A Comprehensive Study on Coping Mechanism with Climate Change of Coastal Areas in Bangladesh

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Abstract: **Bangladesh is considered one of the country's most at risk to the effects of climate change and its coastal area is most vulnerable. Bangladeshi coastal communities are continuously adopting self-instinct survival strategies in order to cope with changing climatic conditions. Almost every year Bangladesh suffers highly by different kinds of disasters like flood, tropical cyclones, tornados, tidal surges, droughts and large scale river erosion etc. Bangladesh is a low lying delta with very gentle slopes. It is located at the lowest end of the Ganges, Brahmaputra and Meghna Basin. Bangladesh has special geographical feature. This paper discusses the impact of climate change on livelihoods and documents current and future adaptation strategies of the Bangladeshi coastal communities from documentary sources. Later, it undertook validation processes of these finding by field visits, observations and Focus Group Discussions. The findings suggest that climate change effects on local community may include, but not limited to, livelihood, migration and health in Bangladesh.**

Key words: **Climate change, coastal areas, community resilience, environment**

I. INTRODUCTION

Climate change is a problem that is affecting people and the environment. Historically, Bangladesh is most vulnerable countries of the world in the unhelpful impact of climate change. The coastal people are one of the worst affected areas to standardize such variations. Climate change refers to any important change in measures of climate (such as temperature, precipitation, or wind, sea level rise, acute events) lasting for an extended period (decades or longer) pose risks for ecosystems, food security, water resources, human health, resolution and civilization. For this research, resilience means 'the degree to which individuals able organize themselves on the basis of learning from past disasters and continuous climate change adaptation to provide better future human security and improved threat reduction strategies'. It is known that frequent natural hazards coupled with climate change will present complex development challenges for remote rural communities (CRED, 2011; Twigg and Bhatt, 1998; Ayers, et al., 2014).

There are a wide variety of meteorological phenomena, which pose a threat to the coastal zones. They could be roughly listed the following: Floods/ flash floods, cloud burst, heavy precipitation; Tropical cyclones and their associated storm surges; Severe convective storms - thunderstorms, hailstorms, tornadoes, lightening, dust storms, sand storms; Heat wave and cold wave; Snow avalanches; Sea erosion etc. The spatial and temporal scales of these hazards vary widely from short-lived, violent phenomena of limited extent (e.g. severe thunderstorms), through large systems (e.g. tropical cyclones). These events can subject large regions to disastrous weather phenomena like strong winds, heavy flood-producing rains, storm surges and coastal flooding, heavy snowfall, blizzard conditions, freezing rain and extreme hot or cold temperature conditions for periods of several days. With this wide variety of the scales of weather phenomena, the requirements of meteorological and hydrological forecasting for effective early warning of these hazards also vary spanning over a very broad spectrum. These can range from very short range forecasts of less than one hour in the case of severe thunderstorms and flash floods; through short and medium range forecasts of from a few hours to days for tropical cyclones, heavy rains, extreme temperatures and high winds.

Due to climate change, most of the coastal areas of the world are at danger from natural disasters and meteorological turmoil. The coastal areas of Bangladesh are not in unusual situation from it. These areas are ecologically susceptible and climatically susceptible because a procedure of erosion and accretion is continued. The coastal areas of Bangladesh are opposite the Bay of Bengal with an area of 472,201 sq. km where 19 districts are included (and that is the reason which has made the country one of the most disaster prone country (CPD; 2000). As the Bay of Bengal is a great reproduction ground for tropical cyclones, the coastal areas have been facing one or two severe disaster each year. For example, cyclones, SIDR and AILA can be mentioned. Disaster in Bangladesh is considered to be a great constraint for sustainable development. Cyclone, tidal surge, flood, river bank erosion are some of the worst types of disaster which is badly affecting the livelihood of our citizens especially in the coastal zone (Alam 2005). Women are supposed to be the most vulnerable for many causes namely their vulnerability, mental attitude, physical structure and other social issues. There exists a lot of problems and lacking in disaster management. Though the vulnerable women of the coastal areas are not getting proper support from the government and non-government authorities, their indigenous coping capacities are appreciable. Due to disasters, sometimes women have to migrate from their residence to different metropolitan cities. It increases different urban problems like unemployment, criminal activities, traffic jam, slum problem etc.

At present Bangladesh has experienced that due to climate change the regularity and intensity of these disasters have increased. These disasters, as happened in the long-ago, continue to impact seriously on the society in terms of human wounded, economic and social losses, disruption of livelihoods, and degradation to surroundings also affecting health and cleanliness and availability drinking water.

II. OBJECTIVES

The overall objective of the research is to suggest vulnerable population of the coastal districts by identifying successful strategies for coping with different climate induced disasters through lesson learnt documentation and analyzing national and International actions for achieving sustainable development. However the specific objectives of the study are as follows:

1. To identify adaptation and mitigation strategies used by the coastal population of Bangladesh.
2. To understand climatic hazards faced by the coastal population of Bangladesh.
3. To analyze vulnerability of the areas.

III. METHODOLOGY

The following mythology was used for the study.

Study Design: The study was survey type.

Study Area: The study has been conducted at Barishal, Khulna, Noakhali, Chattogram.

Sampling Method: Random sampling method has been used for the study.

Tools for Data Collection: Questionnaire has been used for data collection.

Sources of Data: Data have been collected from the field by face to face interview with the respondents.

Sample Size: 100 respondents have been interviewed for the study. The respondents were elected representatives of the local areas. 7 Chairmen, 23 Councilor, 66 Members, 2 Mayors, and 2 Secretary were interviewed for the study.

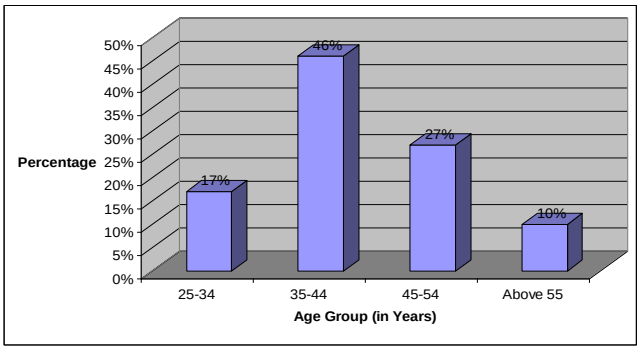
*Data Analysis***:** The collected data were tabulated and analyzed by using Computer Program Microsoft Excel.

IV. RESULTS AND DISCUSSION

Table 1: Age Group of the Respondents

Age Group	Percentage
25-35	17%
35-44	46%
45-54	27%
Above 55	10%
Total	100%

Figure 1: Age Group of the Respondents

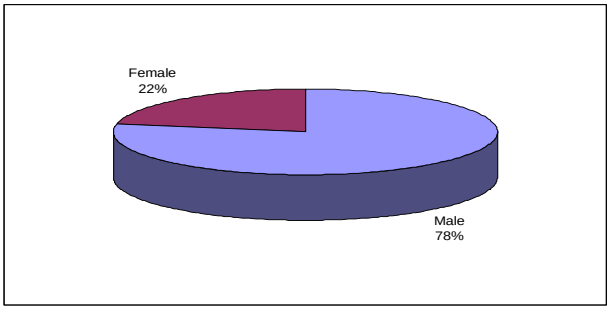


Age groups of the respondents are described in the above graph. From the graph it was found that age group 35-44 is 46% which is the maximum and age group above 55 is 10% which is the minimum. Age group 25-34, 45-54 years is 17% and 27% respectively. The selection of the participants was done randomly. It indicates that most of the elected representatives are from 35-44 age groups. On the other hand, there are very little number of participants is elected from this above 55 age group.

Table 2: Gender of the Respondents

Gender	Percentage
Male	78%
Female	22%
Total	100%

Figure 2: Gender of the Respondents

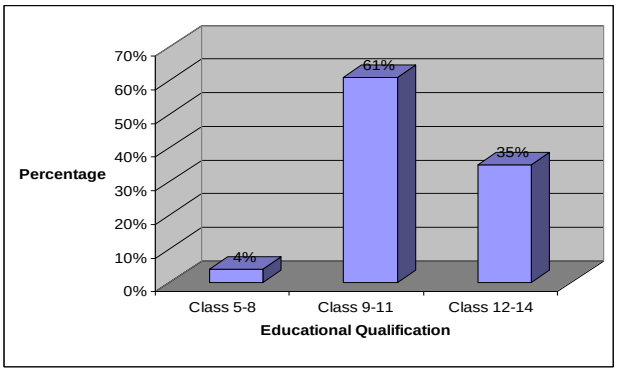


Gender of the respondents is described above. From the graph it was found that out of 100 respondents, 78% respondents were male and 22% respondents were female.

Table 3: Educational Qualification

Education	Percentage
Class 5-8	4%
Class 9-11	61%
Class 12-14	35%
Total	100%

Figure 3: Educational Qualification

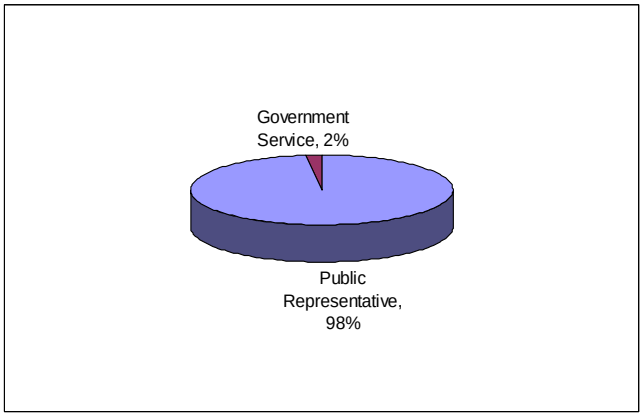


Educational qualifications of respondents are described above. From the graph it was found that out of 100 respondents, 61% respondents completed class 9-11 which is the maximum and 4% completed class 5-8 which is the minimum and 35% respondents completed class 12-14.

Table 4: Type of Job of the Respondents

Type of Job	Percentage
Government	2%
Public Representatives	98%
Total	100%

Figure 4: Type of Job of the Respondents

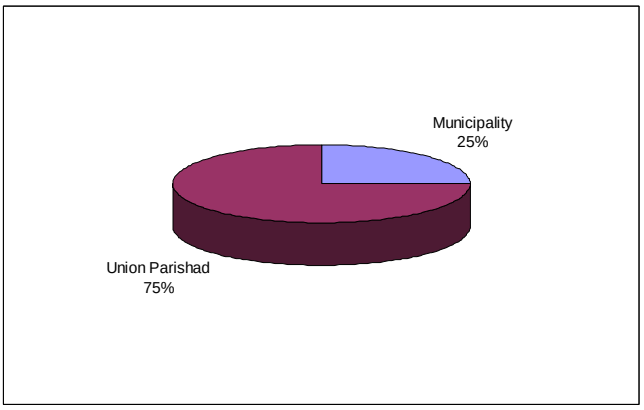


Job category of the respondents is described above. From the graph it was found that out of 100 respondents 98% respondents are Public Representative and 2% respondents are Government Service

Table 5: Type of Organization

Type of Organization	Percentage
Union Parishad	75%
Municipality	25%
Total	100%

Figure 5: Type of Organization

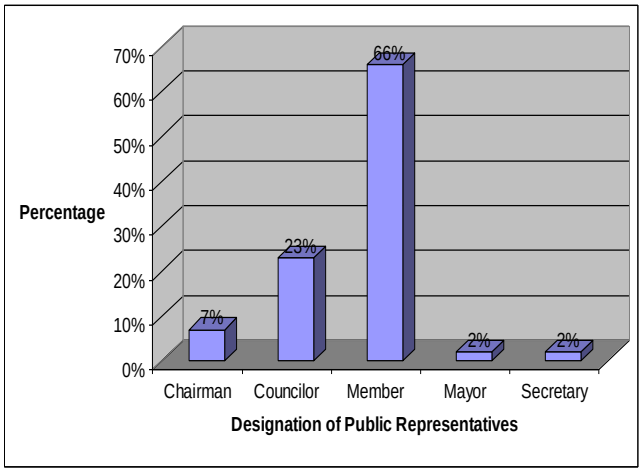


Category of the Organization is described above. From the graph it was found that out of 100 respondents, 75% respondents engaged in Union Parishad and 25% respondents are engaged in Municipality.

Table 6: Designation of Public Representatives

Designation	Percentage
Chairman	7%
Councilor	23%
Member	66%
Mayor	2%
Secretary	2%
Total	100%

Figure 6: Designation of Public Representatives

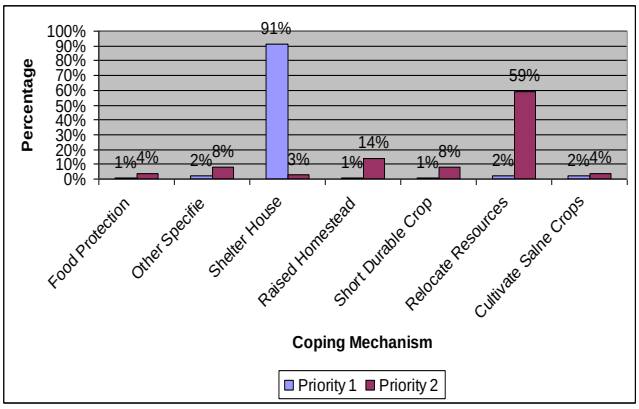


Designation of the Public Representatives is described above. From the graph it was found that out of 100 respondents, 66% was Member of Union Parishad which is the maximum and 2% are Mayor of Municipality and Secretary of Union Parishad. Other representatives are Chairman of Union Parishad, Councilor of Municipality are 7% and 23% respectively.

Table 7: Coping Mechanism of Climate Induced Hazard

Category	Priority 1	Priority 2
Food Protection	1%	4%
Other Specifie	2%	8%
Shelter House	91%	3%
Raised Homestead	1%	14%
Short Durable Crop	1%	8%
Relocate Resources	2%	59%
Cultivate Salne Crops	2%	4%

Figure 7: Coping Mechanism of Climate Induced Hazard

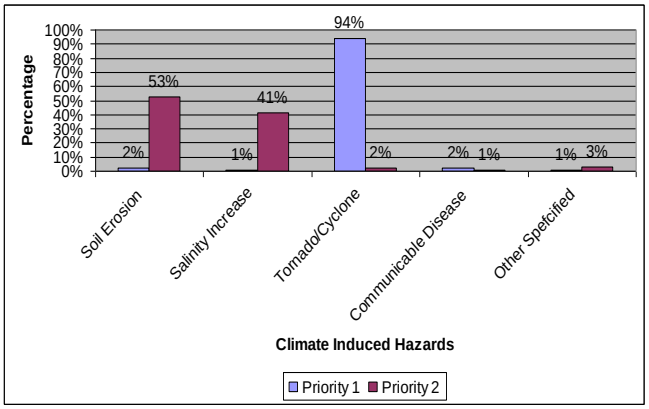


Coping mechanism of the disaster prone areas are described above. Here opinions of the respondents are categorized into Priority 1 and Priority 2. From the graph it was found that in case of priority 1, out of 100 respondents, 91% respondents were agreed that Shelter House is the most effective coping mechanism against natural disaster and other coping mechanisms are Food Protection, Other Specific adaptation measure like take shelter in embankment/dam during disaster period, Raised Homestead, Short Durable Crop, Relocate Resources and Cultivable Saline Crops are 1%, 2%, 1%, 1%, 2% and 2% respectively. In case of Priority 2, out of 100 respondents, maximum 52% respondents agreed that Relocate Resources is the most effective coping mechanism against natural disaster and other coping mechanisms are Food Protection, Other Specific, Raised Homestead, Short Durable Crop, Relocate Resources and Cultivable Saline Crops are 4%, 7%, 8%, 17%, 8%, and 4% respectively.

Table 8: Climate Induced Hazards

Hazards	Priority 1	Priority 2
Soil Erosion	2%	53%
Salinity Increase	1%	41%
Tornado/Cyclone	94%	2%
Communicable Disease	2%	1%
Other Spefcified	1%	3%

Figure 8: Climate Induced Hazards

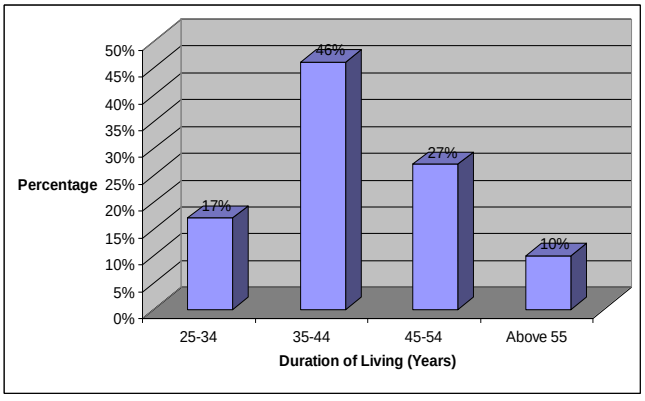


Climate Induced Hazards are described above. Here opinions of the respondents are categorized into Priority 1 and Priority 2. From the graph it was that in case of priority 1, it was found that out of 100 respondents, maximum 94 % respondents agreed that Tornado/ Cyclone is the main climate induced hazards, and other climate induced hazards are Soil Erosion, Salinity Increase, Communicable Disease and Other Specified hazards are 2%, 1%, 2%, and 1% respectively. In case of Priority 2, it was found that out of 100 respondents, maximum 53% respondents agreed that Soil Erosion is the main climate induced natural hazards and other climate induced natural hazards are Salinity Increase, Tornado/Cyclone, Communicable Disease and other Specified hazards are 41%, 2%, 1% and 3% respectively.

Table 9: Duration of Living

Duration	Percentage
25-35	17%
35-44	46%
45-54	27%
Above 55	10%
Total	100%

Figure 9: Duration of Living



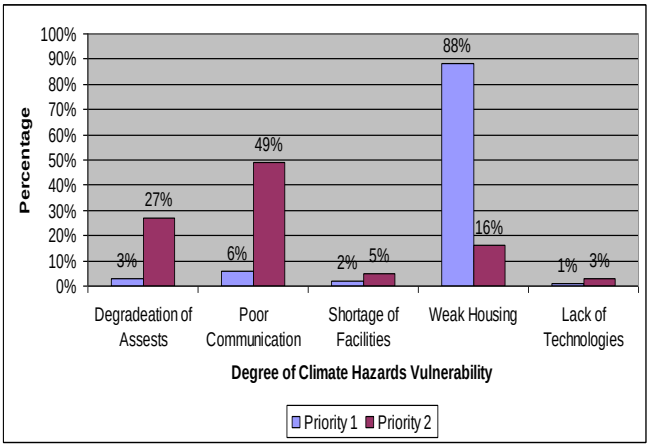
Duration of living of the respondents is described in the above graph. From the graph it was found that duration of living 35-44 years is 46% which is the maximum and duration of living above 55 years is 10% which is the minimum. Duration of

living 25-34, 45-54 years is 17% and 27% respectively. The selection of the participants was done randomly.

Table 10: Degree of Climate Hazards Vulnerability

Degree	Priority 1	Priority 2
Degradation of Assets	3%	27%
Poor Communication	6%	49%
Shortage of Facilities	2%	5%
Weak Housing	88%	16%
Lack of Technologies	1%	3%

Figure 10: Degree of Climate Hazards Vulnerability



Degree of Climate Hazards Vulnerability is described above. Here opinions of the respondents are categorized into Priority 1 and Priority 2. From the graph it was that in case of priority 1, out of 100 respondents, 88% respondents agreed that Weak Housing is the effect of natural disaster which is the maximum and lack of technologies is 1% which is the minimum effect of natural hazards. Other effects of natural hazards are Degradation of Assets, Poor Communication, Shortage of Facilities, Weak Housing and Lack of Technologies is 3%, 6%, 2% respectively. In case of priority 2 out of 100 respondents, 49% respondents agreed that Poor Communication is the effect of natural disaster which is the maximum and Shortage of Facilities s 1% which is the minimum effect of natural hazards. Other effects of natural hazards are Degradation of Assets, Weak Housing and lacks of Technologies are 30%, 6% and 4% respectively.

V. SUMMARY AND RECOMMENDATION

A study was conducted to identify the adaptation and mitigation strategies of climate induced hazards in the coastal areas and understand the climate hazards and degree of vulnerability caused by these disasters in coastal zone in Bangladesh. Adaptation to climate change is complex topic that presents a number of challenges. This involves a process of sustainable and permanent adjustment in response to new and changing environmental circumstances. So adaptation cannot be treated as standalone issue and should be premised on the following factors.

1. Vulnerability and adaptation assessments should be developed for prioritizing adaptation policies and measures. Adaptation has to be mainstreamed in investment planning both in public and private sector. Governments therefore need to devise policies, incentives, and regulation to public and private initiative toward strengthening adaptation.
2. Capacity needs to be built for both short-term and long-term adaptation planning. Innovative risk sharing mechanisms (insurance) are needed to respond to emerging challenges including biodiversity loss and land degradation.
3. Adaptation, rather than being concentrated in one sector, should essentially be dispersed across all socio-economic sectors including water, health, agriculture, and infrastructure, each of which presents in own challenges, and will involve stakeholders in different if overlapping groups. Adaptation measures are likely to be less capital intensive and more amenable to small scale interventions.
4. More Shelter Centers should be built to give shelter during the natural hazards.
5. Living house should be built in such a way so that the houses can resist the tidal surge and cyclones.
6. Governmental institutions (ministries, governmental organizations and agencies), private entries and NGOs should consider integrating climate change in their planning and budgeting at all levels of decision making and coordinate their actions among themselves.
7. Vulnerability and adaptation assessments should be developed for prioritizing adaptation policies and measures. Adaptation has to be mainstreamed in investment planning both in public and private sector. Governments therefore need to devise policies, incentives, and regulation to public and private initiative toward strengthening adaptation.
8. Capacity needs to be built for both short-term and long-term adaptation planning. Innovative risk sharing mechanisms (insurance) are needed to respond to emerging challenges including biodiversity loss and land degradation.
9. Adaptation, rather than being concentrated in one sector, should essentially be dispersed across all socio-economic sectors including water, health, agriculture, and infrastructure, each of which presents in own challenges, and will involve stakeholders in different if overlapping groups. Adaptation measures are likely to be less capital intensive and more amenable to small scale interventions.

Still many climate change impacts timing and exact magnitude are uncertain. Hence, the strategy and Action Plan will require periodical revision. The following enhancements should be considered by Government of Bangladesh to their policies and programs.

1. Adopt meaningful, achievable climate change targets.
2. Pursue strong, biding emissions targets in international negotiations.
3. Ensure commitment of developing countries fair share to climate change adaptation for Bangladesh.
4. Education, training and public awareness.
5. Seeking more support for climate change mitigation and adaptation research: The Government of Bangladesh should look for increased funding support to research into innovative technologies including renewable energy, understanding climate change dynamics, carbon capture and sequestration, energy efficiency, crop varieties, and other adaptation and mitigation innovations.
6. Encourage environmental solutions in other counties.
7. Collaborate with our neighbors who are victim of climate change.

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