Disaster Risk and Community Vulnerability: the Case of Patuakhali, Bangladesh

Kulatunga U, Wedawatta G, Amaratunga D and Md. Shamsuzzoha

Dr Kulatunga U
School of the Built Environment, University of Salford, UK
E-mail:U.Kulatunga@salford.ac.uk

Mr Wedawatta G
University of Coventry, UK
Email: ab4131@coventry.ac.uk

Prof Amaratunga D
School of the Built Environment, University of Salford, UK
Email: r.d.g.amaratunga@salford.ac.uk

Mr Md. Shamsuzzoha
Patuakhali Science and Technology University, Bangladesh
Email: zohageo@gmail.com

Natural disasters have the potential to damage the entire economy of a country, especially when they take place in the developing countries. While no country in the world is entirely safe, the lack of capacity to limit the impact of hazards and bounce back after major natural disasters has made developing countries being some of the most vulnerable nations to natural disasters. Bangladesh is a South Asian developing country that faces variety of problems ranging from low income; a lack of assets such as land and permanent housing to accommodate the people; shortages of clean water and adequate food; inability to participate in commercial activity; high population density. Owing to geographical settings and environmental reasons, Bangladesh is currently ranked as one of the world's most disaster-prone countries in the world. The frequent natural hazards such as cyclones, storm surges, floods, droughts, tornados, riverbank erosions, earthquakes, arsenic contamination of groundwater and landslides account for significant losses in human lives and physical assets while effects are further reflected in social settings, ecosystems and the economic well-being of the country. This paper evaluates the disaster risk and vulnerable factors in Bangladesh with particular reference to Patuakhali coastal region. Focus group discussions and semi-structured interviews were conducted with community, community leaders and local authority when collecting data for this study. Community identified Cyclones as the main disaster that creates devastating damages and losses to their lives, property and belongings. River erosion, Salinity and Floods were also identified as other disasters that affect socio-economic lives of the community. Geographical location, lack of sufficient cyclone centers, vulnerability of female, children and old people; and excessive love and devotion to property and animal were identified as factors that increase the vulnerability of community towards natural disasters.

Key Words : *Bangladesh, disaster, risk, vulnerability*

1. INTRODUCTION

Natural disasters have the potential to damage the entire economy of a country, especially when they take place in the developing countries. While no country in the world is entirely safe, the lack of capacity to limit the impact of hazards after major natural disasters has made developing countries being some of the most vulnerable nations to natural disasters. United Nations Development Programmed (UNDP) reports that 24 out of 49 low-income developing countries subject to high levels of disaster risk and six are hit by two to eight disasters each year (Lloyd-Jones, 2006). Though only 11 per cent of people exposed to hazards live in developing countries, more than half of disaster deaths occur in these countries (UNDP, 2004 cited DFID, 2005a; DFID, 2005b). According to Moe et al. (2007), while Europe recorded the lowest number of victims from natural disasters, there is a higher frequency of disasters occurrence in Asia and the number of people who

were killed and affected by natural disasters was highest in Asia. Proving the fact, Asia and the Pacific has become the world's most disaster prone region, accounting for 91 per cent of deaths from natural disasters in the past century and 49 per cent of the resulting economic losses (UN/ESCAP, 2006).

Bangladesh is a South Asian country with total land area of 147,570 sq. km (Karim, 2004). It still remains a developing nation that faces variety of problems ranging from low income; shortages of clean water and adequate food; lack of assets such as land and permanent housing; dense population, human health, illiteracy etc (Maxwell, 1999 cited in Mclean and Moore, 2005). These long-lasting problems have been further exaggerated as a result of frequent natural disasters that occur in every year in Bangladesh. The natural hazards such as cyclones and storm surges, floods, riverbank erosions, earthquakes, droughts, arsenic contamination of groundwater, tornados, and landslides have caused significant damages to human lives and physical assets while creating long lasting effects to social settings, ecosystems and the economic well-being of the country (Choudhury, 2002; Khan, 2008). Despite contribution of Bangladesh to green house gas emission is almost zero, it suffers from the effects of climate change with increased severity and frequency of natural disasters (Khan, 2008; Ali, 1999). Ali (1999) claims that climate change is responsible for tropical cyclones, storm surges, coastal erosion, floods and droughts in Bangladesh to a greater extent.

The Intergovernmental Panel on Climate Change (IPCC) construed that one of the key reasons leading to ineffective disaster risk reduction activities as the under utilization of local knowledge base (IPCC, 2012), thus highlights the importance of taking local knowledge in to account. The Hyogo Framework for Action 2005-2015 also identified the need for empowering both communities and local authorities to manage and reduce disaster risk (UNISDR, 2005). As noted by Allen (2006), knowledge and capacities of local people and local resources are considered valuable in policy making aimed at disaster preparedness and climate adaptation. Further, local governments are expected to play a central role in implementing disaster risk reduction activities within their region. Engaging local communities with such activities and linking their concerns with government priorities is a key role expected to be played by the local authorities (UNISDR, 2010). In the case of Bangladesh, the government's national plan for disaster management (MoFDM, 2010) endorses community involvement via strategies such as community based risk assessment and preparedness planning. Acknowledging the community participation towards effective and efficient disaster reduction activities, this research evaluates the risk and vulnerabilities of disaster affected community in Patuakhali, Bangladesh. The Patuakhali region in South Western Bangladesh is at risk of multiple hazards including cyclones and storm surges, flooding, river erosion, droughts etc. the paper is structured as follows: first a brief literature review is provided identifying the common natural disasters in Bangladesh followed up with a synthesis on disaster vulnerable factors. Next, the research method adopted for the study is explained. Findings and discussion section is presented by synthesizing the main outcome of the paper.

2. LITERATURE REVIEW

(1) Natural disasters in Bangladesh

Tropical cyclones have been considered as the most devastating natural disaster in Bangladesh whilst floods as the second most severe in terms of the number of death toll resulted in the recorded past (Asgary and Halim, 2011; Shimi et al., 2010). Bangladesh has suffered approximately 178 severe cyclones with wind speeds of more than 87 kilometres per hour (km/h) formed in the Bay of Bengal from 1891 to 1998 and 38 severe cyclones from 1970 to 1998 (Alam and Collins, 2010). The cyclones of 1970, 1985, 1991 and 1997 are some notable events in the recent past (Khan, 2008). According to Alam and Collins (2010) cyclones and tidal surges have caused major devastations in human lives and property in Bangladesh for generations. Floods occur in Bangladesh in each year with different intensity and magnitude (Choudhury et al, 2004; Hossain, 2003). Choudhury et al. (2004) identify four types of floods in Bangladesh: river floods, rainwater floods, flash floods, and cyclonic/storm-surge floods. While heavy monsoon rainfalls and melting snow in the upper catchment areas of the major rivers of Bangladesh result in river floods, rainwater floods occur due to heavy rainfalls that affect floodplains and other low-lying regions (Choudhury et al., 2004). Approximately 80 per cent of the land of Bangladesh is considered as flood plain areas and about 34 per cent of its land area is flooded for about five to seven months in every year (Islam, 2004 cited Shimi et al., 2010). Annual floods bring about significant disruption to Bangladesh economic and social activities by deteriorating the normal functions of life, affecting homesteads, daily activities, water supply and sanitation condition, washing away crops, polluting groundwater stocks and destroying the vernacular mud-brick and palm-leaf buildings (Shimi et al.,

2010; BSHF, 2001 cited Mclean and Moores, 2005).

Drought are not a frequent hazard in Bangladesh, however, it forms a part of the natural disaster list in Bangladesh as they cause extensive damage to crops if they occur (Choudhury, 2002). Karim (2004) reports that Bangladesh experiences drought for 7 months, from November to May, when rainfall is normally low. As Bangladesh is largely depends on agricultural production, drought results in significant economic, social and environmental problems in the country. For example, Karim (2004) notes that the persistent droughts in north western Bangladesh in recent decades had led to shortfall of rice production of 3.5 million tons in the 1990s. Bangladesh is also prone to earthquakes as it lies in the seismic zone and the northern belt of greater Sylhet, Mymensingh and the eastern part of Rangpur Districts in Bangladesh are more vulnerable to earthquakes (Choudhury, 2001). Along the coastal lines in Bangladesh soil erosion every year takes away chunks of land causing displacement of large number of people and losses of properties. Displaced people due to soil-erosion are forced to come to cities for their earning increasing the population in the urban areas. Some rivers in Bangladesh cause erosion in large scale and high frequency due to their unstable topology, braided pattern consisting of several channels separated by small islands etc. During the last 200 years or so, the channels have been swinging between the main valley walls subjecting to river erosion. The unpredictable shifting behavior of the rivers and their encroachments not only affect the rural floodplain population but also urban growth centers and infrastructures too.

(2) Vulnerabilities to natural hazards

Vulnerability factors have been subject to frequent discussion by the disaster research community and it had been recognised as central to forming disasters when enmesh with independent phenomenon called hazards. Authors such as McEntire et al. (2010), McEntire (2001), Weichselgartner (2001) and Wisner et al. (2003) have carried out extensive research on nature of vulnerabilities, variables interact to produce vulnerabilities and vulnerability reduction theories. There is wide range of differing concepts have been termed 'vulnerability'. One of those definitions refers vulnerability as the degree of exposure of the population/property and its capacity to prepare for and respond to the hazard (UN/ISDR, 2004). On the other hand, 'vulnerability' is also referred to "the conditions determined by physical, social, economic and environmental factors or processes which increase the susceptibility of a community to the impacts of hazards" (UN/ISDR, 2004: p.16). According to Jigyasu (2004) and McEntire (2001) vulnerability represents a series of resultant states of social, economic, political, cultural, environmental, physical, technological underdevelopment processes, before, during and after disaster situation. Further, as asserted by Eshghi and Larson (2008) different communities pose different levels of vulnerability towards disasters hence hazards with similar intensity can impact communities in varied level. McEntire (2001) classifies vulnerability factors and components as identified in Table 1.

Table 1: Classification of vulnerability factors (source: McEntire, 2001)

Vulnerability factors	**Variables**
Physical vulnerability	Proximity of people and property to triggering agents, Improper construction of buildings, Inadequate foresight relating to the infrastructure, Degradation of the environment
Social vulnerability	Limited education (including insufficient knowledge about disasters), Inadequate routine and emergency health care, Massive and unplanned migration to urban areas, Marginalisation of specific groups and individuals
Cultural vulnerability	Public apathy towards disaster, Defiance of safety precautions and regulations, Loss of traditional coping measures, Dependency and absence of personal responsibility
Political vulnerability	Minimal support for disaster programmes amongst elected officials, Inability to enforce or encourage steps for mitigation, Over-centralisation of decision making, Isolated

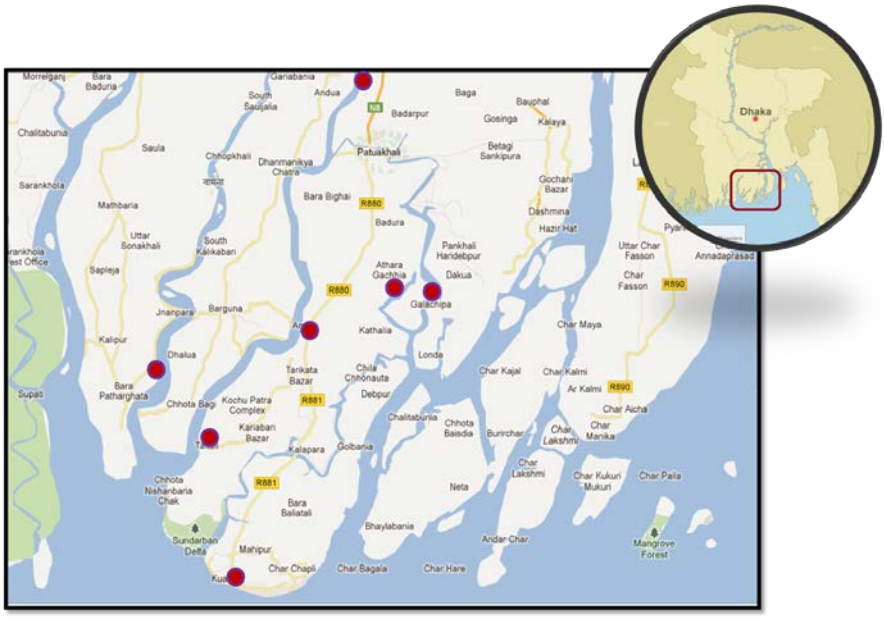
	or weak disaster related institutions
Economic vulnerability	Growing divergence in the distribution of wealth, The pursuit of profit with little regard for consequences, Failure to purchase insurance, Sparse resources for disaster prevention, planning and management
Technological vulnerability	Lack of structural mitigation devices, Over-reliance upon or ineffective warning systems, Carelessness in industrial production, Lack of foresight regarding computer equipment/programmes

3. RESEARCH DESIGN

(1) Study area

Patuakhali is a South-Western region in Bangladesh, facing the Bay of Bengal and consisting of a number of rivers connected to the Indian Ocean including Andharmanik, Agunmukha, Payra, Lohalia, Patuakhali and Tentulia. The constituent districts of Patuakhali region for this study are considered as Patuakhali and Borguna. The area is highly vulnerable to a range of natural disasters and the study area was one of the hardest hit by the 2007 super cyclone Sidr (MoFDM, 2010, Government of Bangladesh, 2008). Patuakhali region was selected for the study due to its significant vulnerability to the two most devastating disasters affecting Bangladesh; that of cyclones and flooding. It was thought that previous experiences of disaster events will allow the local communities to provide useful insights on the issues being investigated, whilst the findings of the study will be of practical importance for policy and practice on disaster risk reduction initiatives in the region. Data were collected from a number of localities within the region, as shown in Figure 1.

Figure 1 – Data collection localities within the Patuakhali region, coastal Bangladesh



(2) Research Methods

A bottom-up approach is adopted for the study, where local community is consulted for their viewpoints, which in turn were fed in to local policy makers for their feedback. Main research areas investigated from this paper were the natural disasters the Patuakhali region subjecting to and the risk and vulnerability of the community to these disasters. Accordingly, existing literature were first reviewed, followed by the collection and analysis of primary data gathered through interviews with at-risk local communities in the Patuakhali region. Community members involved are residents of coastal or river bank areas at-risk from multiple haz-

ards. 31 respondents were interviewed, both men and women, representing different age groups and livelihoods; such as farming, fishing, small businessmen, education, clerical staff, religious leaders etc.

Community members interviewed were asked to rank the level of occurrence (frequency) and level of impact of natural hazards affecting their locality. This information was gathered using a five-point Likert scale and the relative importance index method was used to rank the responses obtained through the Likert scale based questions. Relative importance index (RII) was calculated as;

$$RII = \frac{\sum w}{A \times N}$$

Where, "w" is the weighting given to each impact by the respondents (in this instance ranging from 0 to 4), "A" is the highest weighting (4 in this research), and "N" being the number of respondents.

4. FINDINGS AND DISCUSSION

(1) Frequency and impacts of natural hazards

Cyclones, river erosion, salinity and flooding were identified as the hazards with the highest likelihood and impact in Patuakhali region (refer Table 2). Perceptions of risk of cyclones is in line with the natural hazards risk profile of Bangladesh in general as cyclones are identified as the hazard that have posed the greatest risk when taken as a whole at the country level (World Bank, 2011, MoFDM, 2010), and especially on the coastal communities. For example, in 1970 major cyclone has killed 500,000 people and April 1991 major cyclone was responsible for human casualty of about 140,000 lives (Choudhury, 2002). The Cyclone Sidr hit Bangladesh in November 2007 affecting approximately 30 of Bangladesh's 64 districts, claiming more than 3000 lives, approximately 53,000 people reported missing and affecting 8.7 million people (IFRC&RCS, 2010). In most of the literature based on disasters in Bangladesh has revealed flooding as the second most sever disaster after cyclones (World Bank, 2011, MoFDM, 2010). Flooding affects Bangladesh almost every year (Gupta and Muralikrishna, 2010) and is the most recurring type of disaster affecting the country (World Bank, 2011). However, the findings of this study ranked river erosion and salinity over and above the well known natural hazard flooding. The significant level of impact associated by the respondents suggests the extent of river bank erosion in the region. One respondent noted "…river bank erosion has become more extensive. Few years ago this was a small river, now it is a huge river. Every year it is a common phenomenon to break the bank of the river. River Erosion is one of the major disasters in Patuakhali". The significance of river erosion also reported by Centre for Environment and Geographic Information Services (2000) as Ganges had caused 1778 acres of lands, 136 acres of localities and 570 meters of roads while the Padma had caused 1600 acres of lands, 370 acres of localities, 3930 meters of roads, 9 educational institutions, 5 market places and 1 Union Council office have been submerged in the river by recent rate of erosion.

Table 1 – Ranking of frequency and impact of natural hazards

	RII Values		
	Likelihood	Impact	
Cyclone	0.67	0.83	0.5561
Flood	0.63	0.65	0.4095
Drought	0.48	0.51	0.2448
Earthquake	0.13	0.03	0.0039
Salinity	0.72	0.60	0.432
River Erosion	0.73	0.73	0.5329

Salinity were identified as particularly damaging the farming community, as these affect their day-to-day activities and crop production due to high salt content in the soil. River erosion and salinity are often neglected in most of the studies and do not attract much international community's attention due to their chronic and gradually developing nature, as opposed to rapid devastating events like cyclones and floods. Nevertheless, river erosion and salinity are persistent throughout the year creating enormous damages to human lives (in terms of diseases and health problems), livelihood patters and economy (due to damages to agricultural crops), social issues (due to relocation, etc).

Based on community perceptions of frequency and impact of natural hazards, a risk profile for the Patua-

khali region is developed as shown in Figure 3.

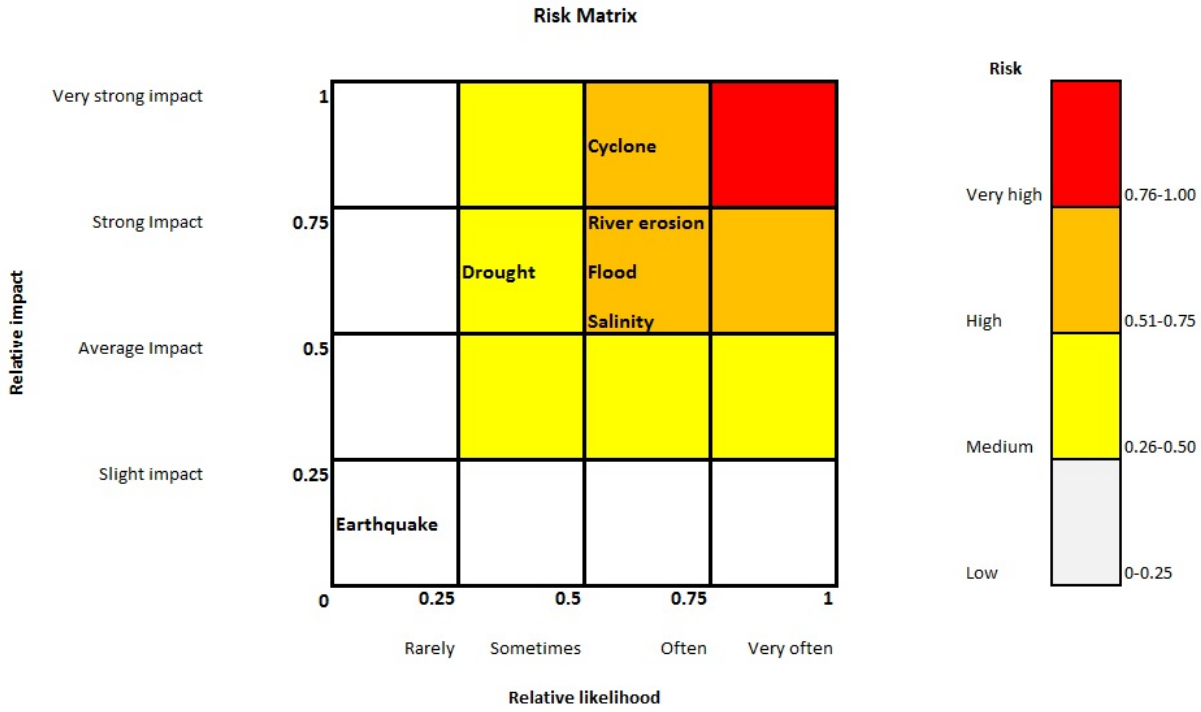


Figure 2 – Risk matrix for the region based on perceptions of respondents

(2) Vulnerability to natural disasters

Respondents were asked to rank different factors that make them vulnerable to natural hazards, in order to identify their perceptions on vulnerability and to recommend solutions addressing those issues. The factors were identified through the literature review and the respondents were asked to identify the importance of each factor towards their vulnerability on a five-point scale ranging from "very high" to "no impact".

Table 3 lists the main factors that were identified as contributing to the vulnerability from natural disasters in the Patuakhali region. The geographical location of Bangladesh has been ranked as the most vulnerable factor for disasters. The environmental changes within the Bay of Bengal and the presence of huge number of massive rivers within the country often cause disasters in Bangladesh. Due to the geographical settings and environmental reasons, Bangladesh is currently ranked as one of the world's most disaster-prone countries in the world (Choudhury, 2002; Shimi et al., 2010; World Bank, 2005). Lack of infrastructure facilities such as sufficient numbers and standards of cyclone shelter, poor road network system leading to protective shelters have been elaborated from the study. In line with this, one respondent commented that "…people are afraid of cyclone hazard because of devastating damage. We have no strong houses to protect against cyclones". Lack of cyclone shelter numbers has been identified in previous studies as well (Hossain et al., 2008, Karim and Mimura, 2008). The government estimated that about 2000 new shelters are required to be built in coastal areas, in addition to nearly 3000 that are already available (MoFDM, 2010). Another vulnerable factor evident from the study is linked with the cultural values of the community in Bangladesh, particularly the "material culture". Extreme devotion to property and livestock has sometimes prevented the community from moving towards protective shelter during the disasters. Similarly Kulatunga's (2011) study also revealed that Bangladeshi communities are hesitant to leave their ancestors lands and property even when a disaster struck them. Lack of management and administrative support for the community in terms of disaster preparedness, during and after the disasters are also revealed as vulnerability factors.

Table 2 – Main factors affecting the vulnerability to cyclones and storm surges

	Factor	RII	Classification of vulnerability

			group
1	Unique geographical location	0.83	Physical
2	Lack of sufficient number of cyclone shelters	0.80	Political/Economic
3	Vulnerability of females, children and older people	0.77	Social
4	Lack of adequate transportation to move to cyclone shelters during cyclonic period	0.77	Economic
5	Excessive love of/devotion to property and animals	0.76	Social
6	Agricultural activities in areas at risk of cyclones	0.76	Social
7	Lack of proper management of the cyclone shelters	0.72	Political
8	Rapid spread of unprotected settlements in hazardous places	0.71	Economic/Political
9	Poverty	0.71	Economic
10	Isolated and scattered settlement layout, and settlements along the embankment	0.69	Economic
11	Limited access to facilities	0.69	Social
12	People resistance to moving to cyclone shelters	0.69	Cultural
13	Lack of decision-making power among female members of households	0.69	Cultural
14	Changing climate conditions	0.69	Physical
15	Lack of information about flood risk	0.69	Political/Social
16	Lack of specific housing policy for settling in high cyclone risk areas	0.68	Political
17	Rainfall in the catchment areas of the rivers	0.66	Physical
18	Densely populated floodplains	0.66	Economic/Political
19	Local relative sea-level rise	0.66	Physical
20	Inefficient administrative system	0.65	Political
21	Remoteness the main administrative and economic centre of the country	0.65	Political
22	Shortage of resources	0.62	Economic
23	Pressure of immediate needs	0.58	Economic
24	Riverbed aggradations	0.50	Economic/Social

The vulnerability factors identified from the study has been categorised based on the McEntire (2001) vulnerability categories. It can be noted that over and above the physical factors that trigger disasters, the majority of vulnerability factors are directly or indirectly inked with socio-economic and political factors that have an influence from the humans. This finding validate the discussions on the level at which disasters can be considered as "natural". As identified by O'Keefe et al. (1976) on his seminal work of "Taking the "natural-ness" out of disasters", the cause for increased occurrences of disasters is the vulnerability of people to physical events due to socio-economic, political factors rather than the changes in the nature. The vulnerability factors identified from the study further confirms that poorly managed interactions between society and environment coupled with lack of capacity of the communities have been significantly increased the vulnerability of community in Patuakhali, Bangladesh towards disasters.

CONCLUSION

The study evaluated the significance of natural disasters in Patuakhali coastal region in Bangladesh through community consultations. Cyclones were identified as the most severe disaster that affects the community in Patuakhali. Community ranked river erosion and salinity as more severe disasters than floods that create ex-

tensive losses and damages to human lives, livelihood patterns and economy and can leads to social issues due to relocation etc. The community's perception on these constantly developing hazards and considering them as over and above or in line with the rapid devastating disasters such as cyclones and floods drove the concept of "disasters" towards a new dimension. Serious and timely attention needs to be given for these silent disasters to ensure the community can successfully manage and cope up with the impacts of these disasters without damaging their socio-economic lives. The vulnerability factors revealed from the study highlighted the significant influence of humans and their actions that create the impact of disaster more distractive. Poverty, rapid and uncontrolled urbanisation, political decisions and their influences, believes and cultural dilemmas impost on the community has been increased the vulnerability of people towards disasters in the Patuakhali region.

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