An Asset-based Approach for Appraising the Risk-Management-Capacity of the Disaster-Prone Coastal Communities of Bangladesh

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ABSTRACT: The current research employed a traditional asset-based approach to evaluate the risk-management-capacity of the disaster-prone coastal communities. A comprehensive survey that includes human perception through household Interviews, Key Household Survey (HHS), Informant Interviews (KII), and Focus Group Discussions (FGD) was conducted within Patharghata Upazila, a coastal sub-district of Bangladesh. Through qualitative analysis of the survey data, a wide spectrum of *natural*, *built*, and *social* assets, utilized by the locals in their daily lives and influencing their risk management capacity in the events of disasters, was elucidated. This underscores the potential for risk mitigation within vulnerable coastal communities of Bangladesh by maximizing the utilization of available resources. Additionally, the research conducted an ordinal regression analysis, the outcome of which revealed the relative influence of the various aspects of coastal residents' living-standard on their risk managing capacity. The particular finding, household's content with their access to basic necessities of life perceiving themselves as adequately prepared for potential disasters, underscores a positive correlation between households' wellbeing and their strength against disasters. The implications of these finding extend to the policymakers of Bangladesh, highlighting the need for investments in developing the living status of the coastal communities for fostering disaster resilience within the coastal region of the country.

Keywords: Asset-based Approach; Risk Management Capacity; Coastal Communities of Bangladesh

INTRODUCTION

Bangladesh is one of those countries of the world ensnared by their vulnerability to numerous climate-related hazards essentially due to its geographical position, and flat, low lying, deltaic terrain condition (Murshed et al., 2022). According to the World Risk Report of 2023 (https://weltrisikobericht.de/en/), Bangladesh stands out as the ninth most disaster-prone country globally. Situated at the nexus of land and ocean, the coastal region of the country is particularly vulnerable to a plethora of dynamic natural processes and multiple coastal hazards, including cyclones, storm surge, sea-level rise and coastal erosion (Islam et al., 2016).Compounded by the inland overcrowding, impoverished communities, often landless, are compelled to settle in hazard-prone coastal areas within Bangladesh. These communities grapple with an array of challenges like, poverty, nature-reliant livelihoods, inadequacy of food and clean water, limited access to healthcare and other critical services (Pachauri et al., 2014). Recurrent onslaught of climatic hazards exacerbates the burdens already borne by these marginal people, inflicting severe long-term impacts on their existence (Islam and Ahmad, 2004).

Over the decades, many countries worldwide have typically reacted to environmental disasters with short-term assistance or relief aid, adopting reactive strategies. However, contemporary disaster scholars contend that proactive strategies, such as addressing the risk factors and implementing appropriate measures for their mitigation, hold far greater efficacy (Alcayna et al., 2016, Gao et al., 2014, Oloruntoba et al., 2018). This paradigm shift underscores a transition from a response-oriented approach to a culture of risk reduction The United Nations Office for Disaster Risk Reduction (UNDRR) has identified resilience building through risk reduction as the most effective strategy for disaster management. Bangladesh serves as a notable example of this shift in disaster management strategy (Shaw et al., 2013, Seddiky et al., 2020). The outcomes of this transition are evident in the reduced loss of lives and

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livelihoods in recent disasters compared to previous ones, attributable to various risk reduction initiatives (Haque et al., 2012).

Nevertheless, disasters are becoming more frequent and increasingly deadlier due to acute changes in climatic condition, threatening to reverse the progress. According to the latest projection by IPCC, the elements of the climate system are anticipated to experience persistent alterations in the coming decades. Heightening the frequency and vigor of environmental hazards that could lead to irreversible consequences for communities, ecosystems, and infrastructure (Birkmann, 2007, Unger et al., 2017). An accelerated increase in sea levels, intensified cyclones, and greater storm surges are among the prominently projected risks. The emerging risks present a significant challenge for the survival and economic stability of those living along the coast. Though the loss of life has been reduced in Bangladesh, the impacts of various climate-related hazards, however, may undermine the developments made over the decades and put a break on the socioeconomic growth of the country.

The coastal population of Bangladesh has a rich history of coping with and adapting to the adverse impacts of climate change and associated disasters (Field, 2012). However, significant variation in their ability to confront disasters is apparent across the communities. People's access to various resources, which form the basis of their living, might have an intricate, albeit not direct, influence on their strength against disasters. These assets can range from tangible resources such as cash, jewellery, land, houses, appliances, and saving schemes to intangible factors, such as health, education, empowerment, livelihoods and social connections (Vatsa, 2004). Access entails the ability to effectively utilize these resources and services. For building disaster resilient coastal communities, it is imperative to gain a comprehensive understanding of the available assets and how at-risk communities deploy these assets to prepare for, cope with, and recover from disasters. This understanding can illuminate the areas where efforts to enhance community capacity should be concentrated.

Motivated by this objective, the present study evaluated the risk management capacity of coastal communities in one of Bangladesh's coastal sub-districts by assessing their access to various assets. Employing a fact-finding methodology, the study sought to comprehend how local communities utilize their available assets

to mitigate disaster risks, and to what extent they perceive themselves prepared for potential disasters. Key sectors were identified addressing which could essentially reduce disaster risks and secure well-being of the coastal communities of Bangladesh. Given the country's resource-constrained context, the findings are anticipated to aid coastal planners in identifying areas with limited access to specific types of assets, thereby enabling them to allocate resources more effectively to those communities. Furthermore, these insights may facilitate the formulation of multi-sectoral projects aimed at both disaster risk reduction and the enhancement of well-being in coastal communities, departing from the less effective practice of managing these issues separately across various domains(Ayers et al., 2014).

MATERIALS AND METHODS

Overview

Disaster risk management capacity generally refers to a community's ability to prepare for, respond to, and recover from disasters effectively (Islam et al., 2021, Shaw et al., 2013). However, this study expands on this traditional definition by conceptualizing risk management capacity as a community's potential for preventing creation of risks, minimizing risks, and adapting to residual risks. The assessment of capacity was based on the coastal people's entitlement and accessibility to various assets at household levels. While Asset-based approaches are frequently employed in analyzing household welfare and poverty condition (Jakobsen, 2013), this study contends that such an approach offers a valuable framework for identifying the prevalent challenges of the at-risk communities, thereby guiding strategies to enhance their resilience.

The appraisal of assets was conducted using data gathered through an extensive fieldwork program conducted in the study area. Aligned with commonly employed sustainable livelihood and asset-based approaches, this study utilized three primary dimensions for asset appraisal: *natural assets*, *built assets*, and *social assets*. Natural assets refer to physical natural resources that supply an ongoing stream of ecosystem services. This study examines natural assets categorized into *forest and vegetation*, *rainfall, soil salinity and water Source*. Built assets included human-made structures designed for various purposes like *houses, cyclone*

shelters, roads, utilities (sanitation, waste management, and power supply) and *embankments.* Social assets encompassed individual capacities, such as *knowledge* and *occupation* and shared interests such as *access to information, disaster management services* and *social cohesion*.

Furthermore, an ordinal logistic regression analysis was employed to elucidate the contributions of various aspects of coastal residents' living standards to their disaster risk management capacity. Key parameters reflecting the living status included access *to fundamental needs* (foods, shelters, clothes and healthcare), *livelihood options*, *disaster training*, *timely hazard-warning*, *social cohesion* and *external support.* The selection of the parameters was based on relevant literature review. Ordinal logistic regression was chosen as the analytical method due to its suitability for modeling ordinal dependent variables, which in this case represent different levels of disaster risk management capacity. By examining these specific aspects of living standards, the analysis aimed to uncover their individual and collective influences on communities' abilities to prepare for, respond to, and recover from disasters effectively.

Study Area

The research delves into Patharghata upazila, nestled within Barguna district in the Barisal division, situated within the latitudes of 22°14′ to 22°58′ N and the longitudes of 89°53′ to 90°05′ E and spanning approximately 387.36 square kilometers. The coastal upazila is bordered by the Bay of Bengal to the south, Bishkhali River to the east and Haringhata River to the west (Figure 1). The total population of the area amounts to 177,875, with 85,801 males and 92,074 females, resulting in a population density of 736.4 individuals per square kilometers (BBS, 2013). Agriculture forms the primary source of income for 60.3% of residents, complemented by various other economic activities such as non-agricultural labor, industry, commerce, and services. According to BBS (2013) data, the literacy rate stands at 60.5%. Patharghata Upazila is delineated into seven unions/wards, housing 39 mouzas and 66 villages (https://pathorghata.barguna.gov.bd/). Land-use data reveals ~ 28503 hectares of cultivable land and ~ 3123 hectares left built-up areas and fallow. Infrastructure includes
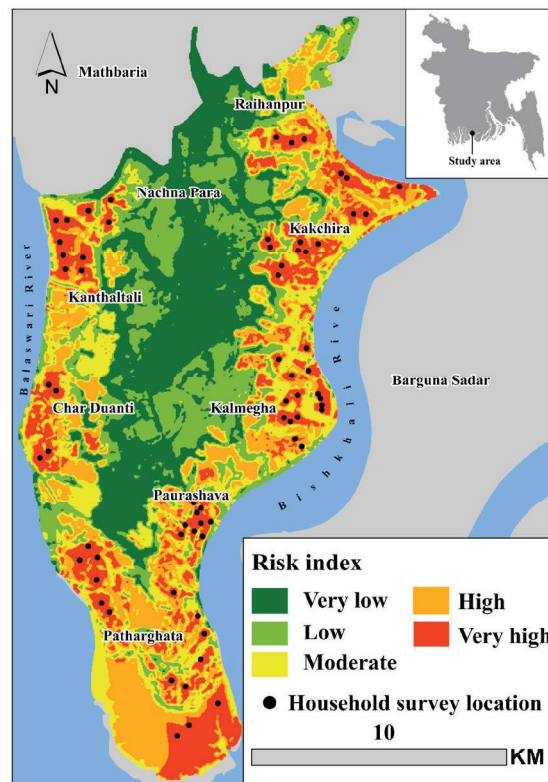

Figure 1: Location Map of the Study Area, Risk Index was Adopted from Murshed et al. (2021)

~ 18 km of paved roads, ~ 359 km of non-paved roads, and busy transport media navigable waterways of ~ 32 nautical miles, though only 5.43% of households have electricity access despite rural electrification efforts.

The upazila features a low-lying fluvio-tidal plain with a mean elevation of approximately eight meters above sea level. Being a part of the Ganges deltaic coast, this area is characterized by its dynamic nature, shaped by the interplay of sedimentation, erosion, and sea-level changes. Over millennia, the deposition of sediments has led to the expansion of the deltaic landforms, creating new land areas and wetlands (Khan and Islam, 2008). At the same time, the coastline has been subject to erosion and accretion processes driven by tidal and wave action (Islam et al., 2011). This region has been marked by historical natural disasters, including a giant tidal bore in November 1971, and a tornado in September, 2006. Additionally, the area has been impacted by tropical cyclones in 2007 (Sidr), 2009 (Aila), and 2013 (Mahasen), resulting in casualties and disruptions of livelihoods (Johnson et al., 2019). The rationale for selecting Patharghata as a case study stems from several factors, including its coastal location, past occurrences of natural disasters, and community vulnerabilities. Patharghata serves as a valuable model for the broader challenges and prospects associated with advancing disaster risk reduction efforts at both local and national scales in Bangladesh.

Data Collection

A comprehensive field survey was undertaken in the study area utilizing various approaches like in-depth interviews (IDIs), focus group discussions (FGDs) and key informant interviews (KIIs). IDIs were conducted at the household level to gather data on the household asset portfolios of local residents and their strategies for mitigating disaster risks. These interviews utilized a set of open-ended questions approved by the University of New South Wales Ethics Panel (HC No.18106). Seventy (70) households situated within seven unions and one municipality (paurashava) of Patharghata were selected for participation. Sample households were carefully chosen from the high risk areas from a study by Murshed et al. (2021). In accordance with the customary practice in Bangladeshi villages, the household heads were targeted for interviews, with additional information often provided by other family members during the discussions (Islam and

Walkerden, 2014). Furthermore, Two Focus Group Discussions (FGDs) were conducted in Kalmegha and Charduanti unions. Each of the FGDs comprised of eight members, all aged above 20 years, including both males and females. Participants were selected from diverse sectors such as government officials, NGOs, school/college teachers, cultural groups, and people from other occupations, all possessing substantial knowledge about community assets. Prior to the discussions, participants were instructed on the study's aims, objectives, and predetermined themes. The FGDs offered valuable insights on various aspects related to the living standards of the coastal communities and their capacities to deal with disaster risks. Moreover, five Key Informant Interviews (KIIs) were carried out with professors of Government College, social activist, engineers, political leaders and local businessmen to validate the data acquired from In-depth Interviews (IDIs) and the Focus Group Discussions (FGDs). These interviews provided qualitative data at the macro-level regarding the disaster risks faced by the community, their resources and capacities for risk management, and the pertinent issues requiring attention.

Data Analysis

The collected data underwent both qualitative and quantitative analysis. Qualitative analysis involved extracting key themes from interview transcripts, while quantitative analysis employed various statistical techniques within the Statistical Package for the Social Sciences (SPSS) software. Descriptive statistics derived from interviews and group discussions were interpreted to discern significant findings regarding community assets of natural, built and social origin. How various aspects of coastal residents' living standard shape their strength against disasters was assessed employing ordinal logistic regression analysis, a widely used approach by social scientists around the world. This specific modelling technique is suitable for estimating the impact of multiple explanatory variables on an ordered categorical response variable (Das and Rahman, 2011, Eboli and Mazzulla, 2009). The residents self-reported capacity, preparedness for potential disasters, was used as the response variable, ranging from 'not prepared' to 'well prepared' whereas the attributes reflecting the coastal people's living standard were selected as the explanatory variables. These included limited parameters like *access to the fundamental needs* (foods, shelters, clothes, and

healthcare), *livelihood options*, *disaster training*, *early hazard-warning, social cohesion and external support* adhering to the principle of parsimony. The Polytomous Universal Model (PLUM), also known as Multinomial Logistic Regression, was employed using SPSS (version 24), with the logit function as the link function. Model performance was evaluated based on the proportional odds assumption and goodness of fit. Regression coefficients were scrutinized to understand the connections between explanatory and response variables.

RESULTS AND DISCUSSION

The present study delineated a spectrum of natural, built, and social assets influencing the risk management capacity of coastal residents. Descriptive statistics detailing these assets are synthesized in subsequent subsections. The outcomes of the regression analysis are articulated in the latter portion.

Natural Assets

In the surveyed area, more than 60% of the respondents collect a variety of forest products such as fish (14%), betel nut (4%), palms (4%), honey (1%), fuelwood (30%), and livestock fodder (1%). Of those who gather forest products, 23% make money by selling them, and the bulk (76%) use them for themselves. Forests are indeed significant from a socioeconomic viewpoint since they support coastal lives by offering valuable resources like wood, habitats, and food for a variety of organisms (Barua et al., 2020). Regarding intangible benefits of forest, nearly 90% of the respondents acknowledged the forest's role in diminishing wind speeds and resisting water surges during cyclones; 9% attributed this to protecting riverbanks and aiding siltation, while a minority (1%) perceived no direct benefit from the forest during hazard. Naz and Chowdhury (2022), in their study also asserted that coastal people believe that the Sundarbans mangroves acts as bio-shield that prevented further destruction within the coastal communities by significantly reducing the severity of mega-cyclones Sidr (2007) and Aila (2009).Tree plantation along the coast has been identified as one of the crucial disaster risk reduction measures in other South Asian countries as well (Mukherjee et al., 2015).

Rainfall yields positive benefits for individuals who rely on nature for their livelihoods. Among the participants,

84% highlighted the significance of rainfall for their primary income sources, particularly agriculture and fishing. It's quite evident that rain-fed agriculture constitutes a substantial portion (68%), of Bangladesh's total employment (Tisdell et al., 2019). Additionally, 57% emphasized the crucial role of rainwater harvesting in addressing the increased demand of water for drinking and household purposes, with 10% acknowledging its importance in supporting vegetation growth around their residences. Ongoing initiatives alleviate drinking water scarcity in the coastal region of Bangladesh are focusing on implementing rainwater harvesting systems was also reported by (Karim, 2010). Conversely, 55% of the respondents expressed concerns regarding the excessive rainfall during the monsoon and post-monsoon periods negatively impacting agricultural and fishing activities. The issue often enforces changes in crop selection and, in severe cases, shifts in occupation. Besides, 52% noted that village roads and pathways, typically unpaved and prone to mud, become temporarily inaccessible, impeding local commerce and activities. Furthermore, 18% reported rainfall induced waterlogging in the study area.Dewan (2015), in his study also confirmed that heavy monsoon rainfall results in inundation and waterlogging and often lead to complete crop loss due to flooding.

In the study area, salinity in croplands remains an alarming problem. Among the respondents, 23% encountered decreased soil fertility because of salinity, nearly 39% reported occasional salinity in their soil while another 38% reported having fertile agricultural land with minimal salinity issue. Focus group discussions emphasized that sea water intrusion during prehistoric disasters had contributed to soil salinity and a gradual decline in crop yield, a contention supported by scientific studies that asserted deterioration of soil quality caused by prolonged inundation (Ali, 2006, Hossain et al., 2013). Again, in the surveyed households, various livestock-keeping practices were observed, with 31% raising cows, 22% raising both cows and goats, and 6% keeping only goats; meanwhile, 41% reported having no livestock. A notable proportion of households lacking livestock can be attributed to soil salinity, which often limits access to grazing land and fodder (Alam et al., 2017). Challenges such as inadequacy of quality feed and financial constraints might also have impeded cattle raising (Miah et al., 2010).

The southwestern coast of Bangladesh is under immense pressure of usable sources of water for drinking and

irrigation purposes. In this area, 80% of the respondents utilize waters from community ponds or their own ponds for various purposes, while 8% obtain household water directly from the rivers. Only 9% have access to tube wells, and a mere 3% have piped water supply. Dasgupta et al. (2015), in their study also documented pond water as one of the primary sources for drinking water in the study area. Again, obtaining water from distant sources poses a challenging and time-consuming task for households. While 58% of respondents can access safe drinking water within a 10-minute walk, 30% require 10 to 30 minutes, and 12% have to travel even further. Accessing drinking water sources presents a challenge in coastal Bangladesh due to extended travel times was also claimed by (Islam et al., 2022).

Built Assets

In this region, 38% of the participants reside within 500 meters distance from the sea or river, while 40% live 0.5 to 1 kilometer away and 22% live at a distance of at least 1 kilometer. The proximity of settlements to the major waterbodies increases their exposure to hazards (McGranahan et al., 2007). Cyclones cause severe damage to houses built closer to the sea, with vulnerability decreasing as distance increases (Islam et al., 2021). Vulnerability of houses also depends on their structure, and construction materials(Vatsa, 2004). In the study area, most houses are either "katcha" (made of mud, bamboo, wood) or "semi-pucca" (with cemented floors, partially brick walls, and corrugated iron sheet roofs), offering some durability. "Pucca" houses (featuring brick walls, concrete floors, and roofs) are rare in rural areas and are typically owned by wealthier families. There is a clear correlation between the materials used in constructing a house and its ability to withstand disasters (X^2 = 16.58, p-value = <.001, df = 2, α = 0.05) which is consistent with Ellingwood Bruce et al. (2004).

As far as cyclone shelter is concerned, there are differences in the number of shelters people have access to; 33% have two or three, 50% have at least one, and 17% have access to more than three shelters. According to Mallick et al. (2011), designated disaster shelter is essential in places highly vulnerable to cyclones. Moreover, it is important that people have quick access to shelters; 39% of people reach one in 15 minutes, 32% in 20–30 minutes, and 29% take longer. Often, people living farther away turn to high ground or nearby residences to secure themselves.

These findings are quite consistent with Paul (2008). 73% of the respondents expressed satisfaction over the security and safety conditions in the cyclone shelters. However, a minority reported instances of preferential treatment associated with political figures, a sentiment corroborated by the key informants. This observation aligns with the findings reported by Hossain et al. (2014) in their study.

In the study area 29% of the respondents were found to be satisfied with the current road conditions. However, despite post-Cyclone Sidr improvements, a significant 50% advocated for further developments in this area. Additionally, 21% expressed dissatisfaction but demonstrated adaptability. However, majority of them underscored their exacerbated vulnerability due to the lack of good quality roads. Poor road conditions often hinder access to daily necessities as well as evacuation and rescue operations in the events of disasters (Murray-Tuite and Wolshon, 2013). Focus group participants criticized the negligence of road construction authorities and use of substandard materials in road constructions, efforts. Prior studies by Mahmud and Prowse (2012) and Mallick and Vogt (2011) corroborate these findings.

Utilities, such as waste management, sanitation, and electrical infrastructure, differ widely across the coastal Bangladesh (Rahman and Rahman, 2015). Due to the engagement of NGOs, particularly in accessible places, almost all families in the study area now have toilets, with 80% reported as sanitary and 20% non-sanitary. For waste disposal, people use different ways. A large percentage of people dispose rubbish in dumping holes nearby or in the suburbs which puts surface and groundwater at risk of contamination. Some people dump directly into water bodies, which exacerbates water pollution and poses health risks (Schlosser et al., 2016). Islam et al. (2020) also identified waste management as a significant problem in rural Bangladesh since inaccurate disposal might cause serious environmental pollution. In the study area, a significant portion of the population had access to either the Rural Electrification Board (REB) network or owned solar panels, indicating the increasing popularity of solar technology introduced in the 1990s by both governmental and non-governmental organizations (Karim et al., 2019) while only a small fraction was found to use kerosene lamps. Access to electricity enhances living standards as well as facilitates disaster preparedness (Shah Alam Khan, 2008).

Regarding embankments, in some of the examined region's seaward-facing embankments were found to be deteriorating, with parts having partially or fully eroded. The respondents underlined that there is a greater chance of inundation during strong cyclones since these damaged portions of the embankments would not be able to prevent robust storm surges. Key informants emphasized the significance of careful planning, including sufficient sluice gate capacity, and regular maintenance to relieve structural constraints in this area, a perspective previously expressed by (Haque et al., 2012).

Social Assets

For Bangladesh's coastal communities that are particularly exposed to environmental risks, education and knowledge has proven to be an invaluable asset (Paul and Routray, 2013). In this study, the educational background of the household head, was considered. 60% reported having primary to secondary education, while 17% attained higher education. Additionally, 23% had no formal education. A chi-squared test ($X^2 = 40.88$, p-value = <.001, $df = 4$, $\alpha = 0.05$) revealed a significant correlation among the head's education level and disaster effects i.e., life and assets loss on the household. The key informants and the FGD participants advised that the situation might be overcome by providing these individuals with disaster-specific knowledge and training.

The source and amount of income of a household is another critical factor that determines its ability to get basic necessities and be resilient to the impacts of disasters (Murshed et al., 2023). Approximately 50% of the respondents in the study area live on agriculture, 34% on fishing, and 10% operate their own business while 6% are employed in a variety of government and non-government services. Respondents confirmed that during extreme weather events, people engaged in agriculture or fishing struggle to find work, with open-sea fishing becoming riskier during monsoons and cyclones. A chi-squared test ($X^2 = 15.89$, p-value = .04, $df = 2$, $\alpha = 0.05$) results reveal that individuals engaged in agriculture and fishing face heightened vulnerability to the adverse impacts of storm surges, cyclones, and rising sea levels on their livelihoods, in contrast to those in other professions.

Having timely and accurate information of potential hazard is crucial for saving lives and minimizing loss. Advance warning allows people to take place in shelters safely. A chi-squared test ($X^2 = 40.15$, p-value = <.001, $df = 1$, $\alpha = 0.05$) examining the correlation between hazard warnings and the safeguarding of lives during hazardous events in the study area reinforces this assertion. Herein, only 2% of people looks into print medias for news, while 6% access both print and electronic media. However, a majority (92%) regularly use electronic media (radio, TV, or mobile phones) for listening to news and weather forecasts. According to Paul (2012), electronic media provides crucial weather information and safety guidance which is invaluable for early evacuations thereby preventing casualties from hazards. Despite limited device ownership, communal facilities are utilized.

The study area is recurrently stricken by massive cyclones and storm surges. Disaster mitigations actions in this region is explicably oriented towards confronting these specific hazards (Ahmed et al., 2016). Even though several interventions have been made to mitigate the impacts of hazards, the respondents only partially agreed that these efforts were beneficial and emphasized that further interventions are required to lessen their vulnerability. Participants of the FGD highlighted that for the effectiveness of disaster management measures, proper co-ordination between central government, local government, and local communities, is essential.

The harmony within a community is vital for enhancing its resilience is acknowledged by disaster scholars globally (Islam and Walkerden, 2014). In the studied area, 47% of the respondents testified strong bonding among the community members, 39% asserted decent relationship, and another 14% perceived their connections as modest, however, no one expressed any negative impression.

Furthermore, in the current study, 26% of the respondents believed that they could withstand any disaster event without any help form outer sources , 40% said they depend on outside help to a certain extent, and 34% said that external aid is their foremost means to survive and recover during disasters. Community members can manifest their potential by getting engaged in various communal activities such as rescue operations, debris removal, and repairing damaged infrastructure. However, their ability to recover from the long enduring impacts of disasters is limited due to their low asset-base. This is when the significance of social links is realized (Aldrich, 2017). According to the respondents,

several government organizations and NGOs provided emergency relief like food, water, and medicine, materials for house reconstruction, agricultural and fishing equipments for livelihood restoration, and support for economic revival through livestock and microcredits after historic disasters in this region. Sports, cultural, and spiritual activities introduced by these organizations also aided in post-traumatic stress recovery, as confirmed by focus group discussions and key informants.

Regression Analysis

A Regression modelling was achieved to explore the relative influence of various factors, reflective of the living status of the coastal communities, on their risk management capacity (Table 1).

Table 1: Case Processing Summary of Ordinal Logistic Regression

Variables	Responses	Coding	Number of respondents	Percentage of respondents
Preparedness Level	Not prepared	0	18	24.6%
	Partially prepared	1	21	30.4%
	Well prepared	2	31	44.9%
Timely Hazard-warning	Usually no	0	11	15.0%
	Usually yes	1	59	85.0%
Disaster Training	Not received	0	30	43.5%
	Received	1	40	56.5%
Livelihood Options	At least one	0	20	27.5%
	Up to three	1	33	47.8%
	Multiple	2	17	24.6%
External Support	Entirely	0	15	20.3%
	Partially	1	44	63.8%
	Not at all	2	11	15.9%
Social cohesion	Average	0	13	17.4%
	Good	1	31	44.9%
	Strong	2	26	37.7%
Access to fundamental needs	Not satisfactory	0	19	27.5%
	Somewhat satisfactory	1	25	34.8%
	Satisfactory	2	26	37.7%
Valid			70	100%
Missing			--	
Total			70	

The readiness of the coastal communities for a potential disaster was recorded on a scale ranging from 'well prepared,' to 'partially prepared,' to 'not prepared.' This was their self-reported capacity i.e., how households rate their strength in the face of disasters. Six factors were included in the analysis: access to fundamental needs, alternative livelihoods, disaster training, timely hazard-warning, social cohesion, and external support.

Before analysis, multicollinearity among these variables was tested. The values of variance inflation factor (VIF) ranged between 1.05 and 2.13, which is well below the threshold of 10. This confirmed no multicollinearity issues.

Strong fit of the model *(p*-value = <.001) suggests that the response variable is considerably influenced by the chosen explanatory variables (O'Connell, 2006).

Furthermore, the model's suitability is confirmed by the non-significant Pearson chi-squared goodness of fit measure (p-value = .812). Ordinal regression is reasonable in this situation since the test of parallel lines confirms the null hypothesis and indicates that the proportional odds assumption is true. With an R^2 value of .695, the model explains almost 69.5% of the variation in the data, which is an excellent result considering the small sample size (n = 70).

According to the analysis of the parameter estimate table, the independent variables except "social cohesion" exhibit strong correlation with the communities' preparedness level. This manifests the influence of these factors on community's capacity to confront disasters. Positive coefficients imply a possibility of higher ratings on the ordinal response variable, whilst negative coefficients imply the opposite (O'Connell, 2006). Keeping other variables constant, the odds ratio illustrates each explanatory factor's impact on the dependent variable and sheds light on their respective contributions. Table 2 provides a detailed summary of the ordinal logistic regression model's findings.

The finding from the ordinal regression analysis reveals that timely hazard warning significantly influences a community's preparedness for dealing with potential disasters. A negative coefficient indicates that those who did not receive any warning before hazard were less prepared than their counterparts. In the coastal region of Bangladesh, disaster management committee and volunteers developed by the Cyclone Preparedness Programme (CPP) are actively involved in hazard forecasting among the coastal communities of Bangladesh thereby facilitating reduced damage (Paul, 2014).

The regression finding also indicates that households with individuals having received disaster training tend to perceive themselves well-prepared, in contrast to households lacking trained members. In disaster situations, trained members are usually able to take prompt and appropriate actions to safeguard their family and assets from potential loss. This difference may stem from the increased knowledge and awareness typically associated with disaster-specific trainings family (Paul and Routray, 2013).

The availability of various livelihood options is another important aspect that affects the preparedness of the population for climate related challenges. The regression analysis with negative co-efficient indicates that individuals with a single livelihood option are less likely to perceive themselves as well-prepared compared to those who have two or three options. Livelihood plays a crucial role in providing households with the means to afford the basic necessities of life (Thulstrup, 2015). Coastal communities of Bangladesh face significant challenges when their climate-sensitive livelihood sectors suffer damage from extreme environmental events (Davies, 2016).This often prompts residents to seek alternative occupations or migrate for survival (Pomeroy et al., 2006).

Reliance on external support for survival and recovery is another crucial factor. The regression's outcome demonstrated that households that entirely depend on outside assistance regarded themselves less prepared than those who rely on outside assistance only partially. During the survey it was documented that many affluent households in this region have recovered using their own assets, since Cyclone Aila caused damage to their house and properties in 2009. In contrast, poorer households initially depended on informal savings, however, once depleted, they resorted to borrowing or external aid. Low asset-based compelled these households to seek external assistance for recovery.

Social cohesion does not seem to correlate with the preparedness of the population. However, rural populations in Bangladesh are known for their congeniality and hospitality (Chambers, 2014). They often share resources, work together, and provide support during crises. However, such bondage may be affected due to disaster impacts, limited household-resources, and disputes over external supports. Therefore, community preparedness for disasters cannot be solely attributed to everyday relationships.

The most noteworthy finding from the ordinal logistic regression is the association between the households' accessibility to the basic needs and their level of preparedness for potential disasters. According to the regression analysis, households that are content with their affordability of fundamental need consider themselves as being well-prepared for any unforeseen disasters.

Table 2: Detail Outcomes of Ordinal Logistic Regression for the Current Study

	Regression coefficient	Standard error	p-value	95% CI Lower bound	95% CI Upper bound	Odds ratio	95% CI Lower bound	95% CI Upper bound
Receive early warning of hazard								
Usually no (x=0)	-2.942	1.197	0.014	-5.288	-1.596	.531	.232	.781
Usually yes *(x*=1)	Ref					Ref		
Training on disaster and emergency								
Not received (x=0)	-4.627	0.967	0.001	-6.523	-2.732	.616	.402	.886
Received (x=1)	Ref					Ref		
Alternative options for livelihood								
At least 1(x=0)	-1.000	1.335	0.041	-3.241	-0.991	.216	.006	.452
Up to 3 (x=1)	-0.625	1.070	0.030	-3.097	-0.069	.744	.342	.914
More than 3 (x=2)	Ref					Ref		
Reliance on outside assistance to endure and recover								
Entirely (x=0)	-2.015	1.624	0.015	-5.198	-1.169	.451	.069	.679
Partially (x=1)	-0.969	1.255	0.040	-3.429	-0.491	.783	.476	.995
Not at all (x=2)	Ref					Ref		
Bonding among the community members								
Moderate (x=0)	-2.589	1.124	0.210	-2.972	-1.387	.148	.041	1.451
Good (x=1)	-0.806	0.925	0.384	-2.620	-0.701	.166	.062	1.852
Strong (x=2)	Ref					Ref		
Access to the fundamental needs of life								
Unsatisfactory (x=0)	-3.044	1.195	0.011	-5.385	-1.702	.825	.664	.985
Somewhat satisfactory (x=1)	-0.542	0.890	0.034	-2.286	-0.235	.478	.326	.564
Satisfactory (x=2)	Ref					Ref		

Chi-square for the model fit was 65.37, *p*-value = 0.001; chi-square for the parallel lines test was 13.25, *p*-value = 0.351. (i) Pearson chi-square = 64.99 (*p*-value = 0.182) and (ii) Deviance chi-square = 57.95 (*p*-value = 0.939) indicate the goodness of fit.

Sen (1993) initially suggested that people who have access to different assets should be able to react freely to unfavorable circumstances. To elaborate, Chambers et al. (1992) proposed that households best able to endure shocks and eventualities are those who possess stable assets or have access to community assets. The application of asset-based method in this study for evaluating households risk management capacity was prompted by these very concepts. The outcome of the regression analysis in the current study testifies that

households adequately equipped with basic resources exhibit higher level of self-resilience to disasters. Adequate assets of several categories can facilitate households to plan for responding to potential hazards and adjust their living strategies to recover efficiently from disaster impacts.

CONCLUSIONS

The coastal region of Bangladesh stands vulnerable to a variety of environmental hazards. With the Earth's climate experiencing warming trends, there is a projected escalation in both the rate of recurrence and vigor of these hazards. The increasing risks present substantial challenges to the socioeconomic development of the coastal population in Bangladesh. While there is no quick fix for this crisis, addressing this issue remains a top priority within the developmental landscape of Bangladesh. Having significantly reduced mortality rates from disasters, the nation is now focusing on minimizing other forms of damage through strategic actions aimed at enhancing resilience. Nevertheless, the lack of coherence between national and local-level organizations continues to exacerbate the plight of the marginal coastal communities. Thus, it is imperative to conduct extensive localized research, such as the study proposed herein, to provide disaster managers with nuanced insights into the specific vulnerabilities of different population segments, enabling them to undertake targeted mitigation measures.

A detailed survey was conducted in Patharghata Upazila, a coastal subdistrict of Bangladesh, to examine the access of local residents to various natural, built, and social assets at the household level. The study sought to comprehend how these assets are utilized by individuals to mitigate risks and ensure survival and recovery in the event of disasters. The findings revealed a propensity among residents to employ a multitude of coping and adaptation strategies to mitigate the adverse impacts of disasters utilizing their assets. This underscores the potential for Disaster Risk Reduction (DRR) through leveraging existing community resources, a crucial approach particularly for economically disadvantaged countries like Bangladesh. Furthermore, a regression analysis was performed to assess the association between the living status of the coastal households and their preparedness for potential disasters. The regression analysis unveiled a significant positive correlation between the living standards of the local populace

and their capacity for risk management. This implies that enhancing the livelihood standards of coastal communities would bolster their resilience against disasters and catalyze their socioeconomic advancement in the interim periods. Given the resource-constrained context of the country, this presents an economically worthwhile strategy for the Bangladesh government to fulfill its commitments to the Sustainable Development Goals (SDGs) and the Sendai Framework for Disaster Risk Reduction (SFDRR) of the United Nations, translating the goals of these international frameworks at the national level for the benefit of all citizens.

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