

## CLIMATE CHANGE AND GENDER BASED VULNERABILITY NEXUS: AN EVIDENCE FROM CYCLONIC STORM SURGES AREA OF BANGLADESH

Muhammad Shahrukh Rahman<sup>1</sup>  
Mashrufah Khatun<sup>2\*</sup>

### ABSTRACT

This study explored vulnerability of women livelihood in Maheshkhali Island through applying Livelihood Vulnerability Index (LVI). Two focus group discussion along with a household survey were done to collect necessary information. Salt production was the main source of income of 68% of the sample households. The overall LVI was found 0.44 means that women livelihoods are moderately vulnerable to cyclonic storm surges. The index was highest in financial capital and lowest in human capital. Among the components, finance and incomes, knowledge and skills and land were the most vulnerable components whereas social involvement and livelihood strategies were the least vulnerable components among the major components for women in the study area. Mud-structure houses, storing dry foods for future and taking refuge in cyclone shelter were the popular coping practices of women to cope to cyclone. In order to reduce existing level of vulnerability formal and informal education, saline tolerant crop varieties and cyclone shelters were the most important adaptation needed by women in the survey area.

**Keywords:** Vulnerability, women, cyclone, Bangladesh

### I. INTRODUCTION

Climate change has been developed through various generations and decades (Dimitrov, 2019). It increases the frequency and intensity of climate change related extreme events such as salinity, storms, drought, irregular rainfall, high temperature, flash flood etc. Although climate change impacts affect all countries, it's impacts will be differently distributed among different regions, generations, age classes, income groups, occupations and genders (IPCC, 2001; Hardee, 2009). Evidence suggests that developed countries located in temperate regions would face less adverse impacts and may gain from climate change (Mendelsohn and Dinar, 2003). In contrast, there is a scientific consensus that the non-industrialized and low-income nations located in tropical and sub-tropical climate are more prone to the negative impacts of climate change (Wheeler and Von Braun, 2013; Ruamsuke et al., 2015; Hossain and Majumder 2018). At the same time, climate change does not affect women and men in the same way and it has, and will have, a gender-differentiated impact (Hardee, 2009). The poor (of which 70%

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<sup>1</sup> Agricultural Economics Division, Bangladesh Agricultural Research Institute, Gazipur-1701, Bangladesh

<sup>2</sup> Department of Agricultural Finance, Bangladesh Agricultural University, Mymensingh-2202

\*Corresponding author: Mashrufah Khatun, Department of Agricultural Finance, Bangladesh Agricultural University, Mymensingh-2202, E-mail: emuagf@bau.edu.bd

are women), primarily but by no means exclusively in developing countries, will be disproportionately affected by climate change related extreme events (Drexhage, 2006).

Bangladesh is one of the most vulnerable countries in the world to climate risks and natural disasters (Agrawala et al., 2003). In other words, the physical, social as well as economic conditions of Bangladesh are very typical to any of the most vulnerable countries to natural disasters (Denissen, 2012). The most critical impacts in Bangladesh are drainage congestion (flooding), reduced fresh water availability, disturbance of morphological processes (erosion) and an increased intensity of disasters (extreme events: cyclone/storm surges, floods and droughts) (Huq et al., 1999; World Bank, 2000; CCC, 2009). The coastal zone, particularly the southern areas of the country would face increased water-logging due to increased flood volumes to drain and increased sea levels downstream (CCC, 2009). Southwestern embankments might face occasional tidal overtopping, leading to saline water-logging within embanked areas (CEGIS, 2006). The consequence of global change is adversely affecting biophysical systems of coastal region by low land inundation, intense flood, cyclone and storm surge risks along with socio-economic conditions specially daily livelihood and food security (Hossain and Majumder, 2018). So, climate is now regarded as a hazard rather than a resource for the coastal region of Bangladesh where most of the marginal farmers, women and children are exposed to climate vulnerability.

Women are said to be more dependent on natural resources which are threatened by climate change. Beside, they have very limited coping capacity due to their duties and responsibilities in society and family as caretakers and care givers, food producers and providers, guardians of health and also in many cases as main economic actors. Beside their workload increases due to getting hampered in accessing basic needs and natural resources, such as shelter, food, fertile land, water and fuel. Again drought, deforestation and erratic rainfall cause women to work harder to secure resources and livelihoods (Mondal, 2014). With this, climate change impacts are higher over poor women due to their limited access towards recovery, rehabilitation and reconstruction. There are certain fundamental causes which are influencing women vulnerability during natural disasters namely economic, social, ecological, political, physical and emotional (Dimitrov, 2019).

Though for many years, gender and environmental nexus has been an issue (UNEP, 2004) but climate change and gender nexus has only started to receive attention during the last decade (Alber, 2011). But there have only a few publications which focuses the linkages between gender and climate change. Most of the approaches towards tackling the threats of climate change focus on scientific and technological aspects of the problem, ignoring the social issues (CCC, 2009). Therefore, gender disaggregated research is required in order to give more importance on different levels of vulnerability among the social groups. Among the climate vulnerable areas of Bangladesh Maheshkhali Upazila of Cox's Bazar district is the most vulnerable to cyclonic storm surges. It is the ideal breeding ground for tropical cyclone. In order to see the women vulnerability of this island under cyclonic storm surges the present study was aim to explore vulnerability of women's livelihood due to cyclonic storm surges and to find out the coping strategies practiced and future adaptation needs by women in the survey area.

## II. METHODOLOGY

### Selection of study area

Two issues were taken under consideration for selecting the study area: (i) the area must be physically susceptible to climate-induced hazards and (ii) inhabitants should have different livelihood opportunities. Based on these issues the present study was conducted in Dhalghata Union which is located in the western part of Maheshkhali Upazila of Cox's Bazar district (Figure 1). It is an island separated by Maheshkhali channel from the main land of Cox's Bazar and extremely vulnerable to tropical cyclones. The position is  $21^{\circ}40'210''N$ ,  $91^{\circ}52'18''E$ . The area of Dhalghata Union is 22.30 sq. km and total population was 20,000 in 2011 (Wikipedia, 2019). In the eastern side of Dhalghata Union, there is Kohelia river and Bay of Bengal in the South and West. Specifically, the study was conducted in Sapmarar Dail village of this Union where the total population is 2352 during the study period. Salt cultivation, along with crop production and fishing are the main economic activity of this village. The union has 5275.36 hectares of cultivable land, 2073.4 hectares of salt production land, 2105.69 hectares of shrimp cultivation and 1715.21 hectares fallow land (CCC, 2009). As a part of Maheshkhali island bounded by the Bay of Bengal, Dhalghata is said to be an ideal breeding ground for tropical cyclones.



Figure 1: Map of Maheshkhali upazila and research area

### Data collection procedure

The data was based on face to face interview and Focus Group Discussion (FGD) which were done in May 2019. The interview was conducted by the researchers along with two trained scientific assistants within the household premises. The interview for the respondents was done separately and privately. The data collection tools were pre tested in the study location before going for final survey. A structured questionnaire with open and closed ended questions was used to collect data from the sample respondents. The total number of respondents was 80. Table 1 presents the distribution of sample size.

**Table 1: Distribution of sample size**

Survey categories	Sample size
FGD Men	10
FGD Women	10
Household questionnaires (Male-40, Female-40)	80
Total	100

The focus group technique was adopted in this study aiming at gathering information from specific groups of natural resources users divided by sex. Group discussion was motivated regarding gender based vulnerability under climate change scenario. Questions were asked in an interactive group environment where participants were free to talk with other group members. Two focus group discussions consist of 10 participants in each group were done. Each group conversation lasted for about 2 hours.

#### **Analytical technique**

In order to assess the vulnerability to cyclonic storm surges, the study adopted Sustainable Livelihood Framework (SLF). Under the context of SLF the level of community vulnerability determines the impacts of climatic conditions on people's livelihood assets and strategies (Can et al. 2013). The present study has followed Livelihood Vulnerability Index (LVI) to assess the level of vulnerability in cyclonic storm surges as developed by Hahn et al. 2009. SLF is based on livelihood assets: human, physical, social, natural and financial capitals. For the purpose of the present study these capitals were grouped into ten major components. Major components were divided into a number of sub-components or indicators of community vulnerability (Table 2).

**Table 2: Sub-components, major components and capitals of LVI**

Capitals	Major components	Sub-components
Human	Health and sanitation	Percentages of ill family members
		Percentages of HHs family members getting illness due to cyclonic storm surges
	Knowledge and skills	Percentages of illiterate HHs family members
		Percentages of literate HHs family members
	Livelihood strategies	Percentages of HHs family members without any knowledge to cope with cyclonic storm surges
		Average agricultural livelihood diversity [ $1/(\text{No. of agric. activities} + 1)$ ]
		Percentages of HHs family members agriculture as main occupation
		Percentages of HHs family members involved only farm activities
		Percentages of HHs family members no work after cyclonic storm surges

Capitals	Major components	Sub-components
Natural Capital		Percentages of HHs involved fishing during cyclonic storm surges
		Percentages of family members with no farm land Percentages of family members belongs to small farm (0.19-0.99 ha)
	Natural Resources	Percentages of family members that are not involved in farming other than rice Percentages of family members consume pure drinking water Percentages of family members involved in forest resources
	Natural calamities and climate variability	Average number of severe cyclone in the last 10 years Average number of deaths/injury in cyclone in the last 10 years Percentages of HHs family members that do not receive cyclone warning
	Socio-demographic conditions	Dependency ratio Percentages of female family members Total family members
Social capital	Social involvement	Number of family members involved in organization Number of family members received help due to cyclone Percentage of female family members have ability to take own decision Percentages of female family members that they think they get proper social honour and independency
Physical capital	Housing and Production means	Number of tin shed or brick built houses Percentages of Houses affected badly by cyclone
Financial capital	Finance and Incomes	Percentages of HHs family members whose annual income below Tk. 50000 Percentages of family members remaining idle during or after cyclone Percentages of family members work in a foreign country and earn remittance Number of family members having at least one bank account Overall LVI (weighted average of human, natural, social, physical and financial capitals)

Balance weighted average approach (Sullivan, 2002, Hahn et al. 2009 and Can et al. 2013) was used to measure LVI. Here, each sub-component contributes equally to the overall index so they are measured on a specific scale. So, the equation used in calculating the LVI in Can et al. 2013 and to assess risks in Hahn et al. 2009 were applied in calculating LVI for the present study as follows:

$$index_{sd} = \frac{S_d - S_{min}}{S_{max} - S_{min}} \quad (1)$$

Where,  $S_d$  = value of sub-component for village d,  $S_{max}$  = maximum value for each of the sub-component,  $S_{min}$  = minimum value for each of the sub-component.

The equation for each major component was calculated by the following formula:

$$M_{dj} = \frac{\sum_{i=1}^n index_{sdi}}{n} \quad (2)$$

Where,  $M_{dj}$  = value for major component j for village d,  $index_{sdi}$  = value for subcomponents which is indexed by I of major component  $M_j$  and  $N$  = number of subcomponent under each major component  $M_j$ .

Values of ten major components were used in the following equation:

$$LVI_d = \frac{\sum_{j=1}^{10} W_{Mj} M_{dj}}{\sum_{j=1}^{10} W_{Mj}} \quad (3)$$

And finally the weighted average of  $LVI_d$

$$LVI_d = \frac{w_H H_d + w_N N_d + w_S S_d + w_P P_d + w_F F_d}{w_H + w_N + w_S + w_P + w_F} \quad (4)$$

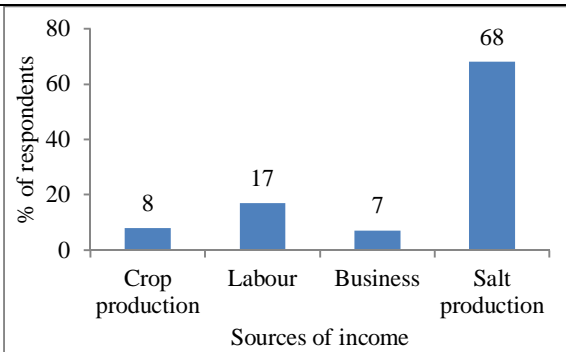
Where,  $LVI_d$  = livelihood vulnerability index of village d (where d for Sapmarar Dail village),  $WM_j$  = weight value of major component j;  $w_H$ ,  $w_N$ ,  $w_S$ ,  $w_P$ ,  $w_F$  are weighted value of assets human, natural, social, physical and financial respectively. The range of LVI is from 0 to 1 where 0 means least vulnerable and 1 means most vulnerable.

### III. RESULTS AND DISCUSSION

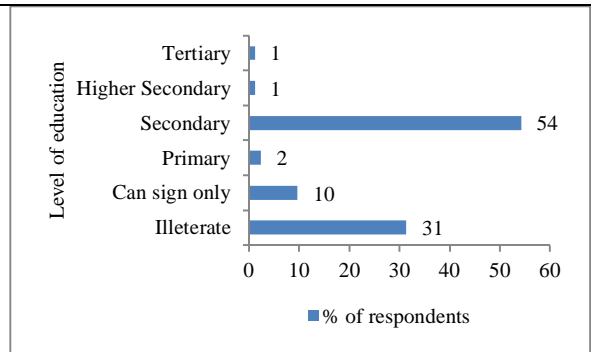
#### General information of the respondents

Salt production was the primary source of income of 68% of the sample respondents followed by hired labour (17%) and crop production (8%) (Figure 2). A small proportion of the respondents (7%) were involved with business. As shown in the Figure 3, 31% of the respondents were illiterate and 10% of the respondents can sign only (Figure 4). Majority of the respondents were marginal (46%) and only a few of them were small (11%) and medium (3%) (Figure 4). There were no respondents belongs to large farm categories in the survey area.

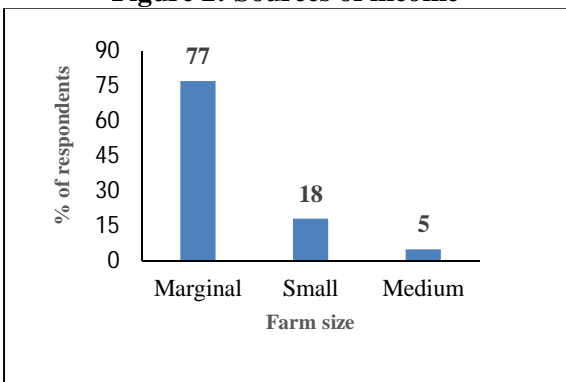
Most of the families were male headed (98%) and only a few of them were female headed (2%) in the survey area (Figure 5). Among the participants, 91% of them opined that they well understand the climate change issues while the rest 9% have no idea about the climate change related extreme events (Figure 6).



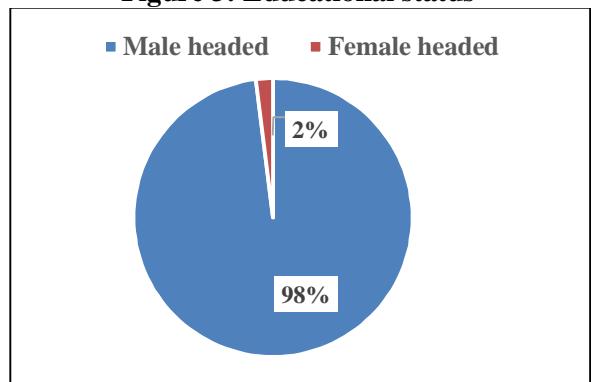
**Figure 2: Sources of income**



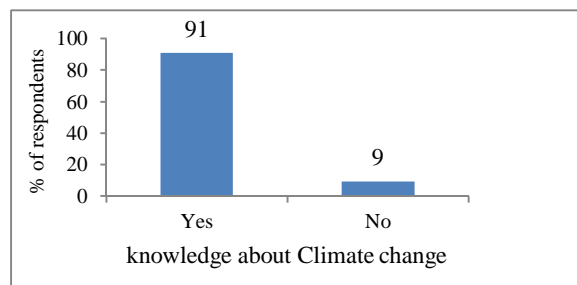
**Figure 3: Educational status**



**Figure 4: Farm size**



**Figure 5: Structure of family**



**Figure 6: Perception on climate change**

### Climate driven problems

Women are differently vulnerable than men to climate change related extreme events in the society for various physical and social reasons. In order to understand women perceptions regarding climate change related vulnerability, two separate FGDs, one with male participants and the other with female participants were conducted. They identified 8 climatic hazards. These hazards were prioritized by the women and summarized in the Table 3. Cyclonic storm ranked highest vulnerability concerns for the women in Dhalghata. The second most vulnerable concern for the women was iron in drinking water. Women were sole responsible to collect drinking water. Due to iron contamination, they has to collect water from distant places which place an extra load to their daily activities. Salinity intrusion, especially contamination of drinking water sources by saline water appeared to be the third highest vulnerable concern for the women in Dhalghata. Beyond these, tornado, water logging, thunderstorm, hail storm and tidal flood were also vulnerable concerns for the women in Dhalghata.

**Table 3: Extent of climate driven problem**

Climate driven problems	Mean of the perception	Standard error	Rank
Cyclonic Storm	9.6	0.22	1
Iron in drinking water	8.3	0.52	2
Salinity intrusion	7.8	0.55	3
Tornado	5.8	0.57	4
Water logging	5.3	0.47	5
Thunder storm	4.8	0.47	6
Hail storm	4.2	0.25	7
Tidal flood	4	0.52	8

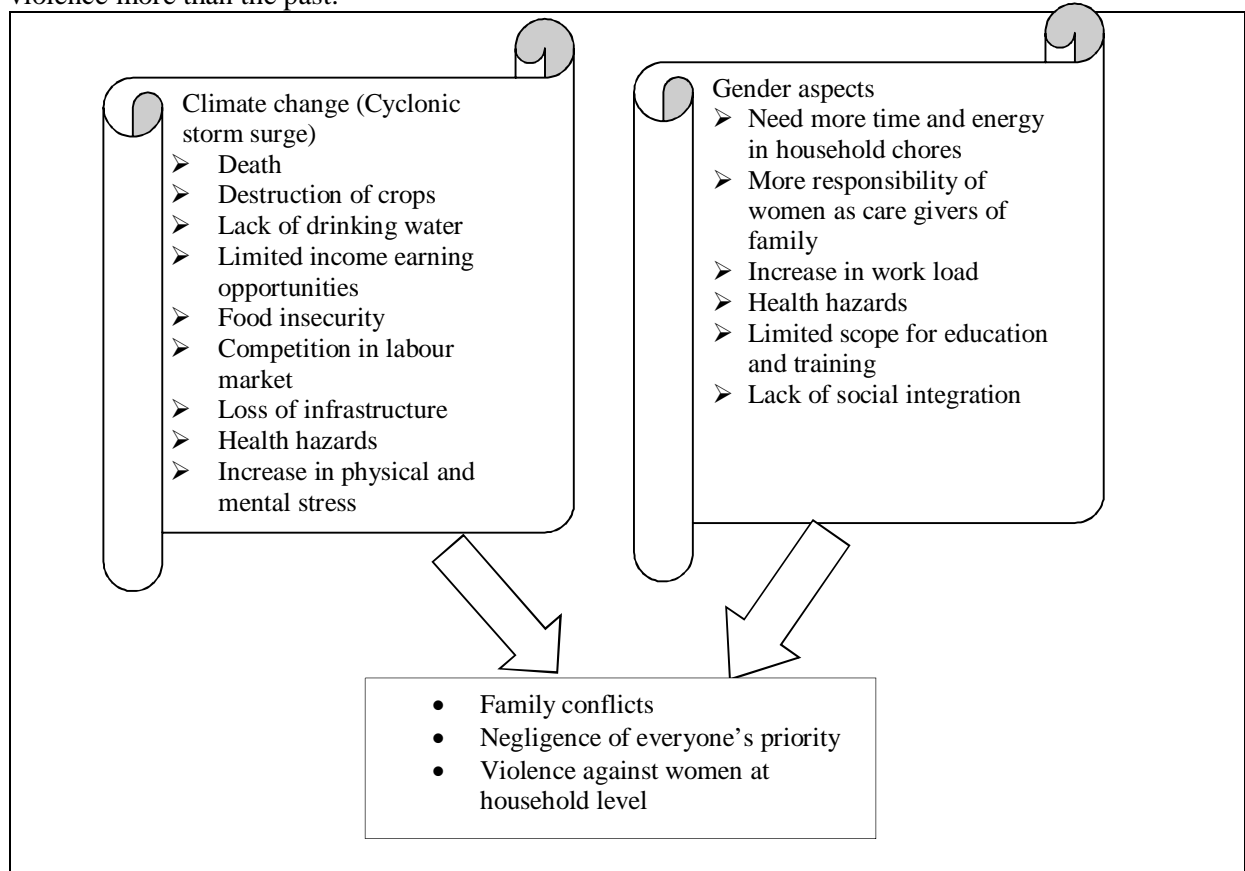
Source: Field Survey, 2019

### Climate change and domestic violence

A cyclonic storm surge in Dhalghata is the primary reason for domestic violence. Figure 7 has outlined the domestic violence through cyclonic storm surges. Death, destruction of crops and food insecurity has been identified as common results associated with such vulnerability concerns (Figure 7). Drinking water became scarce as saline water mixed with all the affordable sources of water. After cyclone high competition emerged in the labour market which shrinkages the income earning opportunities. Besides loss or damage of different infrastructure is a common picture of every cyclone. All these hire physical and mental stress to the affected people. To cope with these effects women had to incur more time and energy to complete daily household chores. Additional responsibility as care givers was also bestowed on women after cyclonic storm surges. Health hazards along with work load limits women's scope to education and social integration. Destruction of livelihood by cyclone gave limited scope to face the situation. Overall food insecurity sank the family and women were the main victim of intra household food insecurity. As houses were damaged or lost completely they have to live in open sky, fetching water from distance places and defecating in the nearby forest. All these invite social insecurity and vulnerable living condition. Finally, the output of a cyclone came as family conflicts and ultimate



victims were the women. The women participants told that post cyclone they have to tolerate domestic violence more than the past.



**Figure 7: Climate change and domestic violence**

#### **Gender differentiated roles and responsibilities in the survey area**

It is evident from Table 4 that there is unequal distribution of roles and responsibilities of male and female in the survey area. In female headed family, women have to take all the responsibilities. All the women in the FGD opined that it is their responsibility to provide food in time to their respective family members even just before any harsh climatic events. Beside this they have a big role as care givers for the baby, child, and elderly people and also for the sick. Drinking water collection is one of the primary responsibilities solely for the women.

**Table 4: Gender differentiated roles and responsibilities in the study area**

Men	Women
1. Managing financial need of the family	1. Food preparation
2. Work for the whole family	2. Homestead gardening
3. Farming	3. Post-harvest processing
4. Food/financial power storage for future	4. Child rearing
5. Business	5. Take care of elderly family member
6. Act as guard during natural calamities	6. Managing fire wood for cooking
7. House building, repair and maintenance	7. Poultry rearing
8. Livestock rearing	8. Water collection for family
	9. Managing all the belongings prior natural calamities
	10. Caregivers for the sick

**Vulnerability of women**

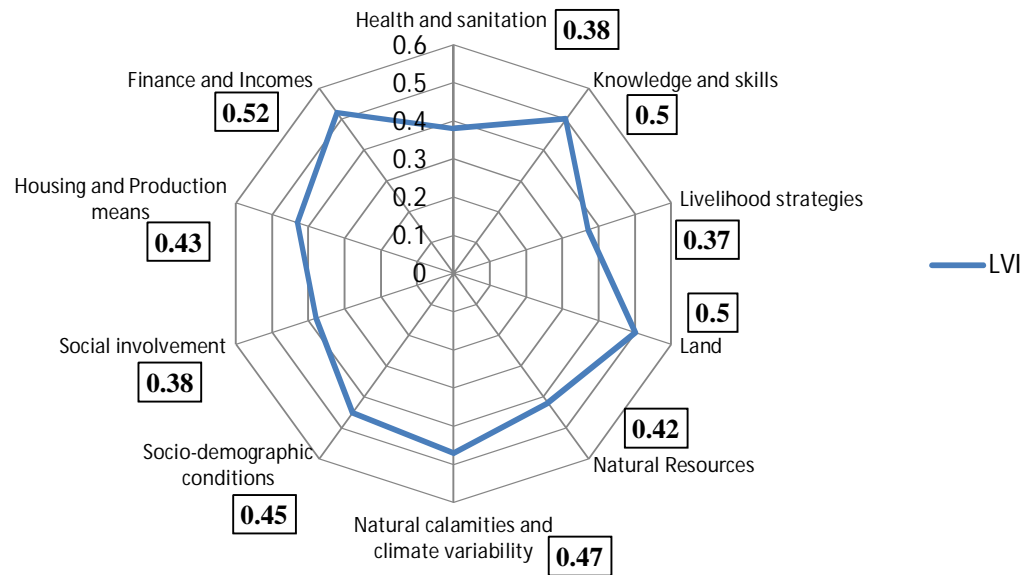
LVI values of all major and sub components and five capitals are presented in Table 5. The overall LVI of Dhalghata Union is 0.44. It means that livelihoods are moderately vulnerable to cyclonic storm surges in the study location. The highest index was found for financial capital where the vulnerability index is 0.52. It means that financial capitals were more vulnerable than the other four capitals. Among the major components knowledge and skills ranked top most vulnerable from other components of human capital. It indicates that post cyclone period respondents got very limited scope in education and training. On the other hand, land got the highest rank from the major components of natural capital. It means that land ownership is the most vulnerable than the other components of natural capital. Most of the respondents belonged to small farm categories and cyclone attacked very badly to all the belongings of land including its crops, salt, fish etc. So, land is the most vulnerable components in case of natural capital. The result is thus high dependency on limited income. Therefore, the vulnerability index of socio demographic conditions is highest (0.45) among the major components of social capital. Under housing and production means of physical capital, percentages of houses affected badly by cyclone has the highest vulnerability index (0.58). This is because houses are the most vulnerable item in any cyclonic storm surges in the survey area. The major component finance and incomes of financial capital has 4 sub-components of which percentages of family members remaining idle during or after cyclone got the highest vulnerability index (0.79). The main cause is high level of competition in labour market along with very limited sources of income in post cyclone period.

**Table 5: LVI of all sub-component, major components and capitals**

Sub-components	LVI value	Major components	LVI value	Capitals	LVI value
Percentages of ill family members	0.38	Health and sanitation	0.38	Human Capital	0.40
Percentages of HHs family members getting illness due to cyclonic storm surges	0.37				
Percentages of illiterate HHs family members	0.25	Knowledge and skills	0.5		
Percentages of literate HHs family members	0.75				
Percentages of HHs family members without any knowledge to cope with cyclonic storm surges	0.38	Livelihood strategies	0.37		
Average agricultural livelihood diversity [1/ (No. of agric. activities + 1)]	0.42				
Percentages of HHs family members agriculture as main occupation	0.39				
Percentages of HHs family members involved only farm activities	0.38				
Percentages of HHs family members no work after cyclonic storm surges	0.37				
Percentages of HHs involved fishing during cyclonic storm surges	0.28				
Percentages of family members with no farm land	0.55	Land	0.5	Natural Capital	0.46
Percentages of family members belongs to small farm (0.19-0.99 ha)	0.45				
Percentages of family members that are not involved in farming other than rice	0.39	Natural Resources	0.42		
Percentages of family members consume pure drinking water	0.79				
Percentages of family members involved in forest resources	0.06				
Average number of severe cyclone in the last 10 years	0.60	Natural calamities and climate variability	0.47		
Average number of deaths/injury in cyclone in the last 10 years	0.33				
Percentages of HHs family members that do not receive cyclone warning	0.50				
Dependency ratio	0.62	Socio-demographic conditions	0.45	Social capital	0.41
Percentages of female family members	0.39				
Total family members	0.35				

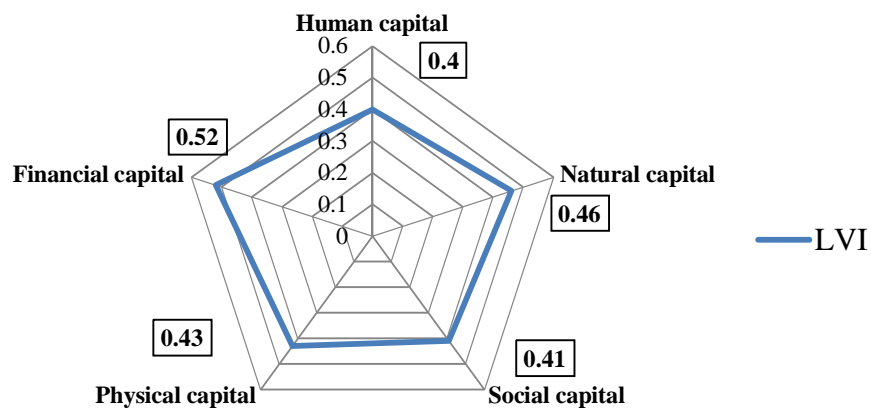
Sub-components	LVI value	Major components	LVI value	Capitals	LVI value
Number of family members involved in organization	0.30				
Number of family members received help due to cyclone	0.53				
Percentage of female family members have ability to take own decision	0.32	Social involvement	0.38		
Percentages of female family members that they think they get proper social honour and independency	0.39				
Number of tin shed or brick built houses	0.28	Housing and Production means	0.43	Physical capital	0.43
Percentages of Houses affected badly by cyclone	0.58				
Percentages of HHs family members whose annual income below Tk. 50000	0.65				
Percentages of family members remaining idle during or after cyclone	0.79	Finance and Incomes	0.52	Financial capital	0.52
Percentages of family members work in a foreign country and earn remittance	0.34				
Number of family members having at least one bank account	0.28				
Overall LVI (weighted average of human, natural, social, physical and financial capitals)			0.44		

The LVI of ten major components of five livelihood assets are presented in Figure 8 through a spider diagram. In the diagram 0 is in the center of the web and it means least vulnerable and 0.6 is in the outside edge of the web means most vulnerable. The diagram shows that all the major components are not equally vulnerable in the survey area. Finance and incomes, knowledge and skills and land are the most vulnerable components and on the other hand, social involvement and livelihood strategies are the least vulnerable components among the major components of women in Dhalghata.



**Figure 8: Vulnerability spider diagram of major components under five capitals**

Figure 9 shows the position of five livelihood assets of Dhalghata women in the survey area. The diagram reflects that financial capital is the most vulnerable assets following by human capital as least vulnerable asset for the women in Dhalghata.



**Figure 9: Vulnerability spider diagram of five capitals**

### Common coping strategies among households

Coping with cyclone is generally related with the ability of every family. Usually they follow a number of coping strategies to cope with pre and post cyclonic damages. Table 6 illustrated the most common coping strategies practices by the survey households in the survey area.

**Table 6: Common coping strategies**

Coping strategies	Description
Relocation to mainland	This is the most common and frequently practiced coping mechanisms in this survey area. A number of families have relocated themselves to the mainland especially to the Cox's Bazar city. Some of them shifted permanently. They shifted in order to earn money to lead their daily life. Besides some of them shifted to be free from climate change related extreme events, to get better education, better work scope etc.
Food reduction strategy	Food reduction strategy is the age old coping mechanism for the poor in case of any crisis. They reduce the food requirement either in quality, diversity and also in quantity.
Sale of livelihood assets	Sale of livelihood assets is one of the post disaster coping mechanisms in the survey area. They sold different types of assets in order to get solvency and to manage their daily needs.
Selling daily labor	This is another option for the poor and marginal households. Though post disaster labor market is very competitive but they had no option at that time even at lower wages.
Borrowing from relatives	Affected people sometimes borrowed from their relatives. This is mainly for short period of time and without interest.
Loans from Mahajan	In the area the rich people are usually the main source of loans. They are called Mahajan. Most of them are living in the Maheshkhali Upazila or Cox's Bazar district. Affected people have to depend on them for loan in the post cyclone period. Usually they charged higher interest rate.
Family migration	This is also a common phenomenon. If the level of damages is high, then they shift to the mainland or other places of Bangladesh fully.

Women in Dhalghata are habituated with the behavior of cyclone from their early life. They thought that cyclone can hit their area anytime of the cyclone season of the year. For this reason, they practice some age old coping strategies to safe themselves from cyclone as much as they can. Table 7 shows the coping practices of women in Dhalghata. All the respondents (100%) opined that they preferred to use mud structures as housing unit. This is because the inhabitants will not hurt dangerously if it completely collapsed during cyclone. It is also easy to repair. In order to use during and after cyclone, all the women were very much habituated to store dry foods as preparatory phase. They stored this in a designated place along with some other lifesaving things such as water, match sticks, candles etc. Cyclone shelter and local mosque were used as temporary refuge during cyclone which was preferred and practiced by 98% respondents. To recover and reduce the magnitude of damages women helped each other. They helped pregnant women, adolescent girls and elderly people and this was practices by 81% of the respondents in the survey area (Table 7).

**Table 7: Coping Practices among women**

Serial No.	Coping practices among women	% of respondents practiced
1.	Use mud-structures to build houses.	100
2.	Store dry foods as a preparatory phase.	100
3.	Use plastic canister to store safe water and bury it in a designated place.	100
4.	Taking refuge in the cyclone shelter and local mosque.	98
5.	Participating voluntarily to repair damaged houses and other belongings.	93
6.	Participating in microcredit programs of various microcredit institutions and accept credit to facilitate household rehabilitation.	89
7.	Cooperative to each other.	82
8.	Help male partners by providing ornaments voluntarily to collect money by selling themselves to mitigate the cyclonic damages.	81
9.	Monitoring flag warning and keep update of the news of warning.	79

**Adaptation needs by women**

Mechanism to adapt to cyclonic storm surges should not be gender blind. The present study identified a number of adaptation needs by the women in Dhalghata through FGD which is outlined in Table 8. Women in Dhalghata need formal and informal education. All the respondents opined that lack of proper education is one of the main hindrance to adapt adequately against cyclonic storm surge related extreme events. Crop production is very difficult in Dhalghata due to salinity intrusion. So, for adapting to the cyclonic storm related extreme events saline tolerant crop varieties can be a best way to renovate agriculture in Dhalghata. Population is increasing very rapidly in the survey area. To place these populations safely in cyclone shelters during disaster capacity and number of cyclone shelters should be increased. Beside this, special attention should provide for the adolescent, elderly people, pregnant women and mother with infant during their presents as refuge in the cyclone shelters. At the same time, women in Dhalghata should be free from patriarchal maltreatment and harassment. They should be free to take decision in order to save their life and other belongings. For this social awareness and positive social attitude is necessary.

**Table 8: Adaptation needs by women**

Serial No.	Adaptation needs by women
1.	Formal and informal education.
2.	Saline tolerant crop varieties.
3.	Increase in number of cyclone shelters and their capacity.
4.	Special provisions in cyclone shelters for the adolescent, elderly people, pregnant women and mother with infant.
5.	Maintaining coastal green belts.
6.	Technology for saline water logging problem.
7.	Availability of disaster information adequately and timely.
8.	Patriarchal maltreatment and harassment free society.
9.	Training on preparatory measures and coping practices.
10.	Freedom in making decision during crisis period. Women need this in order to leave the assets and households with their child and other belongings to be safe from cyclone.
11.	Social awareness and positive attitude towards women.

#### IV. CONCLUSION AND RECOMMENDATIONS

The assessment of livelihood vulnerability is complicated due to many related aspects, dimensions and factors such as natural resources, economic and social conditions, demography. The present study probed into women's vulnerability in relation to men though focusing on some major components and sub-components which are affected by the cyclonic storm surges in Dhalghata Union of Maheshkhali Island. The necessary data and information were collected through household's survey and two focus group discussions. The livelihood vulnerability index under sustainable livelihood framework was adopted to assess the level of vulnerability. The study found differentiated roles and responsibilities between men and women in Dhalghata. Women in Dhalghata regarded cyclonic storm as their most vulnerability concern. Iron in drinking water and salinity intrusion were ranked as second and third vulnerability concern respectively for the women in this island. The highest livelihood index was found for financial capital of women which means that their financial capitals are more vulnerable than the other four capitals. Knowledge and skills ranked the top most vulnerable component among the major components of human capital. On the other hand, land is the top most vulnerable component among the components of natural capital. Likewise, socio-demographic conditions ranked the most vulnerable concern from the major components of social capital. So, it is evident from the study that all the components are not equally vulnerable in cyclonic storm affected Dhalghata women. In order to reduce women vulnerability under cyclonic storm surges in Dhalghata the authority should take care of the needs and wants of the women. Social safety net programme can be a special tool for the women in Dhalghata. In conclusion, this technique of identifying vulnerability level could be used to identify factors of vulnerability and vulnerable communities in different geo-physical regions. It will also helpful for the policy makers to provide need based policies in different vulnerable areas of Bangladesh.



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