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Migration pattern and risk management of climate induced displaced people of coastal area in Bangladesh

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ABSTRACT

Climate displaced persons generally follow the same trails as other migrants, but climate-induced displacement is adding to the pace and scale of human mobility. The prime aim of the study was to investigate the rural to urban migration of climate induced displacement in coastal area of Bangladesh addressing to risks and opportunities. The study mainly based on primary data and secondary data was used for validation. The study reveals that after displacement nearly 89% displaced people migrated from rural (Kutubdia Island) to Cox's Bazar urban area. Consequently, meantime their monthly income, occupational status, housing and sanitation condition, source of drinking water and health care facilities were changed positively but in most cases they are dissatisfied. Because they lost their traditional and indigenous occupations system and their housing pattern and conditions become worsen. Availability of water and sanitation facility and healthcare seeking behavior changed positively in the urban area. Finally, the study revealed that there is risk and opportunity for climate displaced people in urban migration. However, planned/fair migration of climate displaced people can reduce the risk factors in the urban setting.

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INTRODUCTION

Climate change is expected to create global, regional, and local changes in many fundamental approaches of the climate system. Some of the projected climate changes and their associated vulnerabilities imply important consequences for the coastal communities. Coastal area of Bangladesh covered 19 districts, which is the part of 32% of the whole country and there are 35 million people living in the region. The connection between climate change impact by human interferences with the world and environmental vulnerability now been well recognized. Climate change is expected to responsible for people displacement from their living home and land through the four distinct ways: (i) the acceleration of natural disasters together rapid and slow-onset events leading to increased displacement and migration; (ii) the adverse consequences of increased warming, climate variability and other influence of climate change unruly on people livelihoods, health, food security and water availability; (iii) increasing sea levels which generate coastal areas uninhabitable; and (iv) competition over limited natural resources potentially prominent to increasing tensions and even conflict and lastly displacement (Mirza *et al*., 2015; Rahman *et al*., 2016; Barua *et al.,* 2017; Barua

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and Rahman, 2018). From the literature review, it was recorded that there are 26 coastal and mainland districts out of 64 districts of Bangladesh evidence of a climate displacement problem. It also found that about 6 million peoples were displaced from their home and land due to climate change induced natural disasters in Bangladesh (Barua *et al.,* 2017). According to the Norwegian Refugee Council (NRC), near about 50 million people were displaced in 2015 by different natural disasters in which more than 30 million were caused by climate related disasters. Out of 30 million, 1 million were only from Bangladesh (Barua *et al.,* 2016; Barua *et al.,* 2018). On the other hand, it is exposed that because of climate change impact natural hazards, total areas of Kutubdia Island were reduced by almost 50% within the last 20 years. Since 1991 to till date, there are 6 villages on the island have been completely devoured by the sea and about 50,000 people forced to left and most of them took temporary shelter and living now in Cox's Bazar Municipality . The large numbers of these homeless people will be displaced nationally – not across international borders – presenting the government with massive challenges, mostly when it comes to finding locations to live and work for those who have been displaced (Barua *et al.,* 2017). So, the objective of the study was to assess the rural to urban migration pattern of climate change induced displaced people of southeastern coastal areas in Bangladesh, addressing the risk management of displaced people through community based adaptation practices.

MATERIALS AND METHODS

Study area

Authors selected Kutubdia upazila (Sub-district) To assessing the migration pattern and risk management for climate displaced people. Climate susceptibility, displacement rates, land erosion, recurrent disaster has been considered during the selection of the study area for the research. Kutubdia Island situated under the district of Cox's Bazar district with an area of 215.8 km^2 that bounded by the Bay of Bengal. This island created by tidal, supra-tidal and fluvial processes of Ganges river particularly topography is mudflat, sandy and gentle slope (Fig. 1).

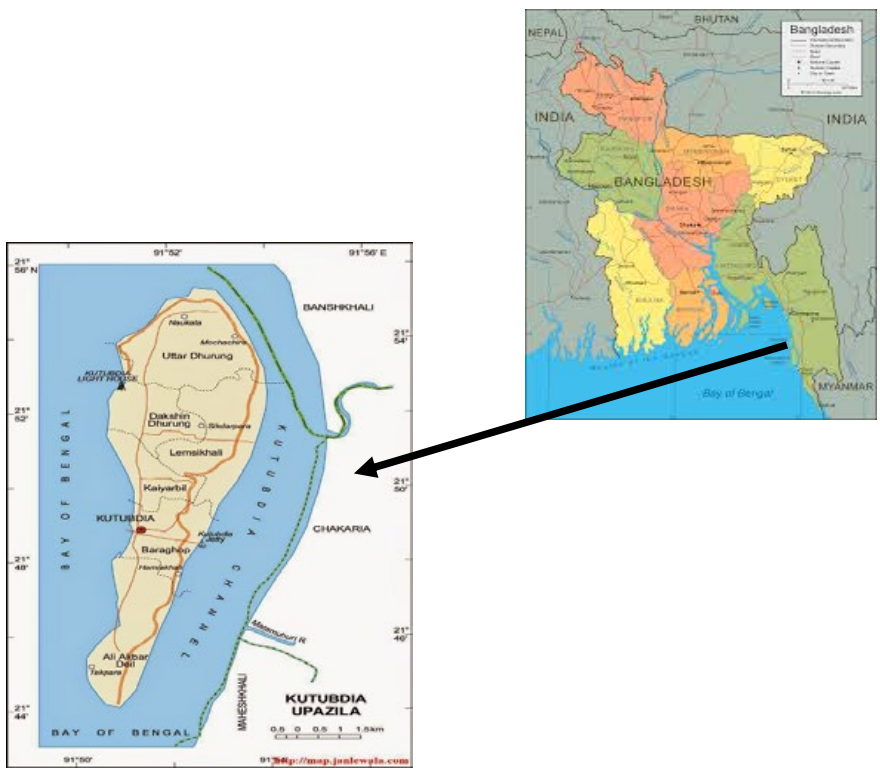

Fig. 1. Geographical Location of the study areas

Two types of data collection methods, namely the qualitative as well as quantitative method were applied to the study work. Qualitative data collected through participant observation, Key Informant Interviews (KII) and Focus Group Discussion (FGD). Besides quantitative data were gathered through questionnaire survey method respectively. Total 10 KIIs were conducted, among 8 KIIs were conducted in displaced areas and 2 KIIs are accompanied in destination areas respectively. The rest of KIIs were done with Additional Deputy Commissioner (Revenue), 2 with union chairmen, 2 with journalists, 2 with Upazila chairmen and Upazila Nirbhahi Officer (UNO) at Kutubdia Upazila respectively. Total 6 FGDs were conducted, among them 4 FGDs were done before displacement (displaced) areas and 2 were conducted after (destination) displaced areas separately.

A semi-structured questionnaire has been applied for quantitative data collection at the household level of displaced people from displaced and destination places. The sample size has been chosen in line with a statistical formula presented by Islam, 2014 (Eq. 1) Sample Size Distribution,

$$n_0 = \left(\frac{z^2 pq}{d^2}\right) \quad (1)$$

Where;

n_0 denoted the desired sample size;

z = standard normal deviate usually set at 1.96, which corresponds to the 95% confidence level (1.96);

p = assumes proportion in the target population estimated to have a particular characteristic (0.50);

q = proportion of the estimation of population (1-p = 0.50);

d = allowable maximum error in estimating a population proportion (0.05) respectively.

Besides, the simple random sampling technique has been adapted for successfully operating of 385 questionnaires at the household level of the climate displaced people.

Data analysis and interpretation

Meaningful data were edited, coded, classified, and tabularized in the consecutive method. Qualitative data have been analyzed with the help of two approaches such as 'Narrative Analysis', besides quantitative data are interpreted with the help of 2 analysis such as 'Statistical analysis' and 'Analytical analysis' respectively. Moreover, statistical and analytical analysis of the study conducted with the help of statistical formula, especially Statistical Package for The Social Science (SPSS: version-20) and various statistical tools such as tables and figures.

PSIR framework analysis for risk management

The Driver Pressure State Impact Response (DPSIR) framework used to explore the vulnerability and community based adaptation in the situation of an erosion prone area of Bangladesh. The DPSIR framework proposed by the European Environmental Agency to address the changes and the trends associated with the environment (Cooper, 2013). The layout of the DPSIR framework generally as a chain of causal links beginning with 'driving forces' (economic sectors, human activities) through 'pressures' (emissions, waste) to 'states' (physical, chemical and biological) and 'impacts' on ecosystems, human health and functions, finally primary to political 'responses' (Bizicova, *et al.,* 2009). Rahman *et al.,* (2014) proposed the integrating principles of vulnerability assessment with existing information on current and future climate change into the DPSIR framework benefits to develop adaptation comebacks that are relevant to other socioeconomic and environmental challenges for climate displaced people. DPSIR approach contributions decision-makers in numerous stages of the decision process. In community and ecosystem based assessment and sustainable management approach in response the vulnerability, the DPSIR tool of Integrated Environmental Assessment will be applied as a strong tool for this study.

Climate vulnerability index analysis

Vulnerability of Climate change is characterized as a function of three dimensions—exposures, sensitivity and adaptive capacity, as follows (Eq. 2)

Vulnerability = f (Exposure; sensitivity; adaptive capacity) (2)

Vulnerability is a positive function of the system's exposure and sensitivity, and a negative function of the adaptive capacity. The authors Climate Vulnerability Index for measure and compare livelihood vulnerability in the context of the coastal area inhabitants living condition (Morton *et al.*, 2008). The present study develops a weighted-balance integrated approach to the calculation of the CVI that

incorporates local and indigenous knowledge into the selection of indicators.

Analysis of chi-square test

For statistical analysis of probability sampling or justification of hypothesis, the research has been carefully applied chi-square test. Following equation has been used for determination of the chi-square test. (Eq.3)

$$\chi^2 = \Sigma \frac{(O-E)^2}{E} \quad (3)$$

Where, O denotes the total number of observation or sample size or observation value and E denotes the expected value.

For statistical interpretation, the null hypotheses (H_o) were adopted for determining the relationship between 'resettlement program and people's displacement' in the coastal area of Bangladesh. For justification of the hypothesis, the study has been applied nine types of indicators such as monthly income, types of occupation, pattern of housing, source of drinking water, sanitation condition, health care facilities, children's education, the nature of security and social and cultural harmony. The indicators have been selected on the basis of Bangladesh Bureau of Statistics, Finance Division, Bangladesh Bank, Ministry of Health and Family Welfare, 2017. Along with, for data authenticity and accuracy, age structure has been discussed

Adaptation Weight Ranking

The criteria's of adaptation are rated using the scale of Low, Medium, and High. The scale is for the ranking of current adaptation practices adopted by The Common Vulnerability Scoring System (CVSS), Version 3. This Scoring System consists of three metric groups: Base, Temporal and Environmental. The numerical formulas were updated to incorporate the new metrics while retaining the existing scoring range of 0-10. Textual severity ratings of None (0), Low (0.1-3.9), Medium (4.0-6.9), High (7.0-8.9), and Critical (9.0-10.0) were defined (Ali *et al.,* 2012). Local people were asked to state their preference and give score about the ecosystem and community based adaptation activities by the GOs, NGOs in the study areas. Total numbers of respondent were 385 who express their perception regarding the adaptation practices taken by different adaptation approaches.

RESULTS AND DISCUSSIONS

Flood, cyclone or storm surge, tornado, drought, coastal erosion or trans-regression, rainfall anomalies (heavy shower or shortage of rainfall), salinity intrusion, thunderstorm and diseases are some of the common climate change induced disasters for the people of Bangladesh (Barua *et al.,* 2017). In coastal areas, inhabitants are familiar with flood (tidal and flash) cyclone or storm surge, coastal erosion or trans-regression, heavy rainfall, salinity intrusion, thunderstorm and suffering different disease also. Hutton and Haque (2003) stated that the coastal population of Bangladesh becoming the displaced persons due to the large scale of river and coastal erosion. The maximum number of poor people don't belong to the land and home; they only have a small piece of land to build a cottage to live in. Once the home erodes into the sea, they become homeless and become displaced person in their home country. Barua et al., (2017) stated that cyclone, tidal flood, coastal erosion, salinity are the major causes of climate displacement in Kutubdia, Maheskhali and Sandwip island. They explored that cyclone is the highest rank of natural disaster that responsible for mass displacement in the coastal island of southeastern islands of Bangladesh. Ciavola *et al.,* (2015) estimated that at least 22% out of a total population of Sandwip Island were forced to migrate to safer places in Chittagong city and other parts of the country as their homesteads were destroyed following unabated erosion. Many former residents of Kutubdia Island left their ancestral homes for a variety of climate-related reasons, and about 50,000 displaced peoples have been living in the Cox's Bazar city located 75 km south of Kutubdia to escape land erosion, floods, cyclones, storm surges, and a rise in sea level (Islam *et al.* 2012). Barua and Rahman (2018) explored that unwilling migration takes place as a last resort to cope with the impacts of disasters in the island of Kutubdia, Maheskhali and Sandwip. They found that 370,000 people of Kutubdia, Maheskhali and Sandwip islands have been experienced for displacement from their living places within 36 years (1980-2016) due to the disaster of cyclone, coastal erosion, tidal flood and water logging (Barua and Rahman (2018). The finding of the present study indicated almost same finding for displacement causes in the climate hotspot in Bangladesh by the all authors. The study found that total seven types of

climate change induced disasters have been recurrent in the coastal area of Bangladesh which depends on the coastal regions (Fig. 2). Most of the people living in coastal zones argued that cyclone, storm surges, and bank erosion are the main climate change induced disasters in coastal Bangladesh. These disasters are familiar, recurrent, and more destructive than others five disasters. Moreover, the coastal people believe that cyclone or storm surge and bank erosion are the main triggers for displacement.

Climate Vulnerability Index for Displaced People

The various dimensions of vulnerability are presented in Table 1. The CVI was 1.452 for the inhabitants of the study area which indicates that households in both areas are vulnerable to climate change and variability

The study households are not only vulnerable to cyclone, tidal flood and coastal erosion, but also to other climatic hazards. The climate change vulnerability index value of the three dimensions—adaptive capacity, sensitivity and exposure-contributed to the CVI of the coastal inhabitant's households. The indicators of 'food', 'water' and 'health' were comparatively higher for Kutubdia people comparable to the earlier studies in the different vulnerable area of Bangladesh. Alarm (2017) found the climate vulnerability index was 0.924 and 0.905 for char dwellers and riverbank households, respectively, which indicates that households in both areas are vulnerable to climate change and variability in Bangladesh. He found that char dwellers are more exposed (0.535) to climate change and hazards than riverbank households (0.506). In terms of sensitivity, riverbank households (0.374) are less sensitive than char dwellers (0.504) which resulted in the higher CVI for the char dwellers. The adaptive capacity is more or less same. Alam *et al.,* (2017) stated that a higher value of CVI in the char and river side inhabitants indicates their higher vulnerability to climate change. The indicators of 'food', 'water' and 'health' were comparatively higher for char dwellers than for riverbank households. The riverbank and mainland households are relatively less vulnerable due to many reasons, such as higher opportunities to diversify their income sources, low dependency ratio, a higher level of education, better economic condition and being better connected to transport and other

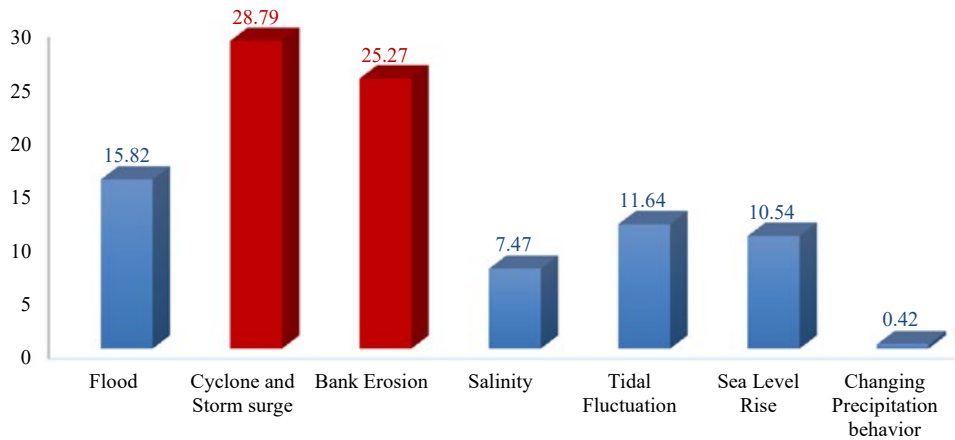

Fig. 2. Causes of Displacement in the study area

Table 1. Climate Vulnerability Index for Island dwellers and mainland dwellers in the study area

Contributing factors of vulnerabilities	Kutubdia inhabitants
Adaptive capacity (Socio-demographic profile, livelihood strategies, and social network)	0.430
Sensitivity (Health, food, and water)	0.540
Exposure (Natural disaster and climate variability)	0.480
Climate vulnerability index (CVI)	1.452

services than coastal islands (Barua *et al.,* 2018).

Gratification of climate displaced people for before and after displacement life

Islamd and Shamsuddoha (2014) found that push factors such as unemployment, lack of housing, poor social facilities, social insecurity, the risk of further disasters, lack of government initiatives post-disaster shortages of livelihood support and lack of public services in the affected areas gave people little option but to move to another place. On the other hand, factors such as employment, income, housing facilities, higher livelihood options and social services including better security pulled them to migrate. The study found two types of displacement/ migration – temporary and permanent. Forced migration was due to the big disasters. Poor people chose temporary migration. The poorest of the poor, particularly the women, children, elderly and disabled people, we're less able to migrate and thus more likely to be stuck in vulnerable locations. The authors identified Two types of destination for displaced people from their origin, such as ownership and outer district (Fig. 3). Fig. 3 demonstrates that most of the displaced people found their destination in their own district (89% in Kutubdia Upazila a) in the study area. However, nearly 10% displaced people found their destination in the outer districts.

In Kutubdia Upazila, choice of majority people is Cox's Bazar and its adjacent Upazilas like Cox's Bazar Sadar Upazila (Including Char Para, Kutubdia Para, Shomiti Para, Kolatoli Moor, Muhuari Para), Chakaria Upazila (Including RongMohol, Cha Bagan, HaiderNashi, Reserve Bazar and Hasinapara at Dulhazara) and Pekua Upazila (Including Malumgat, Mognamaghat) as their destination point. The outer districts and different slums of Chittagong City Corporation areas are BondorTilla, BeriBadh, Near Shah AmanatBridge, Oxygen, and Halishahar and nearby Upazila of Chittagong district like Banshkhali, Anowara and Patiya Upazila respectively. Mallick and Vogt (2014) found that income is the main motivation for human migration during and after the disaster periods, as the male members of the family start moving towards nearby cities to find a job. Ahsan *et al.,* (2014) explored the drivers of migration, the impacts on individual and family

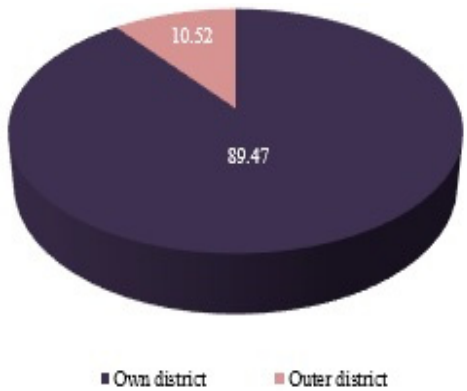

Fig. 3. Percentage of destination for displaced people

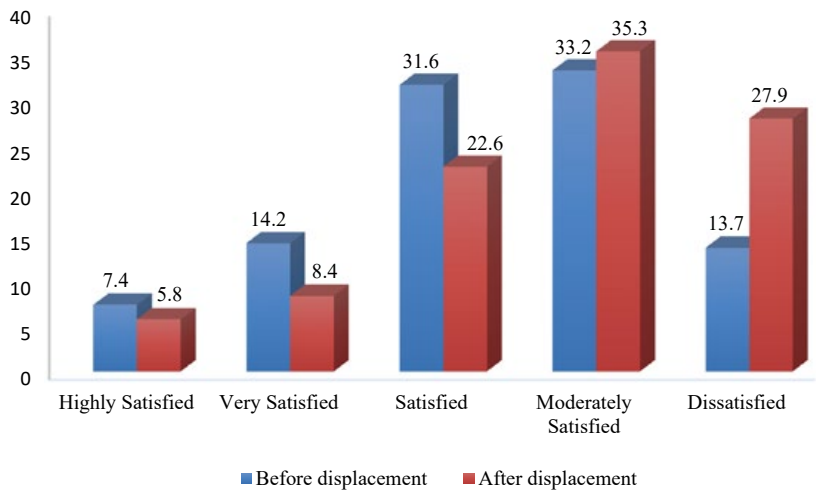

Fig. 4. Monthly Income Before and After Displacement

livelihoods of the explosion of climate migrants and the subsequent effects of urbanization of major cities in Bangladesh. Saha's (2015) findings suggested that the intensity, likelihood, speed of onset, familiarity and the consequences of cyclone were regarded as significant hazard characteristics among the people in Bangladesh. In the study area, monthly income level has changed negatively along with their satisfaction level. Before displacement, people were satisfied (nearly 31.6% were satisfied before being displaced while 22.6% were satisfied after being displaced) with their monthly income (Fig. 4). But after displacement, people were dissatisfied with their monthly income which is 13.7% before being displaced, while 27.9% after being displaced. Before displacement, people were engaged in many occupations and a lot of opportunities were available for alternative livelihood. However, after displacement, homeless people got few opportunities for livelihood. Moreover, in the current location, the cost of living is high and life is insecure, the surrounding is poor, absence of social bonding and feeling of physiological stress is also high.

Islam and Hassan (2016) found that people displaced by cyclone *Aila* were migrating to nearby places due to their financial vulnerability, loss of physical resources and insecurity, and they were suffering severely in terms of unemployment, lack of housing, health problems and poor access to local public services. Islam and Herbeck (2013) found that fishing communities' livelihoods are characterized by a series of vulnerabilities and endemic poverty which contribute to their migration decisions. In the present study, the authors found that types of occupations of climate displaced people before and after displacement was negatively impacted, i.e. the dissatisfaction level rose from 16.3 % to 30.5% (Fig. 5). Although in the before displacement situation, villagers were engaged in different types of occupation like fishing, day labor, small business, boat driving, and farming -- as a result nobody was unemployed. But unemployment problem was a common scenario in after displacement areas. In original areas, people took on traditional occupations which were practiced from their father and grandfather, besides brotherhood existed between occupation owners and workers. As a result, nobody was left unemployed. Also in destination areas, displaced people faced new or unknown environment where none of them were known. As a result, they could not get themselves engaged in new occupations easily. Finally, they faced hardcore poverty, eventually getting engaged in different informal activities.

Barua *et al.,* (2017) stated that The rural islanders built their houses with locally available woodcraft, artesian using wood, bamboo, CI sheet (tin) and other thatching materials. They explored that the displaced people of Kutubdia, Maheskhali and Sandwip upazila totally unsatisfied for their present condition of housing in the destination place rather than origin. In the present study, the authors found that housing conditions of climate displaced people in before

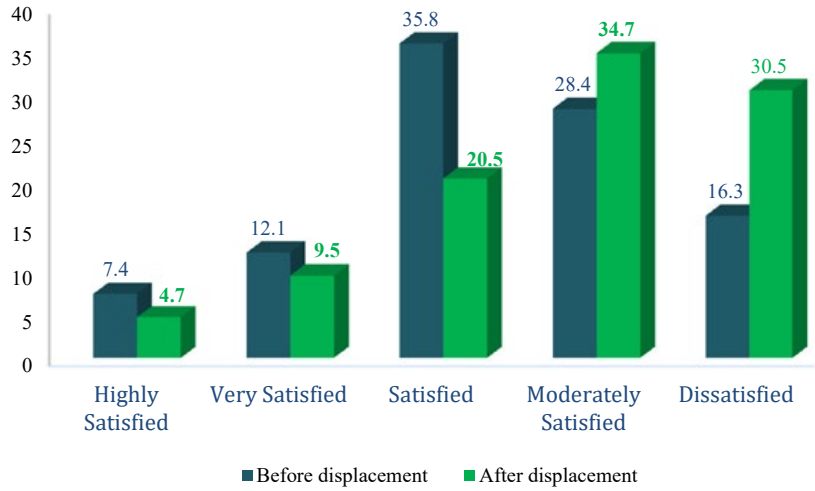

Fig. 5. Pattern of occupation before and after displacement

and after displacement situation were significantly changed, i.e. The satisfaction level increased from 56 % to 41% (Fig. 6).

Though, the houses were made through materials like polythene, earthen wall and floor and straw built a roof on before displacement areas but after displacement, displaced people depended on house owners if they were rented otherwise they would also live in the same house like before displacement. In slum or destination areas people made their household or rent a brick-built house where low space of the room, poor ventilation or lightening, high house rent, and the marshy environment created the unhygienic dwelling in those areas. Consequently, their level of satisfaction was decreased. Sources of drinking water of climate displaced people in before and after displacement areas were little changed (Fig. 7). In the study area, villagers had collected their drinking water from the same sources, particularly tube well, well, pond/doba, river, and neighbor's tubewell. Although after being displaced, displaced people were drinking from the same sources, but very few displaced family had the opportunity to collect the pipeline water in urban slums areas. Yet urban slums areas' displaced people were dissatisfied to meet the sources of drinking water.

Health care facilities of climate displaced people in before and after displacement areas were good (Fig. 8). In the study area, villagers received health care services from *Polli* Doctor in the pre-displacement situation.

On the other hand, after displacement, displaced people received healthcare services from local pharmacy, Polli doctors, union/upazila health care centers and government medical centers respectively. Although displaced people weren't easily getting the ongoing health care facilities, those are provided by the government related agencies. Because displaced

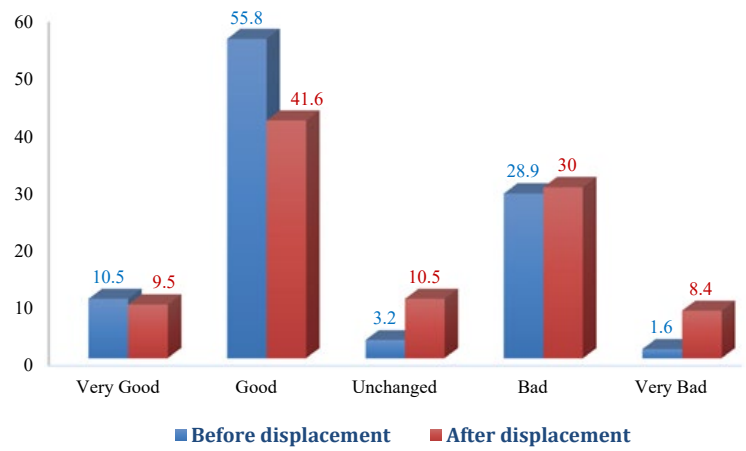

Fig. 6. Housing Pattern in the before and after Displacement Situations

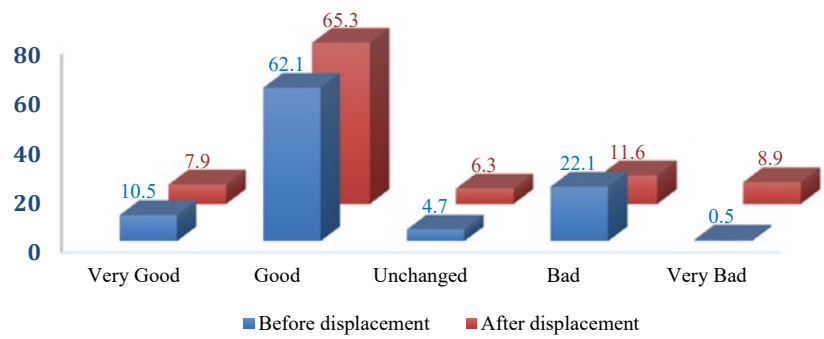

Fig. 7. Sources status of drinking water for displaced people

people didn't get the 'National Identity'-NID from local elected body. So, the satisfaction level was declining in displaced areas. The health and hygienic conditions of these areas were usually very poor, which in the long run might cause health hazards (Mallick and Vogt, 2014). Paul and Islam (2015) found that such people live with inadequate social services and limited access to public services. In another study, Islam and Hossain (2014) found that the government and NGO services are very limited for those displaced people and most of them live in *khas* land (government owned fallow land, where nobody has property rights) where further displacement can affect their livelihoods. From this finding, we can see that the disaster maximizes 'exclusion' for the original community and 'inclusion' pressures in the new community (i.e. Where they move to) (Mallick and Vogt, 2014). During the time of Key Informant Interviews (KIIs), different information were explored that in the Kutubdia Island area, villagers only felt risky of natural disasters before displacement. But in after displacement situation, displaced people felt not only risky of natural disasters, but also harassment by local politically influential people, and gangster / muscle men. However, in the post displacement situations in Cox's Bazar, Chakaria and urban slum areas, displaced people are facing identity crisis, political harassment, and violence of by musclemen. Expert opinion reveals that displaced people were facing a lot of negative behaviors by the society, social stratification, local political and muscle men violence, economic crisis because nobody trust them, psychological stress, loss of social, cultural norms and value and so on. As the lifestyle of the displaced people is very different from local inhabitants, they are not accepted so easily in the community. Along with that displaced people are deprived of their rights, dominated by the local people, threatened

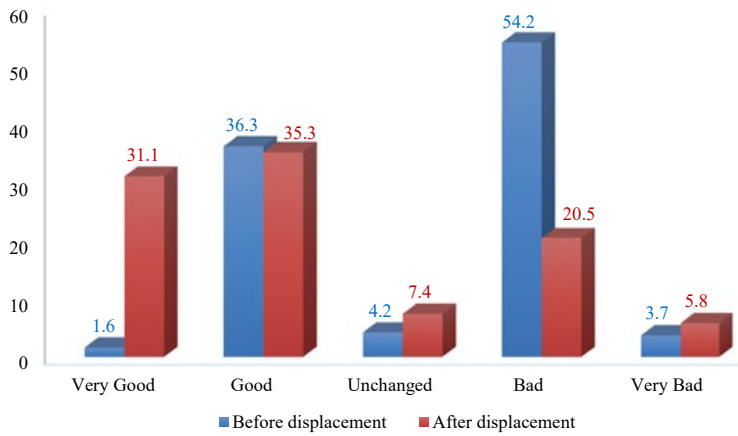

Fig. 8. Health Care Facilities before and after Displacement

Table 2. Socioeconomic condition of displaced people comparing with before and after displacement situation

1st Variable (Before displacement)	2nd Variable (After displacement)	Study Area- I (Kutubdia)				
		Chi-square (X^2-)				
		Cal value	Tab value	Result	df	Sig.*
Monthly Income	Monthly Income	40.45	26.29	14.16	16	S
Types of Occupation	Types of Occupation	45.20	26.29	18.91	16	S
Pattern of Housing	Pattern of Housing	34.74	26.29	8.45	16	S
Source of drinking water	Source of drinking water	1.44	26.29	-24.85	16	NS
Sanitation condition	Sanitation condition	62.46	26.29	36.17	16	S
Health care facilities	Health care facilities	1.26	26.29	-25.03	16	NS
Children education	Children education	1.26	26.29	-25.03	16	NS
Nature of Security	Nature of Security	77.35	26.29	51.06	16	S
Social and cultural harmony	Social and cultural harmony	55.26	26.29	28.97	16	S

*S= Significant, *NS = Not Significant, df = degree of freedom, significance at the level of 0.05

and afraid, and victimized for their marriageable offspring. They often face an identity crisis as well. Local people also tend to show, unwilling behavior when the displaced people sent their children for education and also they were deprived of basic and urban amenities. From the above discussion, it is seen that the types of migration and socioeconomic consequences are highly dependent on the social and ecological contexts to and from which people move (Locke *et al.,* 2000). Black *et al.,* (2011) described five categories that drive migration: social, political, economic, environmental and demographic. These five drivers might interact or overlap in different ways in different places. Of these, five categories, climate change is generally understood to primarily influence the 'environmental driver' of migration. It, however, influences the 'economic driver' by affecting employment opportunities, income, wages and well-being. The experts agree that migration decisions are generally context specific and based upon multiple determinants. In Bangladesh, as a whole, the sea-level rise is most often cited as a primary cause of mass displacement. The objective of this study is to explore the types and nature of climate induced human displacement and migration, and their socioeconomic consequences.

Statistical relation of socioeconomic conditions of displaced people

When people are temporarily displaced during any disaster, they are able to return their home for a certain period if their homesteads remain safe. However, if they lost their homestead they have to find the alternative shelter to survive. People's displacement in Kutubdia is a common phenomenon as a result of climate change induced disasters. The people of this upazila are moving here and there after displacement to find the shelter and livelihood to survive. Often they are to start everything newly in new place such as shelter, environment, livelihood, lifestyle, which put them very challenging situation. Table explores the relation between socioeconomic condition of displaced people in the pre and post displacement situation of both the study areas. In order to analyze the data more strictly, an attempt has been made to statistically interpret the relationship between socioeconomic condition of displaced people in the pre and post displacement situation (Table 2). For this aspect, a null hypothesis is as,

H_o: there are no changes of socioeconomic condition of displaced people comparing with before and after displacement situation.

Chi square (X^2) test has been performed after cross tabulation. Table 2 shows the results with the levels of significance for the chi-square (X^2) test. Rejecting the null hypothesis- there is no association or significant difference in frequency occurring socioeconomic condition between the pre and post displacement. The chi-square (X^2) test results indicate that a significant difference exists in socioeconomic condition between the pre and post displacemen. In both study areas. Table 2 illustrates that monthly income, types of occupation, pattern of housing, sanitation condition, children educational status (study area-II) and the nature of security were significant [Hypothesis (H_o) = Cal $_{value}$ >Tab $_{value}$ = Significant] in the pre and post displacement in both study areas. As a result, the null hypothesis (H_o) was rejected and the alternative hypothesis (H_1) were accepted. Besides, source of drinking water and health care facilities were non-significant [Hypothesis (H_o) = Cal $_{value}$ <Tab $_{value}$ = Non-significant] in the pre and post displacement in both study areas. As a result, the null hypothesis (H_o) were accepted and the alternative hypothesis (H_1) were rejected. From the study it is found that changing patterns of monthly income of climate displaced people in pre and post displacement situations was significant (Table 2). Although their income level positively changed from pre to post displacement situation, satisfaction level was low compared to the pre displacement situation in both study areas. Displaced people claimed that although their monthly income increased, it was insufficient in their families. Besides, types of occupations of climate displaced people in the pre and post displacement situation were significant (Table 2). Housing condition of climate displaced people in the pre and post displacement situation was significant (Table 2). The housing pattern did not change in the pre and post displacement situation in the study area, though people moving beyond their island or Upazila after a certain period find the shelter and livelihood. Sources of drinking water of climate displaced people in the pre and post displacement situation were non-significant (Table 2). Hence, same proportions of drinking water sources and their satisfaction level were non-significant of null hypothesis. Health care

facilities of climate displaced people in the pre and post displacement situation was non-significant (Table 2). The social and cultural harmony in the pre and post displacement situation was significant (Table 2). After displacement from the study area, displaced people were facing a lot of negative things such as specified by the society, social stratification, local political and musclemen violence, economic crisis because nobody trust him, psychological stress, loss of social, cultural norms and value and so on. As the lifestyle of the displaced people is very different from the local settlers, they are not accepted so easily in the community.

Risks management for displaced people

From the study, it is found that the cyclone / storm surge and erosion were major in the study areas and created for mass displacement. However, every disaster hindered the life and livelihood, but the cyclone/ storm surge and erosion is devastating among them. Furthermore, the study area is more susceptible to climate change induced disaster because of gradually eroding. For this reason, the villagers are losing their livelihood. At this point of view, climate changes induced victims, not to lose their life, but their house, land properties and stored resources. The dyke's influence of the inflammation rate of erosion and sedimentation, has also been recognized as a threat of losing land in the study area. On the other hand, an impulsive, increasing trend of tidal saline water flooded the fertile agriculture land and increased the rate of salinity level into the sediment, decreased fertile crop land and also reducing the crop production due to reduction of agriculture land in the study area. Inhabitants of the study area are practicing the salt farming in the

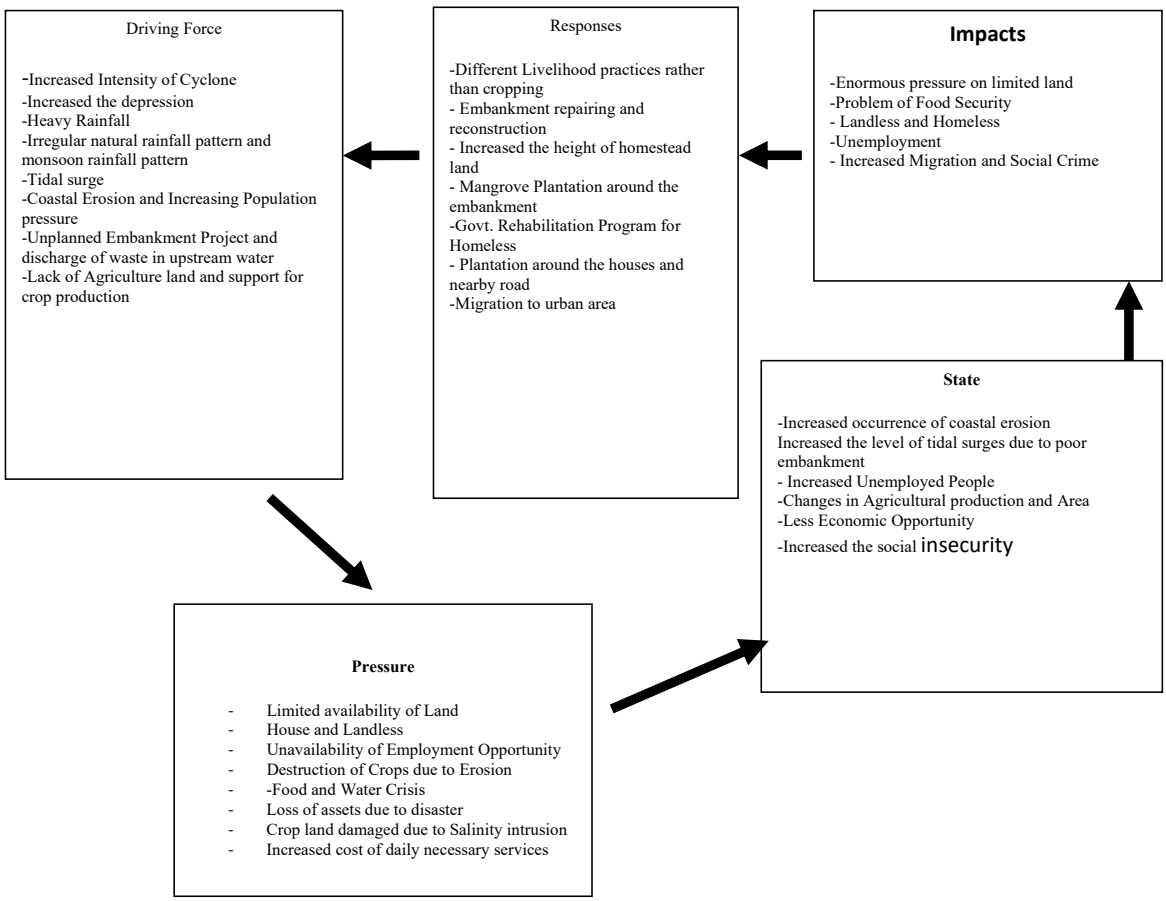

Fig. 9. A DPSIR Framework Model for Responses of Climate Displaced People

abandoned paddy field and mangroves near the embankment uprooted by the greedy people. This activity is creating the poor situation of the existing embankment in the study islands and tidal water easily entrance in the villages of the study areas through the damaged part of the older and the embankment. The vulnerabilities and responses of the communities and different possible attempts for risk management of displaced people of the study area have been depicted from the DPSIR framework (Fig. 9).

During the household survey, it was found that inhabitants of Kutubdia peoples have been bound to change their occupation. Before being affected by erosion, most of the people were involved in agricultural activities and fishing was their seasonal occupation. After losing homesteads and lands due to erosion they fell in the lowest tier of the economic condition as they lost the only means of income. As most people (48.9%) lost 2 to 4 *kani* (968 kani equal1 acre) agricultural land while the big farmers lost more than that. Moreover, more than two third (81%) people lost 2 to 5 *kani* lands as a homestead and garden in the past.. These mechanism (loss of land) converts the landowner into landless. Landlessness offer displacement with extreme poverty which forces them to sell their labour as a day labour while the most disable people are turned into beggars. In the study area, before coastal erosion nearly 85.7% island dwellers were involved in farming or agricultural activities and after erosion they turned into mainly day labour (42.9%) or were involved in *Jhuta kaj* (19.1%) (Daily works based on availability), fishing (19.1%) or other profession (11%) respectively (Fig. 4). Moreover, the percentage of illiterate (69.9%) people may prove that after erosion people were unable to do any institutional or other works related with education. Due to shifting occupation their income level decreased (89.3%) and availability of work reduced (Fig. 10). As a result, unemployment and poverty never left their side.

Nearly 43.2% villagers of the study areas wanted to remain as renter or in the temporary shelter by making adjustment with landlords. A representative portion (16.3%) wanted to live with kin while 19.1% chose neighbors' companion after erosion. Besides, about 90% inhabitants of the study area went to Cox's Bazar and Chittagong city in search of works purposes and 50% people migrated to both Chittagong and Cox's Bazar because of having good relationship with kin's and seeking for livelihoods. It is interesting matter. About 62.4% inhabitants have been displaced from their houses from nearby areas and wanted to stay here due to lower land price (Fig. 11). Besides, 25.4% respondents displaced shifted their houses from other unions or char lands and a very few portion migrated from villages to nearby town areas, colony and government land. Though for future migration, more than two third (79.4%) displaced persons want to stay in their present areas but 15.9% inhabitants are kept the decision on the wish of the almighty.

The qualitative survey has explored that displaced people have been in flux in urban slum areas. In these circumstances, displaced people didn't enjoy their cultural harmony, social status, social bondage and a natural lifestyle in urban areas. Furthermore, the displaced people were left out of ongoing social safety net programs and fell in inaccessible situations to get their children into school, children education program, community based health care facilities and were not easily getting the authorization of the local administrative body. Moreover, there are some misconceptions among local people such that the displaced people are involved in many anti-social activities, particularly local violence, robbery and ransoming, drug business activities and so on. Consequently, local people were unwilling to create any kinds of social bondage like marriage, community based get-together, social and cultural events with displaced people. Parvin *et al.,* (2008) advised that understanding a community's unique perception and assessments of their adaptive and proactive capacities is important in creating successful risk management for rehabilitation of climate migrant programs. Mitchell (1987) also suggested that the development of effective hazard-reduction programs requires cooperation and exchange of experiences between hazards affecting the community and local government (Marfai *et al.,* 2007). Therefore, this paper has tried to disclose people's perceptions about coastal hazards, their vulnerabilities to these hazards, and the adaptation practices they employ to cope with a variety of hazards for risk management. Along with the understanding of people's perceptions and coping methods in different hazards, this study has also

tried to highlight the efforts of government (GO) and NGOs in coastal hazard management. Climate displacement is not an issue of future it is already underway in many countries like Bangladesh. After displacement, island people are moving in different places, especially Cox's Bazar area, Chittagong city and nearby hill areas. They generally make shelters in the polder area with the hope of relief that has been proven by government and different organization. The residents of Islands have been trying to protect themselves since people started to live here. The study revealed that most adaptation strategies of the households were autonomous. It also found that households in the study areas have individually trying to adopt applying very traditional and manual methods namely indigenous knowledge (IK). However, the households also acted as a group, led by the social leader, in requesting government assistance so that they could cope with the climate change vulnerabilities. Their action may be considered as one type of collective adaptation. Governments of Bangladesh also attempted adaptation measures for protecting the peoples of Kutubdia from displacement. Some approach seems to be successful and some methods found failure (Table 3).

Kazi *et al*., (2015) suggested for the plantation of salinity resistance and green belt around the embankment at Coastal area of Bangladesh for protects the people for displacement risk from climate change induced natural disaster. During the study, it was found that Bangladesh Forest Department planted salinity resistance trees around the island. Besides, experts during the Key Informant Interviews suggested for taking initiative to develop uninterrupted coastal afforestation cum embankment by salinity resistant and indogenetic species (Table 4).

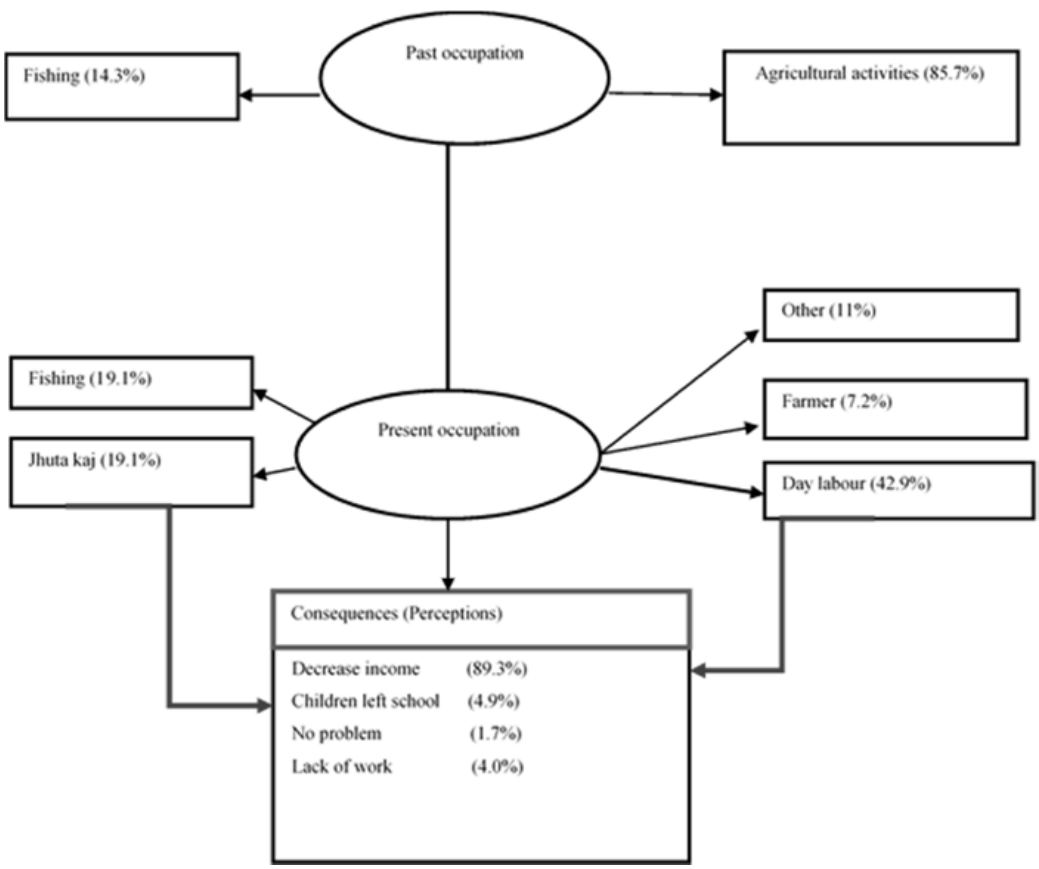

Fig. 10. Relationship between occupation and income status of the displaced people

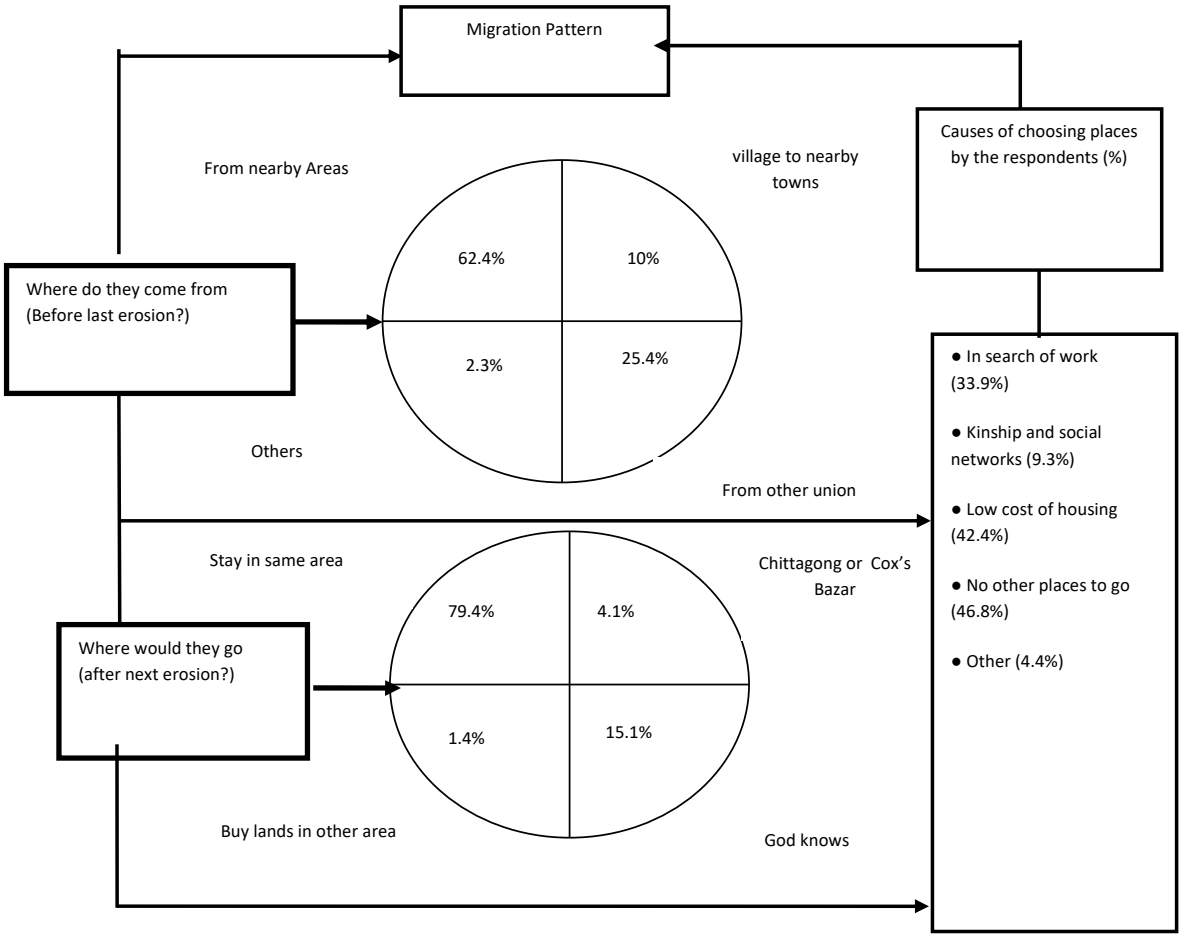

Fig 11. Migration pattern and causes of moving after displacement by erosion

CONCLUSION AND RECOMMENDATIONS

From the study, it is explored that there is a significant gap in coordination among the various government agencies and also between the government and non-government initiatives in the contrary of cyclone, flood, erosion and other climate change induced natural hazard. The government initiative is mostly highlighted about the some subsidy programs that are relief distribution, Vulnerable Group Feeding (VGF), Vulnerable Group Development (VGD), etc., However, these social security strategies found inadequate, mismanagement, politicized, ad-hoc and ineffective; so, there is most possible for the improvement of government initiatives. Close coordination is prerequisite to reduce the problem among different local government institutions. Besides, some NGOs have specific programs especially for climate change induced displaced families, although they make large efforts in addressing the other natural disasters, both natural and man-made. Climate induced disasters are recurrent, and reduce and interrupt the development activities and weaken the 'development wheel' due to an influx of displaced people in urban and semi-urban areas. These disasters are also responsible for destroying the extensive and highly productive low-lying coastal areas that are home to millions of people who have to relocate permanently. The process declines the poverty line and interrupts the achievement of the Millennium Development Goals (MDGs). During the rehabilitation of the climate displaced community in the study area, there should be a resettlement approach for livelihood security and

development of health care facilities, services and education. NGOs should provide elastic micro credit schemes for the affected people so that they can instantly restart their income generating activities. NGOs can campaign for rights- based advocacy campaign so that affected people may be encouraged to demand access to education, health care, water, sanitation and work opportunities as part of their rights. On the contrary, it is also important to develop skills of the respondents to cope with the problems. As the displaced persons are suffering mostly for shelter less life, house building materials such as tin, doors/windows, bamboo sticks, trees, and livestock are important items for re-building lives of the affected people and they can also be rehabilitated by making. *Adarsha Gram'* (Village having farming and other facilities). The respondents in the study area have lost their previous profession of farming. For these people the government can consider insurance schemes at soft premiums so that effect of loss of crops, trees, dwelling structures can be minimized and such families could make a fresh start. Besides, *Khas* lands have to be distributed among the people for cultivation and rehabilitation with giving the priority to most affected victims. Irrigation was identified as one of the top priorities of those still struggling to maintain livelihood in the agricultural sector along with supplying of quality seeds and fertilizer for the farmer timely and adequate. So, the alternate livelihood measures such as industry related

Table 3. Adaptation practices and weight ranking of their effectiveness in the study areas

Adaptation Practices	Level of Quality					Weightage Analysis		
	Excellent	Very Good	Good	Fair	Poor	Total Frequency	Weight	Ranking
Coastal Afforestation on the slopes of embankment and roadside	150	135	90	10	00	1580	4.32	High
Plantation around the homestead area	125	130	90	40	00	1495	4. 09	High
Govt. Khas land distribution for rehabilitation of displaced people	75	135	160	15	00	1425	3.90	Medium
Sluice gate constructed and regularly maintenance of tidal water controlled	10	90	165	80	40	1105	3. 02	Medium
Brick builds and earthen wall surrounding the house, especially the front side of the door	25	110	145	100	05	1205	3.30	Medium
Tying Roof of House with Veranda and Mud walls with Wooden Pegs Fixed to Ground	90	130	125	40	00	1425	3.90	Medium
Tying roof to mud walls of the house	30	120	158	75	2	1256	3.46	Medium
Short height house construction	15	110	150	90	20	1165	3.19	Medium
Increase the heighten of the dike along the houses	20	85	185	78	17	1168	3.2	Medium
Bamboo revetment or Bandalling of Bamboos for Erosion protection	8	69	112	129	67	977	2.67	Low
Concrete-pole breakwater system for protection from erosion	45	95	135	100	10	1220	3.34	Medium
Setting new poles diagonally around the house	28	111	143	89	14	1205	3.30	Medium
Develop the Cluster village/Ashrayan/Abasan program	79	97	124	76	9	1316	3.60	Medium
Building houses on raised platform	66	165	125	19	10	1413	3.87	Medium
C.C block Embankment set up for erosion protection and attraction for tourism	85	165	123	12	00	1478	4. 04	High
Gathering foods and crops under the soil and safe place from the fields	22	89	195	75	4	1205	3.30	Medium
Micro credit loan without interest or low interest from Go and NGOs	3	55	145	86	96	938	2.56	Low
Production of short duration, high productive year round based crops and vegetables in the crop field and homestead area	55	97	159	74	00	1288	3.52	Medium
Pond excavation & raising boundary of pond	34	85	148	115	4	1188	3.25	Mediu

Table 4. Plantation of Saline resistant and tree for green belt at coastal area of Bangladesh as an adaptation option from erosion

Local name	Scientific name	Family	Habit
	Salinity resistant trees		
Sundari	*Heritiera fomes*	Sterculiacede	Big or large tree
Keroa	*Sonneratia apetala*	Sonneratiaceae	Small tree
Narikel (coconut)	*Cocos nucifera*	Palmae	Tree
Babla	*Acacia nilotica*	Leguminosae	Medium tree
Sisu	*Dalbergiasissoo*	Leguminosae	Medium tree
Kakra	*Bruguiera sexangula*	Rhizophoraceae	Medium tree
Keroa Babla	*Pithocello biumdulce*	Leg uminosae	Tree
	Tree for Green belt at coastal area		
Hijal	*Barringtoniaacutangula*	Myrtaceae	Medium tree
Supari	*Areca catechu*	Palmae	Large tree
Khajur	*Phoenix dactylifera*	Palmae	Medium tree
Tetul	*Tamarindus indica*	Leguminosae	Big or large tree
Bans	*Bambusa spp.*	Graminae	Medium tree
Silkoroi	*AlbiziaproceraBenth.*	Leguminosae	Medium tree

to fishing, agricultural goods and handicrafts may be more effective solutions for creating employment opportunity. Adequate supply of dry food, medicine and mobilization of health care providers with proper incentives is essential to ensure services to the victims of riverbank erosion. For providing health facilities to the displaced persons local government and NGOs should take special initiative by providing tube-wells or water purification tablets as well as to build sanitary latrines or to create awareness about sanitation among the char and main land people. Besides, credit or loan with easy condition or lower interest should be given in agriculture and other sectors. To stop early marriage and physical threat to women the government should also promote programs for eroded women focusing on developing their economic opportunities such as a) access in family property or assets, b) access to credit and start business c) acquire marketable skills d) make them conscious about their rights. To enhance literacy rate educational facilities must be increased in the erosion prone areas particularly in the char areas at least the primary level of education should be ensured. The educational institutions have to be built in safer, but easily accessible places for the displaced students. Therefore, the study has prescribed the following recommendations with a stress on considering the opinions of different stakeholders, especially experts, researchers, academicians, planners, local government representatives, related government high level officials and their related agencies, journalists, local public representatives and so on. These recommendations would ensure a planned/fair migration of climate displaced people and reduce the risk factors in the urban setting such as,

- Government should ensure civilian rights of displaced people, mainly humanitarian assistance in emergency period, housing and shelter, land, food, water and sanitation, education for school children, health care facilities, freedom of movement, and right to choose their residential location and relocate.
- Strengthening the existing climate change or disaster related laws, rules and policies and reviews and updating the aspect of the contemporary situation, particularly the rights of displaced people and protect their social, cultural naturalization.
- Government or related agencies should ensure the priority based rehabilitation program of the displaced people to get *khas* land at before and after displaced situation.
- No-specialized resettlement program or *'Community Based Resettlement Program'* means boundary less area, non-specificity and does not remark the displaced people and their livelihood areas. It will ensure their permanent settlement, dignity, livelihood, social-cultural harmony, and local integration. As a result, they will create their legal representatives and welfare committee. Finally, they will be united and strong, and be able to protect themselves.
- Government should ensure that all these people get to live in free and fair conditions without any political and illegal influences during rehabilitation program.

- Government should ensure proper coordination among stakeholders, particularly government related agencies and NGOs/development partners. It will ensure the relocation/rehabilitation of displaced people in the most efficient way.

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CONFLICT OF INTREST

The authors declare that there are no conflicts of interest regarding the publication of this manuscript. In addition, the ethical issues; including plagiarism, informed consent, misconduct, data fabrication and/or falsification, double publication and/or submission, redundancy have been completely observed by the authors.

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