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

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ABSTRACT

Bangladesh is prone to a multitude of natural hazards and vulnerable to the adverse impacts of future change in climatic conditions. One of the most vulnerable aspects in climate change is the fragile coastal ecosystem in Bangladesh. Here, different ecosystems are highly exposed to cyclone, sea level rise, coastal flooding, flash flood, intense riverine floods, droughts and other climatic extremes. Traditionally, in Bangladesh, climatic variations have provided opportunities (resources) and imposed costs (hazards), depending on how society adapted to the environment. In the drive for modernization, evolving technologies and economic and social structures alter existing systems and make many sectors and groups in the ecosystems (especially Coastal Areas) more vulnerable to significant variations in climate and sea level. In this regard, indigenous knowledge and local coping capacities have become a key to survival of the people of the coastal areas (like Sundarbans Area) of Bangladesh. But in recent years, climate change has had a serious impact on the livelihood enterprises and coping capacities. The present paper has been prepared based on secondary sources to examine the often intriguing coping strategies of the coastal areas due to the adverse impacts of climate change.

Keywords: *Climate Change, Coastal Environment, Ecosystem Challenges*

INTRODUCTION

Climate change is a problem that is affecting people and the environment. Historically, Bangladesh is most susceptible countries of the world in the negative impact of climate change. The coastal population is one of the worst affected areas to attune such variations. Climate change refers to any significant change in measures of climate (such as temperature, precipitation, or wind, sea level rise, extreme events) lasting for an extended period (decades or longer) pose risks for ecosystems, food security, water resources, human health, settlement and society. Greater energy efficiency and new technologies hold promise for reducing greenhouse gases (such as Carbon dioxide- CO2, Methane- CH4, Nitrous oxide- N2O, water vapor, while others are synthetic. Those that are man-made include the chlorofluorocarbons-CFCs, Hydro-fluorocarbons-HFCs, Per-fluorocarbons-PFCs, Sulphur hexafluoride- SF6) and solving this global challenge. Greenhouse gases and certain synthetic chemicals, trap some of the Earth's outgoing energy, thus retaining heat in the atmosphere. Reducing, reusing and recycling solid waste can decrease the amount of heat-trapping greenhouse gases released.

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.
According to the 3rd assessment report of IPCC, South Asia is the most vulnerable region of the world to climate change impact (Mc Cathie, et.al. 2001). Bangladesh ranks high in respect of vulnerability due to its topography and other factors such as hydro geological and socio-economic factors mentioned below:

1. Its Geographical location in South Aisa
2. The Ganga-Bramaputra-Meghna Catchments area includes a great diversity of Physical environment
3. Its flat deltaic to photography with very low elevation
4. Its extreme climate variability that is governed by monsoon and which results in acute water distribution are space and time.

It may be mentioned here that there are four main seasons recognized according to monsoon. Those are:

a. Pre monsoon (March-May)
b. Monsoon (June-September)
c. Post Monsoon (October- November)
d. Dry Season (winter)
5. Life style of costal people
6. High population density and poverty incident.
7. Major population depending upon Agriculture and livelihood depends on climate variability and change.

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At present Bangladesh has experienced that due to climate change the frequency and intensity of these disasters have increased. These disasters, as happened in the past, continue to impact seriously on the society in terms of human casualties, economic and social losses, disruption of livelihoods, and degradation to environment also affecting health and sanitation and availability drinking water.

OBJECTIVES OF THE STUDY

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.

METHODOLOGY OF THE STUDY

The following mythology was used for the study

Study Design: The study was survey type.

Study Area: The study has been conducted at Samnagar Upazila of Satkhira District, Pathorghata Upazila of Barguna District and Cox's Bazar Sadar Upazila and Moheskhali Upazila of Cox's Bazar District.

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.

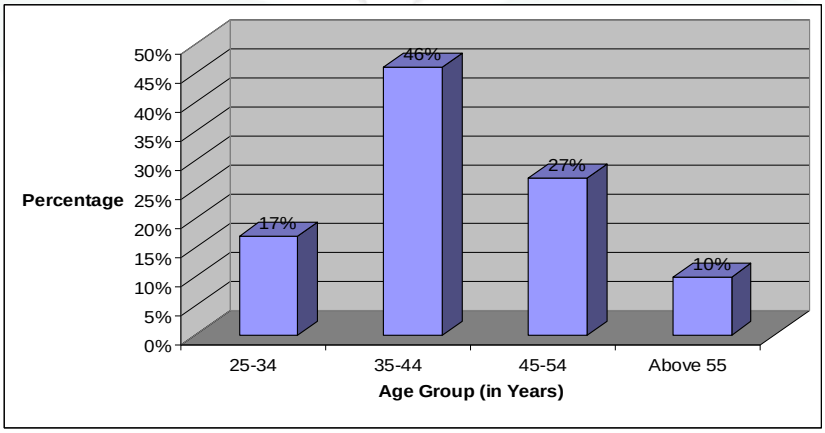
Data Analysis: The collected data were tabulated and analyzed by using Computer Program Microsoft Excel.

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

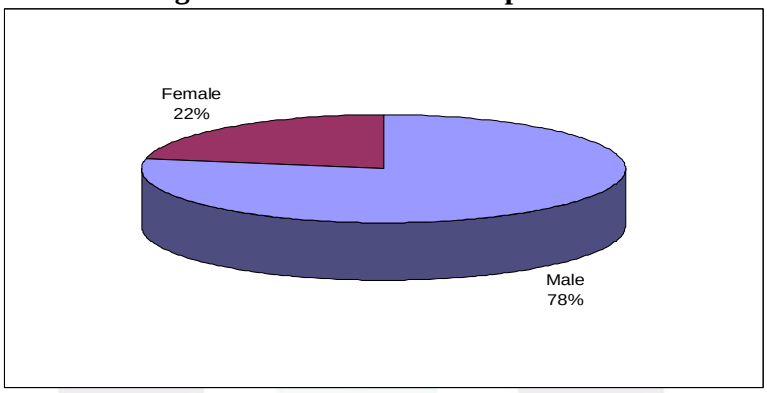


Age groups of the respondents are described in the above graph. From the graph it was found that age group 35-44 is 46 % which is the maximum and age group above 55 is 10 % which is the minimum. Age group 25-34, 45-54 years is 17% and 27 % respectively. The selection of the participants was done randomly. It indicates that most of the elected representatives are from 35-44 age group. 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%
	100%

Figure 2: Gender of the Respondents

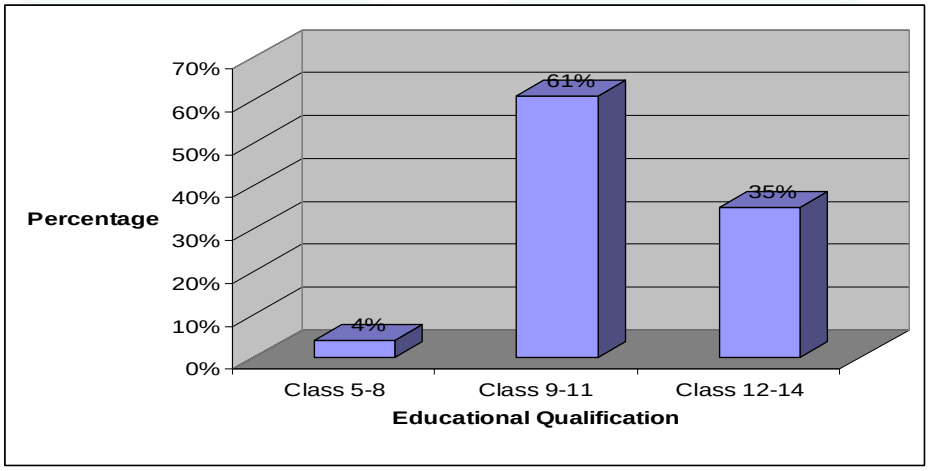


Gender of the respondents is described above. From the graph it was found that out of 100 respondents, 78% respondents were male and 22% respondents were female.

Table 3: Educational Qualification

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

Figure 3: Educational Qualification

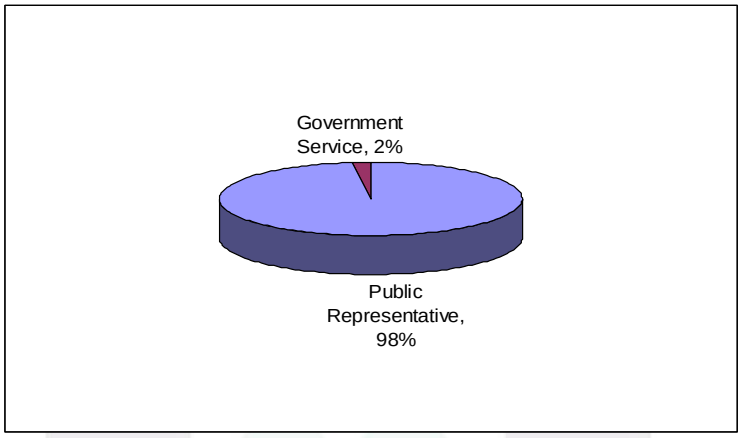


Educational qualifications of respondents are described above. From the graph it was found that out of 100 respondents, 61 % respondents completed class 9-11 which is the maximum and 4% completed class 5-8 which is the minimum and 35% respondents completed class 12-14.

Table 4: Type of Job of the Respondents

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

Figure 4: Type of Job of the Respondents

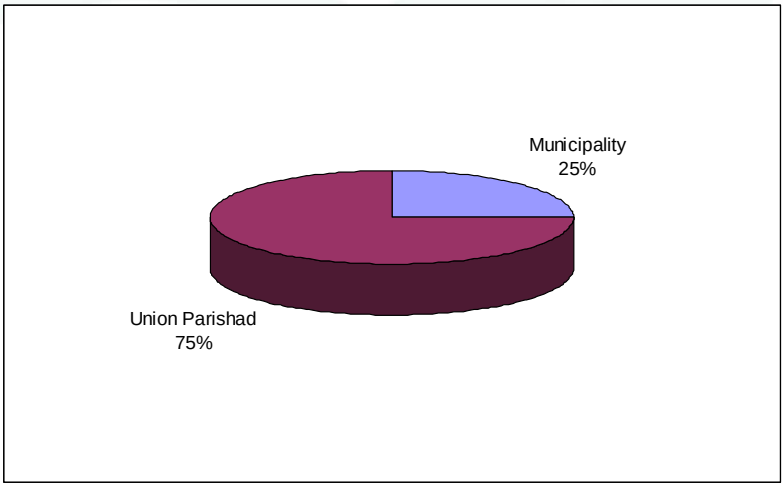


Job category of the respondents is described above. From the graph it was found that out of 100 respondents 98% respondents are Public Representative and 2% respondents are Government Service holder.

Table 5: Type of Organization

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

Figure 5: Type of Organization

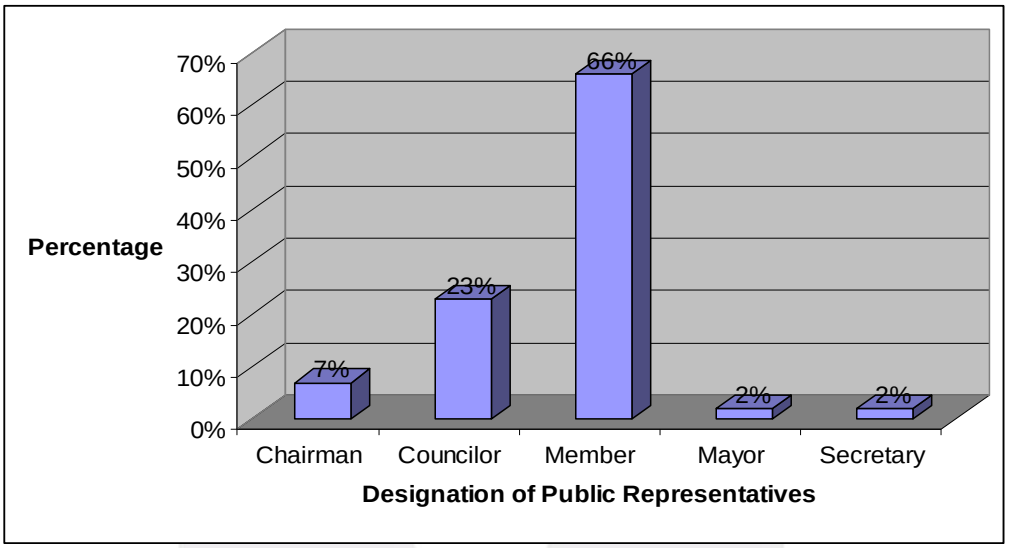


Category of the Organization is described above. From the graph it was found that out of 100 respondents, 75% respondents engaged in Union Parishad and 25% respondents are engaged in Municipality.

Table 6: Designation of Public Representatives

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

Figure 6: Designation of Public Representatives

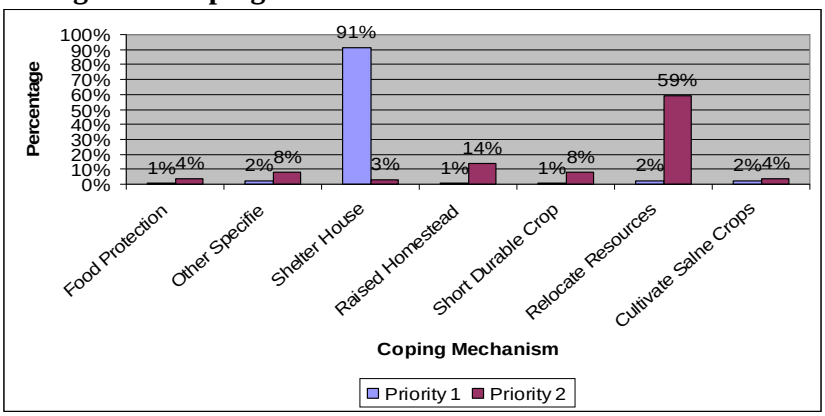


Designation of the Public Representatives is described above. From the graph it was found that out of 100 respondents, 66% was Member of Union Parishad which is the maximum and 2% are Mayor of Municipality and Secretary of Union Parishad. Other representatives are Chairman of Union Parishad, Councilor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

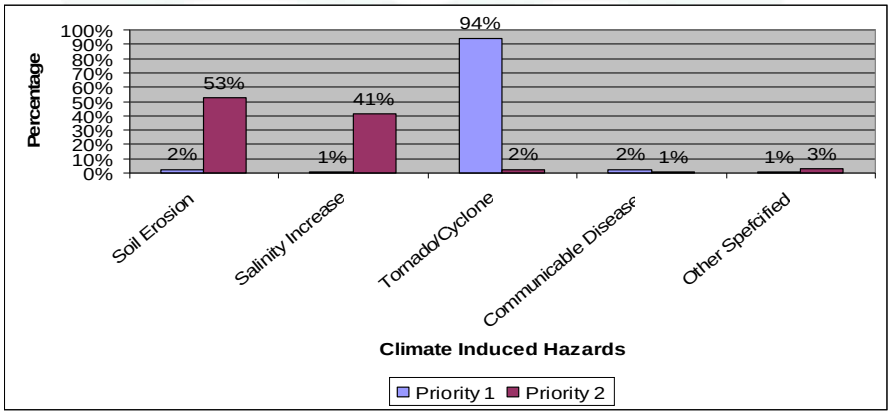


Coping mechanism of the disaster prone areas are described above. Here opinions of the respondents are categorized into Priority 1 and Priority 2. From the graph it was found that in case of priority 1, out of 100 respondents, 91% respondents were agreed that Shelter House is the most effective coping 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



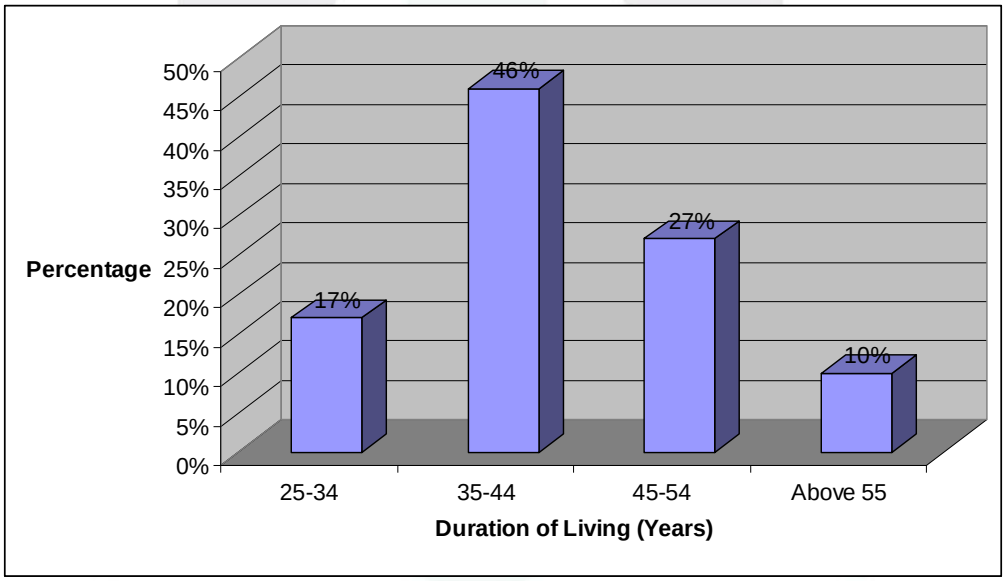
Climate Induced Hazards are described above. Here opinions of the respondents are categorized into Priority 1 and Priority 2. From the graph it was that in case of priority 1, it was found that out of 100 respondents, maximum 94 % respondents agreed that

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%
	100%

Figure 9: Duration of Living

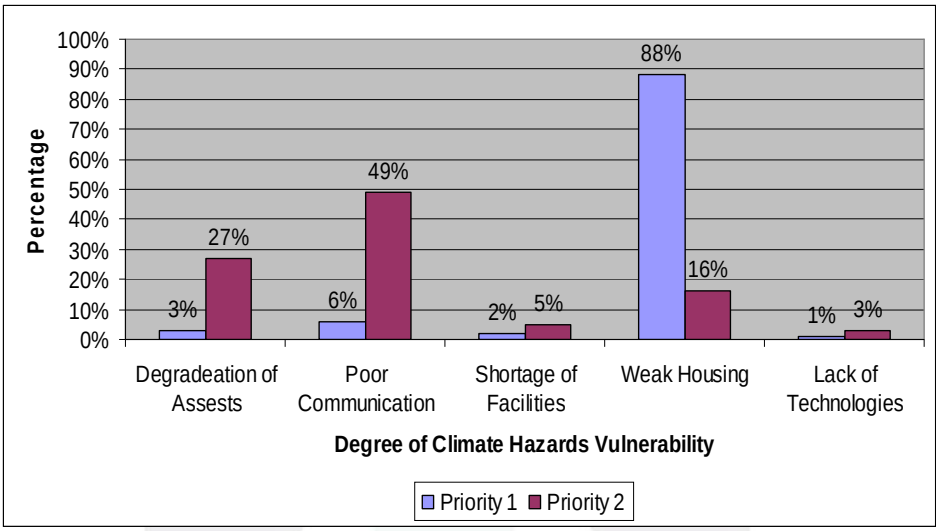


Duration of living of the respondents is described in the above graph. From the graph it was found that duration of living 35-44 years is 46 % which is the maximum and duration of living above 55 years is 10 % which is the minimum. Duration of living 25-34, 45-54 years is 17% and 27 % respectively. The 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.

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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