Bangladesh Journal of Political Economy

Vol. 38, No. 1, June 2022, pp. 417-426
Bangladesh Economic Association
ISSN 2227-3182
http:/doi.org/10.56138/bjpe.jun2226

Responses of Fishermen to Climate Change in the South-Western Coastal Regions of Bangladesh

Md. Enamul Haque*

Abstract

Environment and sustainable development can go hand in hand and are often analysed through the sustainable livelihood framework. This literature shows that shrimp production is not the only source of livelihood for south-western coastal people in Bangladesh. Diversifying into non-farm activities is increasingly adopted as a viable livelihood strategy and its importance is profoundly growing daily. Recently, climate change and the recognition of its adverse socio-economic impacts on livelihoods remains a cornerstone in the developing world. Shrimp producers see a devastating fall in shrimp production due to natural disasters like floods and drought that leave thousands of people in this region unfed and malnutrition. Diversification seems like one of the main strategies by which coastal people can respond to the challenges of climate change. Fishers who rely on nature for food and income have minimal livelihood alternatives. Yet, natural resource-based tactics appear to be prevailing in the existing degree of diversification, which may not be sufficient to deal with the effects of current climate extremes and forecasted changes. This paper aims to document local ways of responding to the impacts of climate change. Given this, the thesis aims to provide a theoretical and empirical analysis of non-farm diversification in climate change adaptation in south-western coastal regions in Bangladesh. The study also examines the impact of non-farm income diversification on income distribution. These analyses reveal that incomes from other than fishing have a positive impact on coastal households" welfare and income distribution. This result strengthens the argument that non-fishing income diversification can be an excellent strategy to reduce risks in shrimp production and paves the way to sustainable development.

Keywords *Climate Change · Adaptation · Livelihood diversification · South-Western Coastal Region · Bangladesh ·*

* Assistant Professor, Department of Economics, Pabna University of Science and Technology, Pabna, Bangladesh. Email: enaml875@yahoo.com

1. Introduction

One of the most significant difficulties facing our society today is dealing with the socio-economic effects of climate change. Increased global temperature and accompanying severe events such as sea-level rise, droughts, flooding, and cyclones are already revealing the reality of its destructive effects on people and nations. Developing countries must adapt quickly because of their heightened vulnerability (Agrawala & Van Aalst, 2008).

Responding to the socio-economic impacts of climate change is one of the significant challenges facing our world today. The reality of its devastating effects on people and nations is already unfolding through increasing global temperature and associated extreme events such as sea-level rise, droughts, flooding, and cyclones. Adaptation is crucial for developing countries because of their increased sensitivity to the effects of climate change (Agrawala& Van Aalst, 2008). As a result, Erikson and O'Brien (2007) argue that reducing climate change risk through adaptation measures is becoming increasingly crucial for long-term development. Diversification entails the continual maintenance and variation of a wide range of activities and occupations to reduce household income variability, mitigate the adverse effects of seasonality, and give employment / supplementary income (Ellis, 2000; Barrett et al., 2001; Lanjouw & Lanjouw, 2001; Davis & Bezemer, 2004; Haggblade et al., 2010). Bangladesh is a developing country vulnerable to natural calamities such as floods and cyclones. Several natural disasters have impacted Bangladesh at various times. A natural tragedy known as ILA struck the south-western coastal region in 2009, causing massive devastation and leaving many people dead and malnourished.

Furthermore, the ILA had other negative socio-economic consequences that hampered the country's ability to achieve long-term development goals (SDGs). People are still suffering from the adverse effects of ILA. Some fundamental issues can be asked, such as what has happened to poverty, inequality, and unemployment. The study's goal is to discover those answers.

2. Impacts of Climate Change in Bangladesh: Some Sectors

Fisheries: Increasing year-to-year variability, as well as an increase in both droughts and high precipitation events, reduces agricultural production and has a negative impact on food security.

Water: The availability of safe drinking water is projected to diminish because of increased evaporation and variability in rainfall events.

Health: Malaria cases surged quickly in parts of the highlands where the disease had previously been absent. Increases in cardio-respiratory and viral disorders are also projected due to the warming.

Ecosystems: Forest ecosystems are threatened by climate change and human activity such as forest fires and logging.

Furthermore, many plant and animal species are on the verge of extinction as climate conditions change too quickly for them to adapt.

Infrastructure: Floods and heavy rainfall caused damage to roads, highways, and structures.

3. Aims and Objectives

This study aims to look into ways to adapt to climate change, mainly through livelihood diversification, and to make recommendations for shrimp producers to improve their performance by leveraging economies of scale.
The following are the precise goals:

i. To determine the dangers and risks of cyclones and other natural disasters.
ii. To investigate the local people's coping mechanisms for dealing with cyclones.
iii. To identify ways for fishers to diversify their livelihoods in the face of climate change.
iv. Make some suggestions for resolving the associated problem.
v. To prepare the road for Bangladesh's coastal regions to achieve the SDGs.

4. Review of Literature

An attempt has been made in this study to present a review of research on shrimp production and the socio-economic consequences of climate change on Bangladesh's fisheries sector. A disaster is an unexpected, catastrophic event that causes significant damage, loss, destruction, and devastation to people and property.

Disaster damage is immeasurable and varies depending on geographical location, temperature, and the type of earth surface/degree of vulnerability. It impacts the impacted area's mental, socio-economic, political, and cultural state (Assam Govt. Disaster Management Institute, 2003).
Cyclones, earthquakes, floods, and other natural disasters are examples.

Bangladesh is one of the world's least developed and disaster-prone countries. Bangladesh is vulnerable to natural disasters, particularly cyclones, due to its conical form and location on the point of the Bay of Bengal (Tareq, 2010). A cyclone is an atmospheric system characterised by low barometric pressure (depression) and strong winds that rotate counterclockwise in the northern and southern hemispheres (Assam Govt. Disaster Management Institute, 2003).

The cyclone formed over the ocean, where the water was warm.

Cyclones have impacted the country throughout the last 30 years, resulting in the loss of precious lives and property.

The Bay of Bengal (Murty and El-Sabh 1992; Haque 1997), which is believed to be one of the perfect grounds for cyclone formation because it has 6–10 per cent of tropical cyclones, has the physical and climatic characteristics necessary for developing tropical cyclones. Each year, on average, 12–13 depressions emerge, and at least one intense hurricane strikes Bangladesh (Mooley 1980; Haque 1997; Paul 2009a, b).

Bangladesh has been hit by several devastating cyclones, including those in 1822, 1876, 1961, 1965, 1970, and 1991. (Wisner et al. 2004; Dube et al. 2004; GoB 2008).

According to previous studies, Bangladesh accounts for 80–90 per cent of global damages and 53 per cent of overall cyclone-related deaths (Ali 1999; GoB 2008; Paul 2009a, b).

In the last two centuries, cyclone-related deaths have accounted for almost 42% of all deaths in Bangladesh (Nicholls et al. 1995).

For example, in 1971, the total death toll from cyclones was predicted to be between 300,000 and 500,000, with 100,00 people dying. For example, the total death toll from a storm in 1971 was between 300,000 and 500,000, with 100,000 persons missing; the estimated damage was USD 450 million.

The official death toll from the 1991 storm was 140,161, with a total population of 10,721,707 people impacted; damage estimates ranged from USD 1.8 billion to 4.3 billion. The poor socio-economic situations of coastal residents, in addition to the geophysical characteristics of the Bangladesh coast, contribute to residents' increased vulnerability to cyclones (Paul, 2009).

Coastal inhabitants' livelihoods rely strongly on ecosystems linked to agriculture, fisheries, forestry, and salt farming, among other things.

As a result, the rising frequency of cyclones would undoubtedly impact the livelihoods of vulnerable people living in low-lying coastal Bangladesh (Mian 2005, Islam 2008).

As a result, cyclones are a common occurrence in Bangladesh and a colossal calamity. While cyclones can produce dangerous winds, many people are unaware that they pose several other risks, both directly and indirectly.

Hazards are described as -Phenomena that pose a risk to persons, structures, or economic assets that may result in a disaster.

They could be created by humans or occur naturally in our surroundings (Assam Govt. Disaster Management Institute, 2003). Salinity, water logging, and embankment erosion are just a few examples. Cyclones have a wide-ranging impact, bringing powerful winds and heavy rainfall to a large area.

However, secondary occurrences like storm surges, water logging, tidal surge, and salinity cause the most harm to life and property. Multi-hazard occurs when more than one danger occurrence occurs in the same place. These many hazard events may occur at the same time or at separate times.

For example, a cyclone can cause salinity, water logging, embankment erosion, tidal surge, and storm surge in the same place.

5. Methodology

5.1 Conceptualisation

Cyclone in Bangladesh is a disaster that has wreaked havoc on property, agriculture, infrastructure, and life.

Simultaneously, Indigenous coping mechanisms are one of the strategies being investigated to deal with cyclones.

If the Participatory Rural Appraisal (PRA) is used, indigenous knowledge and practices can be effectively identified.

Local knowledge combined with policy measures effectively mitigate the cyclone's detrimental effects.

This viewpoint informs the study's central notion.

5.2 Selection of the study area

Santa Village in Garaikhali Union, Paikgacha Upazila, Khulna District, was chosen as the study area based on the goals.

Cyclones frequently impact people who live in this remote coastal location.

In Bangladesh, this region is highly vulnerable to climate change. The primary source of income is fishing.

Approximately 75% of the working population is employed in this sector. The majority of fishing is done for both subsistence and commercial purposes. They use traditional knowledge and practices (such as housing, agriculture, and warning techniques) to reduce damage and costs before and during cyclones.

5.3 Draft questionnaire preparation

For the study, a draft questionnaire is being produced. Personal information, cyclone information, and three phases are all included in this questionnaire (hazard phase, impact phase and recommendation phase).

5.4 Sample size selection

The overall population is mainly determined by its geographical location and size. Data collection by population requires more time and is not practical.

Identifying the right sample size to achieve the desired study outcomes is critical. A stratified sampling strategy was used to identify the 100 people who made up the sample. The sampling size plays a critical role in providing the actual scenario that the study seeks. A household can be considered a sampling unit for the household survey.

Because of several constraints such as time, money, and helping hands, a large sampling size with many households is advantageous.

5.5 Sources of data collection

Data was gathered from direct and secondary sources to examine fishers' coping capacity.

Primary data collection refers to information gathered from the field through first-hand observation. Secondary data collection is when information is gathered from a variety of sources such as organisations, websites, journals, and so on.

The primary data collection procedure is divided into two steps: The PRA is responsible for questionnaire and survey preparation.

Questionnaire preparation: To gather the essential data, a questionnaire is created.

The following are the contents of the questionnaire: Cyclone information (history, trend, frequency, length, intensity); Demographic information (population, income, occupation); Identifying risks and their consequences (water logging, salinity, river erosion, tidal surge, structural, agricultural, fisheries, pollution, diseases etc.); Coping strategy (agricultural pattern, structural pattern, awareness, signal, service etc.); Recommendations from locals.

Participatory Rural Appraisal: The surveying is mainly conducted by Upazila administration members such as the Upazila disaster management officer, the UP Chairman, and the general public.

The Participatory Rural Appraisal (PRA) survey is a type of survey that relies on the participation of rural residents.

It is carried out in two significant steps.

Semi-structure Interview: First, the Paikgacha Upazila map and general information such as total population and village names are gathered. The Upazila disaster management office is then contacted for cyclone-related information.

Focused Group Discussion (FGD): It's a simple approach to bringing people together to discuss a given issue. The inhabitants of a selected hamlet, primarily 6-8 residents, are convened here for a focus group discussion (FGD). They give cyclone spatial and nominal information.

The opinions of the public were gathered on- 1. Cyclone history and trends, 2. Cyclone Hazard Venn Diagram, 3. A map of potential hazards (i.e., Salinity map, water logging map, vulnerability map etc.), 4. Calendar of Hazardous Seasons, 5. Seasonal calendar for livelihood.

Secondary data is gathered from the Department of Public Health and Engineering (DPHE), the Agricultural Office, the Local Government and Engineering Department (LGED), and pertinent journal articles. The secondary information includes a physical map, a land-use map, a hazard map, an annual fisheries report, and relief information (DPHE).

Climate change and fisherman's livelihood diversification: Fishermen adapt to climate change by diversifying their livelihoods, including fishing, boating, rickshaw/van pulling, housekeeping, small business street vending, and farm labour. Although natural disasters have badly harmed the fishing industry, most

fishers still find work in the coastal region.

Table 1: Livelihood diversification

Diversified livelihood	Frequency
Sheep rearing	20
Small business	30
Street vendor	25
Boat man	48
Housekeeping	29
Fishing	82
Rickshaw/van pulling	35

6. Constructing the Coping Capacity Index of Coastal Fishers (FCCI)

Formula 1: Calculating the indicator score I= (cumulative response score/maximum response score) X5

Formula 2: Computation of capacity score for factor d1= (sum of Id1/maximum sum of Id1) X ranking score for d1

Formula 3: FCCI= (percentage sum of d/100) X5

Table 2: Coping capacity factors

Determinants of coping capacity	Factors	Factor assumptions
Economic resources	Diversity of income source (b) Remittance	More diverse sources of income have a higher coping capacity.
	Access to credit	Remittances play an essential role in facing climate change.
		Fishers with credit access are more economically able to cope with climate change.
Social capital	Access to family/household labour	More access to family/household increases the social capital of fishermen
Awareness and training	Level of literacy	Literacy contributes to coping capacity
	Access to climatic information	
Technology	Knowledge of fish varieties	Fishers with Knowledge about fish varieties are better able to adapt to climate change
	Mobile phone use	Fishers who use a mobile phone are better off the climate change

Determinants of coping capacity	Factors	Factor assumptions
Infrastructure	Access to roads	Access to roads made them capable of marketing input and output
	(b) Waterways	Waterways play an essential role in marketing input and output
Institutions	Government subsidy	Fishers with government subsidies for fishing are more resilient to climate change
	Disaster relief assistance	Climatic disaster is easily adapted with disaster relief assistance

Among the six factors of coping capacity, institutions, infrastructure, and technological knowledge seem most relevant for fishers' coping ability. While economic resources, social capital, awareness, and training were ranked least important. The research shows the aggregate coping capacity of respondents is low.

Table 3: Calculating response score

Factors	Frequency	%	Cumulative	Rank	Maximum
Diversity of income source	35	.35	.35	7	
Remittance	10	.10	.45	12	35
Access to credit	30	.30	.75	9	
Access to family/household labour	40	.40	.40	6	40
Level of literacy	32	.32	.30	8	32
Access to climatic information	27	.27	.59	10	
Knowledge of fish varieties	63	.63	.63	3	74
Mobile phone use	74	.74	1.37	2	
Access to roads	25	.25	.25	11	57
waterways	57	.57	.82	4	
Government subsidy	54	.54	.54	5	82
Disaster relief assistance	82	.82	1.36	1	

Table 4: Calculation of I

Calculation of I	Calculation of d	Rank score
I1=.05	d1=.02	D1=3
I2=.06	d2=.06	D2=6
I3=.11	d3=.11	D3=4
I4=.05	d4=.03	D4=1
I5=.05	d5=.09	D5=5
I6=.10	d6=.05	D6=2
I7=.04	Sum of (d)=0.36	
I8=.09		
I9=.02		
I10=.07		
I11=.03		
I12=.08		

FCCI= (percentage sum of d/100) x5
= (.36/100) x5
=1.8

Table 5: The levels of coping capacity based on the ranges of index scores (source: modified from Egyir et al.2015)

Level of CC	FCCI score range
Very high CC	4.01-5.00
High CC	3.01-4.00
Moderate CC	2.50-3.00
Low CC	1.51-2.49
Very low CC	0.00-1.50

The factors normalised capacity score involves the normalisation of the capacity score of an aspect of coping capacity about the maximum score of the factor using a Likert scale of 0 to 5 (where 5 is the total score). The survey result shows low aggregate coping capacity (FCCI=1.8).

7. Conclusion

We will be able to provide some policy implications on the elements that contribute to reducing climate change vulnerability in Bangladesh's south-western coastal regions. As the residents of this region become powerless owing to a lack of economic possibilities outside of shrimp farming, sheep rearing would be a viable alternative.

Sheep farming has numerous advantages. It could be a protein source and substitute for shrimp production. Sheep farming will benefit a large number of individuals. Sheep farming requires a low initial investment, allowing anyone to participate**.** It appears to be the polar opposite of poverty's vicious circle—more jobs, more income, savings, sheep—rearing investment, and employment. On the other hand, shrimp farmers require agricultural finance from the government or non-governmental organisations (NGOs) at first. This study offers recommendations on how agricultural finance might be used cost-effectively.

References

Jennifer, Noralene., & Rajib. (2008). Good Practices and Lessons Learned from Experiences in the Asia-Pacific Region for Indigenous Knowledge for Disaster Risk Reduction Bangkok is the capital of India.

K. Routray., & Paul Routray. (2013). The Use of Indigenous Knowledge for Cyclone Forecasting in Bangladesh: An Analysis of the Causes of Non-Responses to Cyclone Warnings Barguna is a town in Bangladesh.

M. Kamal., & Shahidur Rahman. (2008). Indigenous Disaster Loss Mitigation Practices Bangladesh's Khulna.

M. M. Mustafa (2000). Indigenous Knowledge Development in Bangladesh: Present and Future, edited by P. Sillitoe, Towards an Understanding of Indigenous Knowledge. The University Press Limited, Dhaka.

Awori and Achoka are two characters from the anime Awori and Achoka (1991). Indigenous knowledge: Is it a myth or a fact? Journal for Sustainable Development in Africa 2 (Resources) (1).

Bangladesh should be taken care of (2012). Transferable Indigenous Knowledge and Coping Strategies for Disaster Risk Reduction are being documented and promoted. Bangladesh's capital, Dhaka.

Daniel Chebutuk Rotich., & Joseph N. Kiplang'at. (2008). Agricultural Indigenous Mapping and Auditing

Harding, John. (2003). Community coping mechanisms that take into account all disaster risk elements.

S. Hassan, Hassan, Hassan, Hassan, Hassan (2002). Indigenous Disaster Management Culture: A Comparative Study of Bangladeshi Cyclone Victims, Journal of Human Sciences, Vol.26, No. 3, 2000, pp. 251–263.

P. Howell., & Howell. P. (2003). Benfield Hazard Research Centre, London, Indigenous Early Warning Indicators of Cyclones: Potential Application in Coastal Bangladesh.

Morshed Monzu. (2007). Flood-Resistant Indigenous Coping Mechanisms, Dhaka's BRAC University

S. Ahmed, Mahmuduzzaman, Z. Ahmed, A. K. M. Nuruzzaman., & Mahmuduzzaman (2014). Causes of Salinity Infiltration in Bangladesh's Coastal Belt 8-13 in Journal of Plant Research, 4 (4A).

Uddin Ektear. (2012). In Selected Storm Surges, Marginal Farmers' Household Food Security Status