurricular activities to inculcate a lifestyle change to cope with the changed situation
- Conduct PVA at all schools and make the model in Figure 9.2 operational. PVA is not about data acquiring alone, it instills a strong feeling of



solidarity which is needed before, during and after disasters. The findings of PVA could be a good premise for people-centric national strategies on climate change in primary education

- Make a strong case at international level showing that top down policies in the context of climate change are in line with the grass root level reality and hence, sustainable
- The EMIS department of the DoE to co-ordinate the vulnerability mapping. Ensure adequate equipment, human resources and capacity for calculating the number of schools and children in the high risk zones- link EMIS with GIS
- The macro level maps (are available) should be supplemented with micro level information

which can be acquired through school-based vulnerability assessment of the communities and then made it part of the EMIS data.

- Immediate need to update Building Codes and prepare a multi-hazard map
- Encourage community based repair and retrofitting with offline support of the engineers
- Need capacity building of construction workers, engineers and architects towards disaster safe construction- upgrade syllabi of engineering and architecture curricula – include climate change and disaster safety of infrastructure