Volume 22, Issue 2: KUS: 1482: 317-330: 15092025: 2025

KHULNA UNIVERSITY
STUDIES

journal homepage: www.kus.ku.ac.bd

Research article

Using the Social Ecological Model to Identify Barriers and Facilitators to Adapting Disaster Risk Reduction Strategies by Southwestern Coastal Communities in Bangladesh: A Qualitative Investigation

Nadim Morshed, S M Faizul Haq and Sanjoy Kumar Chanda*

Sociology Discipline, Social Science School, Khulna University, Khulna-9208, Bangladesh

ABSTRACT

Bangladesh has worked to improve disaster adaptation strategies in line with the United Nations Sustainable Development Goal 13 (climate action). Notwithstanding recognitions and efforts, Bangladesh's coastal villages continue to encounter numerous challenges and require assistance to manage natural disasters, which remain a largely underexplored field of inquiry due to the absence of epistemological scholarships incorporating a socio-ecological point of view. With that in mind, this study aims at identifying multiple-level barriers and enablers to adapting disaster risk reduction strategies by the coastal community at Sharankhola upazila in Bangladesh. Focus Group (FG) and In-Depth Interview (IDI) methods were used to collect data from the purposefully selected disaster-affected coastal community in Bangladesh. In this study, FGs and IDIs utilized an interview topic guide, which was constructed upon the principles of the Social Ecological Model (SEM). Data gathered from the three FG and six IDI participants were analyzed using Framework Approach underpinned by the SEM. Besides, the SEM has also been a cornerstone for preparing the conceptual blueprint of the study as well as organizing and interpreting the outcomes of the research. The findings related to barriers and facilitators to adapting disaster risk reduction strategies are discussed specifically under five broad themes: (i) individual-level, (ii) family-level, (iii) community and societal-level, (iv) organizational-level, and (v) policy-level barriers and facilitators. Barriers to adapting disaster risk reduction included inadequate knowledge about disaster adaptation, household financial instability, poor cyclone forecasting systems, inadequate cyclone shelters, and insufficient media exposure. By contrast, being younger, strong family ties, social cohesion among community members, relief assistance, and media outreach played supportive roles for coastal communities in adapting to disasters. This research identifies essential initiatives for improving adaptation strategies, including training to enhance coastal peoples' adaptation capabilities, organizing community awareness programs to mitigate social stigma and gender-related issues, developing community infrastructure and security systems, and increasing mass media exposure.

ARTICLE INFO

Article timeline:
Date of Submission:
15 September, 2025
Date of Acceptance:
27 November, 2025
Article available online:
27 November, 2025

***Keywords*:**
Social Ecological Model
Disaster Risk Reduction
Coastal communities
Resilience
Adaptation strategies
Barriers and facilitators
Bangladesh

Introduction

Natural catastrophes are hazardous events that disrupt normal living conditions, leading to loss of life, destruction of property, and long-term socio-economic impacts on communities. Such disasters threaten the physical, social, and economic fabrics of society while undermining sustainable development. In recognition of these challenges, United Nations Sustainable Development Goal 13 (Climate Action) calls for urgent efforts to strengthen resilience and adaptive capacity against climate-related hazards, which underscores the significance of developing robust climate adaptation strategies to secure lasting climate resilience

*Corresponding author: <skchanda@soc.ku.ac.bd>

DOI: https://doi.org/10.53808/KUS.2025.22.02.1482-ss

(United Nations, 2015). When the extent of the damage exceeds local capabilities, impacted populations must depend on external aid for relief and recovery (Petrucci, 2012). Contemporary climate science demonstrates that the Earth's temperature is consistently increasing, presenting potentially grave repercussions for ecosystems and human cultures (Mohammed et al., 2019). This incremental warming is anticipated to modify weather patterns and exacerbate the frequency of extreme events. Natural disasters occur worldwide, frequently without any or no warning, resulting in extensive devastation and considerable fatalities (Abe & Hoontrakul, 2014). The abrupt emergence of these occurrences renders preparation and prompt response more difficult. Developing nations have increased susceptibility to these disasters, both for the probability and intensity of their effects (Somasundaram et al., 2003). In numerous instances, constrained resources, inadequate infrastructure, and elevated population density exacerbate the risks. Bangladesh is regarded as one of the nation's most susceptible to severe repercussions from climate change, leading the government to implement adaption measures and disaster preparedness methods (Noorunnahar et al., 2023). These activities, however, are influenced by the country's distinctive geographic and socio-economic situation. The coastal zone, particularly the low-lying areas, is acknowledged as significantly vulnerable to climate-related threats (Haque et al., 2020). This region encounters persistent hazards from storm surges, cyclones, flooding, and saltwater intrusion. From 2009 to 2014, Bangladesh had numerous catastrophes, such as floods, cyclones, and droughts, leading to elevated rates of injury, disability, and mortality per 100,000 individuals (Ahmed et al., 2018). These data illustrate the ongoing human cost of repeated disasters. Bangladesh is ranked among the most disaster-prone countries globally, with coastal people facing the most significant and enduring effects on their livelihoods and well-being (Banu, 2020; Sarker et al., 2019).

In these susceptible coastal regions, communities have considerable difficulties in managing the effects of natural disasters. The primary obstacles include insufficient funding, restricted technical expertise, and minimal public awareness. Concurrently, specific enabling elements, such robust social networks, access to timely information, and the existence of supportive governance structures, can enhance resilience and recovery (Kenneth R. McLeroy et al., 1988). Overcoming these obstacles necessitates planned and meticulously organized interventions. In this context, targeted educational initiatives, financial and technical assistance, and the establishment of strong policy and governance frameworks are considered useful methods for improving adaptive capability (Ware & Banhalmi-Zakar, 2020). Nevertheless, adaptation initiatives must be integrated into a comprehensive catastrophe management framework. The most suitable responses to natural disasters include both urgent relief efforts and long-term development strategies designed to mitigate vulnerability (Barasa, 2018). Effective adaptation is a multifaceted process influenced by geographical location, migration opportunities, resource availability, housing quality, training prospects, and access to alternative livelihoods (Amin et al., 2022). The capability for local-level adaptation is impacted by community features, the availability of internal resources, and the extent of familiarity with the dangers encountered (Yulianto et al., 2021). In rural areas, especially in agricultural communities, natural disasters frequently induce socio-economic difficulties, forcing households to implement various coping and adapting techniques (Sultan et al., 2021). However, economic development by itself does not ensure a decrease in fatalities associated with disasters. Enhanced adaptation methods, coupled with specific exposure reduction strategies, are significantly more effective in alleviating disaster impacts (Parida et al., 2021).

Given the increasing adverse impacts of climate change on coastal communities in Bangladesh, understanding how these community populations navigate and respond to such impacts is essential. This study is particularly concerned with exploring the conditions that shape community-level adaptation strategies following natural disasters. The importance of local experiences, collective understanding, and the availability of internal resources in shaping adaptation outcomes is emphasized in existing literature (Aksa & Afrian, 2022; Yulianto et al., 2021). These factors help determine the way coastal communities perceive risks and decide on suitable coping mechanisms. Additionally, Almutairi et al. (2020) emphasize the necessity of adopting comprehensive frameworks that integrate various dimensions of community resilience and actively involve diverse stakeholders in the adaptation process. Such frameworks can offer context-sensitive approaches that reflect local capacities and needs. Existing literature has also reaffirmed that the character of the community, access to indigenous resources, and prior exposure to similar hazards significantly influence adaptation responses (Yulianto et al., 2021). These insights emphasize the indigenous knowledge in building adaptive capacity. Furthermore, understanding the role of social connectedness and internal cohesion within a community can offer practical direction for replication of successful strategies in similar settings (Suharyono & Indraningsih, 2022b). Recognizing these facilitators may help guide more inclusive and effective intervention planning. Likewise, Islam et al. (2021) argue that public education, awareness initiatives, and capacity-building efforts are instrumental in strengthening community-level decision-making regarding coastal adaptation. Based on these insights, the present study aims at exploring the key barriers that inhibit, and the facilitators that support the adaptation strategies adopted by coastal communities facing natural disasters. It is crucial to identify these variables for improving future resilience frameworks and ensuring that adaptation efforts are reflective of the lived realities of the affected cohorts. On the basis of these localized factors, this study seeks to contribute to developing more effective and community-driven disaster response strategies.

Theoretical framework

The Social-Ecological Model (SEM) is a predominant theoretical framework for understanding the different layers

of influence on individuals' behavior. The model includes five interrelated levels: intrapersonal, interpersonal, community, organizational, and policy levels (Figure 1). At the intrapersonal-level, adaptation decisions are influenced by perceptions, attitudes, and knowledge of individuals. The interpersonal-level includes interactions between individuals and their families that affect an individual's ability to respond. The community-level encompasses the influence of neighborhood connection, cultural values, collective norms, and the accessibility of local resources for individuals to make decisions. The organizational-level examines the influence of institutions, including governmental and non-governmental organizations (NGOs), schools, and workplaces, in shaping and reinforcing behavior. Finally, policy-level decisions involve broad application through mass media or other agencies (K. R. McLeroy et al., 1988). As an effort to comprehend how multi-level social determinants influence the adaptive strategies of the coastal communities using the SEM, this study articulates the key barriers and facilitators in adapting risk management strategies experienced by the subjects. The multilevel structure of the SEM allows a holistic approach to comprehending why some adaptation strategies are adopted and others are not. The study uses SEM to develop an interview topic guide for data collection and guide data analysis.

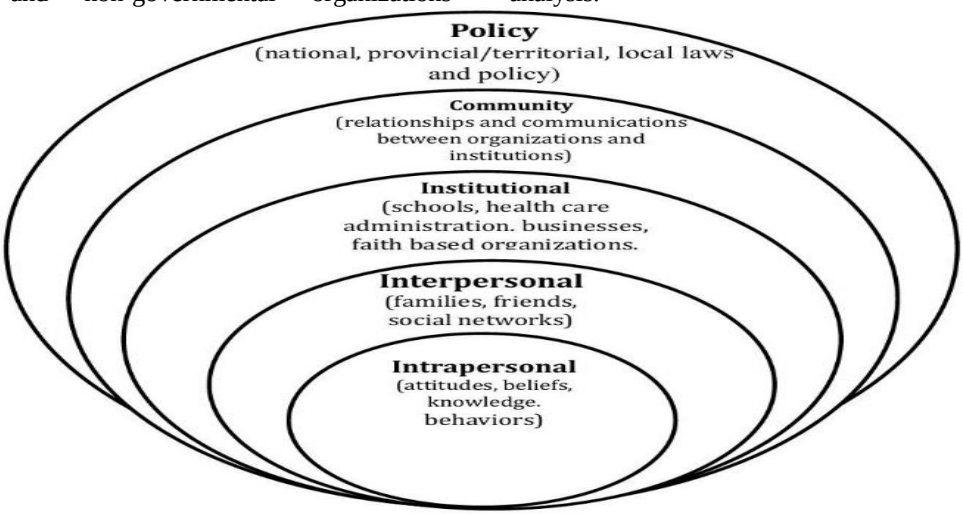

Figure 1: The Social Ecological Model (Ma et al., 2017)

Materials and Methods

Design

This is exploratory research that includes qualitative methods, such as Focus Groups (FGs) and In-Depth Interviews (IDIs) to investigate the key barriers and facilitators to adapting disaster risk reduction strategies by southwestern coastal communities in Bangladesh.

Study setting

Sharankhola upazila, located in the southwestern coastal part of Bangladesh, was chosen for this study due to its vulnerability to tropical cyclones such as Cyclone Aila (Figure 2). These cyclones have significant impacts on livelihood patterns of local coastal populations (Malaker et al., 2022). Being close to the Bay of Bengal, the study location is highly susceptible to cyclonic events (Sultana & Mallick, 2015). The area also faces frequent flooding and storm surges that increase its vulnerability (Malaker et al., 2022). The diverse socio-economic characteristics of the coastal inhabitants, with a notable literacy gap between genders, provide a unique context for understanding resilience strategies.

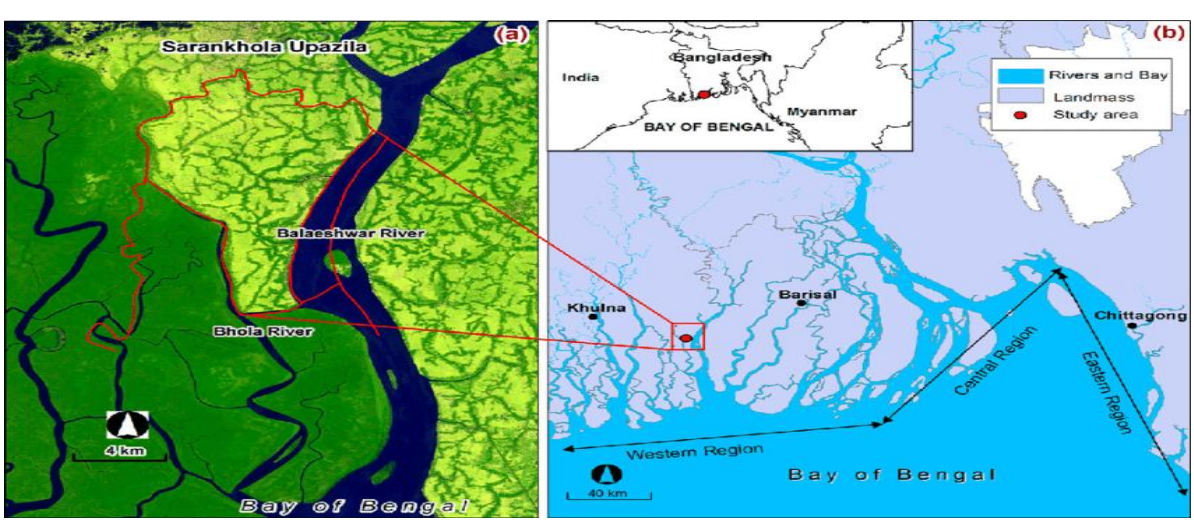

Figure 2: Study area

Sampling and sample size

The purposive sampling technique was employed to select the three villages, namely Rayenda, Dakkhin Rajapur, and Kodomtola from the purposively selected Sharankhola upazila as it is considered to be one of the most disaster-prone coastal areas vulnerable to tropical cyclones (MODMR, 2014). Afterward, 24 adult participants, including both male and female, having the experiences of cyclones and exposure to the associated vulnerabilities were selected purposefully with the help of gatekeepers, basically local community leaders, living in the respective cyclone-affected areas.. Purposive sampling was used as it allowed for the intentional selection of diverse participants based on age, occupation, and location, aligning with the study's objectives (Andrade, 2021). Unlike theoretical sampling, it was not used to generate theories but to gather varied perspectives relevant to the research. Stratified sampling was not chosen because the study prioritized capturing a broad range of lived experiences rather than predefined subgroups (Creswell, 2013). The number of respondents was determined based on qualitative research guidelines, ensuring data saturation while maintaining feasibility (Creswell, 2013).

Data collection

Data collection started with developing interview topic guides. After developing the topic guide in Bengali using the SEM, they were pilot tested with a small group of participants before being finalized. Three FGs and six IDIs with participants were conducted face-to-face to explore the barriers and facilitators of adaptation techniques among disaster-affected individuals. These methods were chosen to capture both collective perspectives through FGs and detailed personal experiences via IDIs, ensuring a comprehensive understanding of adaptation strategies (Creswell, 2013). Verbal consent of the participants was sought before starting FG and IDI interviews. An audio recorder with the consent of participants was used to record interviews with participants. Data collection with the selected participants took place between August and September 2023 through face-to-face interviews, with FGs lasting 40–55 minutes and IDIs 25–30 minutes.

Data processing and analysis

The lead author transcribed the data verbatim in Bengali after listening to FGs and IDIs. To translate data, the back-translation method proposed by Brislin (1970) was used, which includes two key processes. First, the main author translated the Bengali transcripts verbatim into English. Then, an English-degreed interpreter went back and translated the transcripts into Bengali. Second, the results were shared with the research team to see if there were any inconsistencies.

Guided by the SEM, qualitative data from FGs and IDIs were analyzed using the five phases of Framework Analysis (FA) (Ritchie et al., 2013): (i) familiarization, (ii) initial thematic framework, (iii) indexing and sorting, (iv) reviewing data extracts, and (v) data summary and display. Coding and 'code names' were applied to the transcript data in NVivo 14. Data were deductively coded and the SEM domains were used to match code names to themes. The data was reviewed again and categorized accordingly. Findings from FGs and IDIs were triangulated.

Findings

Characteristics of the participants

Table 1 indicates that the number of FGs and IDIs was three and six, respectively. Each FG included six women, resulting in a total of 18 participants across all FGs. All study participants resided in villages and were aged between 22 and 62 years. The majority of participants were male and married. Eighteen participants identified as Muslims, while the remaining six identified as Hindus. The majority of participants had finished both basic and high school education. Most of the participants were engaged in fishing, farming, and labor-related activities.

Table 1: Characteristics of the participants

Method	Location	Age	Sex	Marital status	Religion	Education	Occupation
FG1 (N=6)	Village: Rayenda	22-55	Male (N=5) Female (N=1)	Married (N=4) Unmarried (N=2)	Islam (N=5), Hinduism (N=1)	Primary (N=2), Secondary, (N=3), Higher (N=1)	Fishing (N=2) Farmer (N=1) Laborer (N=2) Business (N=1)
FG2 (N=6)	Village: Dakkhin Rajapur	30-62	Male(N=6) Female(N=0)	Married (N=6)	Islam (N=2), Hinduism (N=4)	Primary (N=5), Secondary (N=1)	Fishing (N=2) Farmer (N=2) Business (N=2)
FG3 (N=6)	Village: Kodomtola	29-50	Male(N=5) Female(N=1)	Married (N=6), Unmarried (N=0)	Islam (N=6)	Primary (N=2), Secondary (N=2), Higher (N=2)	Housewife (N=1), Service (N=2) Laborer (N=3)
IDI 1	Rayenda	46	Male	Married	Islam	Secondary	Blacksmith
IDI 2	Dakkhin Rajapur	37	Female	Married	Hinduism	Primary	Housewife
IDI 3	Rayenda	37	Male	Married	Islam	Primary	Business
IDI 4	Rayenda	56	Male	Married	Islam	Secondary	Business
IDI 5	Rayenda	53	Male	Married	Islam	Secondary	Fishing
IDI 6	Kodomtola	61	Male	Married	Islam	Primary	Fishing

Themes related to findings

The findings have been structured into five overarching themes, which were mapped into all levels of the SEM framework (Table 2). These themes serve as broader categories under which the respondents' experiences of barriers and facilitators to disaster adaptation are presented. The themes include (i) intrapersonal-level, (ii) interpersonal-level, (iii) community and social-level, (iv) organizational-level, and (v) policy-level barriers and facilitators. The findings are presented under each of these thematic areas in the sections that follow:

Table 2: Mapping themes and sub-themes with the SEM framework levels

SEM levels	Overarching themes	Subthemes			Codes
		Area covered: Barriers	Area covered: Facilitators	Area covered: Barriers and facilitators	
Intrapersonal-level	Theme 1: Individual-level barriers and facilitators			Age-related barriers and opportunities	• Elderly experience • Youth experience
				Gender-related barriers and opportunities	• Male experience • Female experience
		Lack of knowledge and institutional training			• Lack of institutional training and scientific knowledge
Interpersonal-level	Theme 2: Family-level barriers and facilitators			Family decision-making: challenges and strengths	• Family conflict • Collective decision-making
				Financial stability and economic challenges	• Consequences of financial instability
				Family support: absence and presence	• Lack of family support • Had family support
Community-level	Theme 3: Community and social-level barriers and facilitators			Community awareness of cyclones	• Lack of awareness • Having community awareness
				Volunteer support	• Absence of volunteer support • Presence of volunteer support
		Inadequate infrastructure and technology			• Poor infrastructure • Old technology
				Social equality vs. inequality in	• Social inequalities

				relief distribution	• Social equalities
			Community cohesion		• Community support
Organizational-level	Theme 4: Organizational-level barriers and facilitators			GO and NGO assistance	• GO support • GO limitations • NGO support • NGO limitations
		Inadequate local support			• Lack of local institutional support • Lack of cyclone centers
Policy-level	Theme 4: Policy-level barriers and facilitators	-	-	Mass media influence	• Lack of media exposure • Media exposure

Theme 1. Individual-level barriers and facilitators

At the individual-level, various factors influence how individuals adapt to natural disasters, including age, gender, physical capability, and knowledge or training. These factors can either hinder or support adaptation strategies of coastal dwellers.

Age-related barriers and opportunities

The elderly (age 65 or over) faced unique challenges during natural disasters due to limited access to resources, social isolation, and communication difficulties. The lack of tailored emergency plans increased their vulnerability. For example, a participant expressed the overwhelming chaos in cyclone shelters:

> *In the cyclone center, the chaos and noise overwhelm me, making it hard to move. In crowded shelters, I fear being pushed aside, lost in unfamiliar spaces. Even asking for help feels impossible when survival consumes everyone around me.* (P1, FG3)

Additionally, physical problems like arthritis and reduced mobility also restricted older adults' ability to evacuate or protect their property, often making them reliant on family support. One participant shared:

> *Now, I have become a burden on my family. I also have poor eyesight and back pain. I do not dare to go to the bathroom during emergencies. It is painful to move.* (P4, FG1)

In contrast, some older participants did not perceive age as a barrier. One stated:

> *I do not personally feel that my age is a significant barrier to adaptation (laughing). Though I am about 66, I can easily move forward with each warning.* (P4, FG3)

Similarly, younger individuals noted their physical ability helped them adapt swiftly, with one mentioning:

> *As a young and physically able individual, I do not personally feel that my age is a significant barrier to adaptation during a natural disaster.* (Irshad, IDI6)

These findings suggest that age alone does not determine adaptation capacity; physical health and perception also play important roles.

Gender-related barriers and opportunities

The findings of this study show that gender significantly shapes adaptation experiences. Women faced restricted mobility due to cultural norms, which in turn limited their access to resources and evacuation centers. Adding further to their vulnerability, maternity issues reduced their participation in decision-making. A female respondent described her experience of being pregnant and alone during a cyclone:

> *During Cyclone Aila, I was eight months pregnant. My husband was not at home, and the roof of the house was blown away by the storm. I was alone at home and did not know what to do... Suddenly a tree fell on my house, but I did not face any physical harm. Allah saved me that day.* (P4, FG1)

Interestingly, young men also encountered gender-based social barriers. Societal expectations stigmatized them for seeking shelter, as one participant noted:

> *As a 30-year-old young man, society expects me to be strong and self-sufficient. This makes it difficult for me to ask for help or admit that I need support... I was hesitant to go to the evacuation shelter because people believe that cyclone shelters are only for women and children. I was afraid they would mock me.* (P2, FG3)

These findings demonstrate the complex ways gender roles influence disaster adaptation, with both women and men facing distinct yet significant challenges.

Lack of knowledge and institutional training

A major barrier identified was the absence of institutional training and scientific knowledge about disaster adaptation. Many participants had some practical experience but lacked comprehensive understanding of disaster science and advanced strategies. One participant from one FG expressed frustration that no formal training was available in their area and felt that better knowledge could have reduced the damage caused by disasters. Conversely, individuals who received institutional training, especially near urban centers, were better equipped to assess risks, construct resilient shelters, and diversify livelihoods. A trained participant highlighted how institutional training improved preparedness and disaster management skills:

> *I have special knowledge about natural disasters and disaster management skills, and I have also received institutional training... Now we understand what to do before, during, and after an Aila (storm). We know when to go to the cyclone center, what food to take, and how to protect vulnerable family members.* (P6, FG1)

Institutional training thus acts as a key facilitator for effective disaster adaptation.

Theme 2: Family-level barriers and facilitators

Based on respondents' observations at the family-level, factors that enable or constrain climate adaptation have been examined. Several subthemes emerged from their experiences. These include family dynamics, financial stability, and the influence of familial decision-making on disaster adaptation. Each of these elements can either facilitate or hinder effective adaptive responses.

Family decision-making: Challenges and strengths

Family decision-making often involves multiple perspectives that can enrich understanding but also cause delays and conflict. Some participants reported that it was difficult to take timely action during a crisis when family members disagreed about decision-making. For instance, one participant shared how family disagreements during Cyclone Mahasen affected the decision-making and subsequent perceptions of her judgment:

> *During Cyclone Mahasen, my husband asked my opinion about going to the cyclone center. I chose to stay to protect our livestock, and he accepted my decision. However, a fallen tree destroyed our animals and cowshed. Since then, my husband blamed me and no longer valued my opinion.* (P4, FG1)

Despite such conflicts, many families found collective decision-making helpful. Considering diverse experiences and skills allowed them to coordinate and respond effectively. One participant shared:

> *Everyone's opinion is very helpful. Last time, I went to the board (cyclone center) with everyone's consent. After the storm, our house was damaged, so we returned to the shelter. If we had stayed home without prioritizing everyone's opinion, it would have been very difficult.* (P6, FG1)

This illustrates that inclusive family decision-making can strengthen adaptation efforts.

Financial instability and economic challenges

Financial instability was a major barrier. Disasters destroyed homes, livestock, farms, and income sources, leaving many unable to recover or invest in adaptive measures. Lack of access to formal loans forced some to borrow at high interest rates, which made them even more vulnerable. A shrimp farmer highlighted how financial constraints and high-interest loans hindered both recovery and adaptation after flooding:

> *When my shrimp farm floods, I lose savings and cannot afford pumps or generators. Repairs require high-interest loans, trapping me in debt. Lack of capital prevents me from adopting alternative livelihoods.* (Haldar, IDI3)

Economic hardships thus limit individuals' capacity to prepare for and recover from disasters.

Family support: Absence and presence

Some participants experienced neglect and hostility within their families during disasters, especially where prejudiced social constructions or caste differences existed. A female interview participant described being excluded from family support during a disaster due to marital disapproval:

> *No, I didn't get support. My father-in-law, mother-in-law, and sister-in-law always ignored me to take recovery strategies during disasters*

> *because we married against their wishes.* (Haldar, IDI 2)

In contrast, others described the perks of having strong family support as a potential source of emotional comfort and practical help. A male participant from one FG emphasized how strong family bonds provided both emotional and practical assistance, enabling relocation to safety:

> *We were severely damaged, but with support from my elder brother and sons, I built a floating boat and moved to the cyclone center. My whole family supports me; my second elder brother gives me money.* (P2, FG1)

Family solidarity thus plays a vital role in coping with disaster impacts.

Theme 3: Community and social-level barriers and facilitators

This section includes data from the community and social-level factors, divided into subthemes that reflect both barriers and facilitators: lack of awareness, lack of volunteers, poor infrastructure and old technology, social inequalities, community awareness, volunteer support, social equality, community cohesion, and media coverage.

Community awareness of cyclones

Lack of awareness stemming from limited access to reliable information and the absence of early warning systems or weather updates, often leaves vulnerable communities unprepared or underprepared. Six respondents mentioned such lack of awareness. One participant from one FG noted that generational attitudes of leaving matters to fate had hindered preparedness, leading to severe impacts during disasters:

> *Unawareness creates several barriers. I see my father and grandfather not worrying so much about it. They have the tendency to leave everything to fate. As a result, we have suffered from disasters. The floodwater entered our house; there was no place to sleep. Needless to say, our whole place was destroyed; there was no place available to cook. There was not enough food, and there was no source of drinking water either. Diseases spread during and after the disaster.* (P3, FG3)

However, eighteen participants noted that community awareness facilitated adaptation. Knowing cyclone warning signals, first aid, and tidal surges enabled timely and effective responses. One of them claimed,

> *Knowing cyclone warning signals and evacuation protocols helps me act promptly to protect my family. Learning first aid skills enables me to help injured people safely. Understanding natural coastal processes like tidal surges makes me prepared. Receiving weather alerts via text messages or radio keeps me updated to respond quickly.* (Ravi, IDI1)

Volunteer support

During disasters, both the absence of volunteer support and the presence of support were reported.

During disasters, a shortage of volunteers limited the capacity to provide assistance, relief distribution, and emergency response. A participant reiterated that,

> *…the lack of volunteers creates barriers to our adaptation strategies during natural disasters. When there is a shortage of volunteers, it limits the capacity to provide immediate assistance, distribute relief supplies, and conduct…* (P5, FG2)

At the same time, volunteer groups like the Bangladesh Red Crescent Society (BDRCS), BRAC, and local police were recognized as important facilitators, providing emergency aid, educational programs, and organizing evacuations. According to one participant from one FG, volunteer organizations such as the BDRCS and BRAC play a vital role in meeting immediate needs after disasters:

> *Volunteer organizations like BDRCS and BRAC provide emergency aid and relief materials, including food, water, medical assistance, and temporary shelter, to those affected by disasters. This immediate support helps meet basic needs during the initial phase of a disaster.* (P3, FG3)

Inadequate infrastructure and technology

Poor infrastructure, such as inadequate transportation and lack of electricity, hindered evacuation and medical services during disasters. As one respondent from one FG explained, the absence of electricity has wide-ranging effects on disaster response:

> *…Lack of electricity disrupts communication, hinders medical facilities, and affects the overall response and recovery efforts.* (P2, FG1)

Social equality vs. inequality in relief distribution

Social inequities create barriers, including uneven distribution of relief and furthering discrimination and marginalizing some disaster victims. One FG participant recounted how political favoritism deprived him of entitled assistance:

> *Disaster-affected people receive insufficient relief assistance compared to what they are entitled to. I, too, am a victim of such discrimination. The local members and the chairman of the Union Parishad unfairly*

distribute this relief assistance to their party members, while I, the actual victim, am being neglected and left without it. (P2, FG3)

In contrast, participants also reported how the absence of social discrimination and fair relief distribution enhanced their adaptation capabilities at times. One respondent said,

Neither I nor my family have been subjected to social discrimination. Our house was destroyed during Cyclone Fani. The chairman of the local union council assisted us in rebuilding our house. Even my father was given a relief card from Union Parishad. (P3, FG2)

Community cohesion

Strong social bonds and collective action helped mitigate disaster impacts. Neighbors provided shelter, food, and medical aid and shared information to prepare for cyclones. During one interview, a participant said the following:

In my village, the strong sense of community has been a lifeline during times of disaster. When cyclones hit, my neighbors rally together to provide shelter, food, and medical aid to those who have lost their homes or livelihoods. We share information about the approaching cyclones and evacuation routes, ensuring that everyone is well-informed and prepared. The collective action of my community helps mitigate the impact of disasters and facilitates my recovery efforts. (Suman, IDI3)

Theme 4: Organizational-level barriers and facilitators

This theme includes data from organizational-level factors divided into subthemes reflecting both barriers and facilitators, including limited NGO assistance, inadequate assistance from government organizations (GOs), local institutional engagement, shortage of emergency shelters, along with instances of NGO, GO, and local institutional facilitation.

GO and NGO assistance

Participants reported that they received assistance from both GO and NGOs after the disaster. However, participants expressed mixed opinions (positive and negative) about receiving assistance from GO and NGOs. GO and NGO support was reported as insufficient due to corruption among political leaders and officials, incapacity and reluctance of workers to distribute relief, which prevented community people from receiving proper services during disasters. One participant described how government relief failed to reach those in need due to corruption:

*After Cyclone Fani, the Ministry of Disaster and Relief Welfare sent money and relief materials to the people affected by the disaster in our upazila. But we who are the disaster-affected people did not receive the relief goods and money from the political and government officials… (*P4, FG3)

However, the GO and NGOs played an important role in providing early warning systems, food, water, clothing, temporary shelter, rebuilding assistance, and training on disaster preparedness. One FG participant highlighted the critical relief and training NGOs provided:

After Cyclone Sidr in 2007, NGOs provided me with food, water, and shelter. They also helped me to rebuild my home, which had been partially destroyed by the storm. In addition, NGOs provided me with training on how to prepare for future disasters. NGOs have also been instrumental in helping me to receive government assistance. (P2, FG2)

Although GO and NGO played supportive roles to address disaster impact, their support is not equally distributed, preventing the cyclone victims from adapting to cyclone impact.

Inadequate local support

Inadequate local support encompasses the limited availability of institutional backing from local government, as well as the insufficient provision of infrastructural resources necessary to facilitate climate adaptation in disaster-prone villages. Local institutional support was found to be scarce in peripheral villages. Fire and civil defense services were distant and slow, and rescue operations were delayed due to lack of timely Coast Guard assistance. Participants also reported no help from Union Parishad, Upazila Parishad, or Zilla Parishad. A participant pointed out the limited reach and delayed response of local institutions during emergencies:

Civil defense offices are far from our village. When our village is heavily damaged, the fire service cannot come to our village. Moreover, we need Coast Guard boats for rescue operations, but they provide them too late. Moreover, we do not get any help from Union Parishad, Upazila Parishad, or Zilla Parishad. (P5, FG2)

Additionally, the inadequate number and capacity of cyclone centers created significant barriers. Overcrowded shelters could not provide sufficient food, clean water, or medical supplies, disproportionately affecting vulnerable populations. One respondent described the challenges of staying in an overfilled cyclone center:

Inadequate cyclone centers can lead to resource shortages during and after a disaster. For example, our Kadom Tola Cyclone Center is designed to accommodate 200 people but has to shelter 500; there is not enough food, clean

> *water, or medical supplies for everyone. Vulnerable populations, who often require additional care and resources, suffer the most during such shortages.* (P5, FG1)

Theme 5: Policy-level barriers and facilitators

This theme encompasses the absence and presence of media exposure concerning cyclone or disaster-related information. The media campaign was very poor in the southwestern coastal area of Bangladesh, especially during disasters. Participants reported that they were unable to watch television or access the internet due to electricity disruptions. The radio connection was inadequate. One FG participant shared his experience:

> *We do not expect updates on television or radio anymore. They rarely tell us where the shelter is, when to leave, or what to do after the disaster. We rely on the internet, but it often fails during severe weather and can be unavailable for days. (P3, FG2)*

However, some participants who had access to media shared a positive experience. Media raise awareness through weather forecasts and early warnings, helping individuals prepare and evacuate early. One participant explicitly highlighted the role of media coverage during disaster:

> *Weather forecasts on radio, TV, and newspapers help me prepare better for upcoming storms, floods, or cyclones. I can secure my home, stock emergency supplies, etc. Media spread awareness about disaster preparedness measures like evacuation routes, cyclone shelter locations, resisting rumors, etc. This knowledge helps me act responsibly. Early warning alerts broadcast on radio or TV enable me to evacuate early to safer areas. This saves lives.* (Ravi, IDI1)

Discussion

The SEM (Golden et al., 2015) was employed in this study to explore both the obstacles and facilitators influencing disaster risk reduction strategies by the coastal community of Sharankhola following natural catastrophes. Based on the SEM, findings were categorized into five key themes: individual, family, community and social, organizational, and policy-level barriers and facilitators. This approach, incorporating focus groups alongside in-depth interviews, facilitated the collection of qualitative insights from disaster-affected individuals. The SEM served as a guiding framework for designing the interview schedule and analyzing the data, providing a structured lens through which the adaptation process was examined.

The study identified several significant impediments that hindered adaptation strategies. Among these were old age, lack of women's adaptation, physical incapacity, limited knowledge of adaptation strategies, inadequate institutional training, insufficient family support, economic constraints, lack of social capital, low awareness, limited availability of volunteers, social discrimination, lack of GO and NGO support, inadequate local institutional backing, a shortage of emergency shelters, and poor infrastructure and technology. Conversely, key facilitators of adaptation strategies included age-related opportunities, institutional training, awareness, family support, volunteer support, community cohesion, media coverage, and local institutional assistance.

At the individual-level, institutional training and age support emerged as crucial facilitators for disaster-affected individuals in adopting adaptation strategies. While previous studies have highlighted the role of institutional training (Suharyono & Indraningsih, 2022) in equipping individuals and communities with the skills and knowledge necessary for effective disaster response, this research extends the discourse by examining additional intrapersonal facilitators, including age-related support, scientific knowledge, and traditional adaptation practices. However, significant intrapersonal barriers also emerged from FG discussions and interviews, such as gender- and age-related constraints, physical limitations, lack of knowledge, and insufficient institutional training. These findings align with prior research conducted in various regions (Mallick et al., 2012; Parvin et al., 2018; Yulianto et al., 2021), which has similarly documented the challenges posed by aging, women's vulnerabilities, and the absence of adequate training in implementing adaptation strategies. Individual barriers, if unaddressed, can severely impede coastal populations' ability to adapt, thus increasing their susceptibility to climate-induced hazards.

The study also highlighted that older populations face distinct challenges in disaster situations, not solely due to age but also because younger individuals encounter age-related adaptation difficulties. This finding challenges existing literature, which predominantly associates adaptation struggles with the elderly (Parvin et al., 2023). Moreover, gendered dimensions of adaptation were evident, with women disproportionately affected due to food insecurity, heightened health risks, caregiving responsibilities, and structural inequalities limiting their access, mobility, ownership, and decision-making power (Sams, 2019). Interestingly, this research further revealed that men also faced societal stigma and restrictions when it came to performing traditionally feminine roles during disasters. Such social stereotyping hindered their participation in crucial adaptation activities such as shelter maintenance and relief distribution.

At the family-level, this study underscores the significance of social capital, family support, and decision-making in shaping disaster-affected individuals' adaptation strategies. Existing literature was found to be emphasizing the role of family decision-making and support in post-disaster recovery (Willroth et al., 2012) since family involvement in disaster preparedness not only fosters resilience but also facilitates the dissemination of

culturally appropriate resources while ensuring informed decision-making (Mallick et al., 2009). The current study further reiterated that each family member's unique experiences and expertise contributed to a holistic understanding of disaster scenarios, which appeared to be crucial for engendering more comprehensive adaptation strategies. Notably, prioritizing women's perspectives in decision-making during and after disaster allowed families to draw from a broader knowledge base, enhancing the overall effectiveness of their responses.

Nevertheless, our study findings revealed several family-level challenges, including a lack of awareness in family decision-making, financial instability, unethical behavior, and insufficient familial support. Although previous studies have primarily focused on financial constraints and inadequate family support (Pozzi, 2021; Rahman, 2014), this investigation unveiled additional complexities, such as harmful, restrictive behaviors and prolonged decision-making processes that ended up delaying crucial adaptation measures. Such findings underscore the need for targeted interventions to strengthen family cohesion and encourage proactive disaster preparedness.

Key facilitators, including community awareness, volunteer support, social equality, and community cohesion, are included at the community and social-level in our study. These facilitators exist in Bangladeshi society due to having strong ties at a community level. These findings are aligned earlier studies where disaster awareness time and fostering community engagement (Rahman, 2014) and community cohesion are identified as essentials for strengthening community adaptation strategies (Willroth et al., 2012). On the other hand, several barriers at the community and social-level were also evident, including a lack of awareness, inadequate volunteer support, poor infrastructure, outdated technology, and persistent social inequalities. In line with our study, awareness deficits, social disparities, poor volunteering, and inadequate infrastructure were revealed in hindering adaptation strategies (Jia et al., 2021; Parvin et al., 2023).

At the organizational-level, our study showed that GOs, NGOs, and local institutional support played a critical role in facilitating adaptation strategies among disaster-affected individuals. While prior research has recognized the contributions of GO and NGOs in reducing vulnerability and raising awareness concerning human mobility (Klöck & Fink, 2019), this study extends that discourse by highlighting the crucial role of institutional support. Local institutions, such as emergency services and law enforcement, were found to be instrumental in evacuation and rescue operations. However, participants noted significant organizational barriers, including limited government and NGO interventions, inadequate institutional assistance, and a shortage of emergency shelters. The research identified two primary impediments to adaptation: the absence of emergency shelters and inadequate institutional support. In marginalized villages, institutional support was notably weak, with limited services provided by the local government and a rather consistent inability to duly assess disaster impacts. Moreover, the lack of emergency cyclone centers highlights the critical need for such facilities, as they not only provide shelter but also serve as essential hubs for receiving post-disaster services, such as medical aid, food, water, and sanitation. While previous literature has acknowledged the role of GO and NGOs in providing healthcare, financial aid, and essential resources without obstructing adaptation efforts (Chowdhury et al., 2020), the present study found that a lack of such support significantly hindered the development of comprehensive adaptation strategies. Addressing these organizational deficiencies is imperative not only to enhance disaster resilience but also to ensure that affected communities receive adequate support.

Finally, at the policy-level, this study highlighted the potential role of media in supporting disaster risk reduction and adaptation. Mass media appeared to be underutilized in both pre- and post-disaster management, as experienced by the respondents. Besides, with media being largely restricted to issuing emergency alerts shortly before a disaster, they further expressed that critical information was often not effectively disseminated. Respondents also perceived that policymakers have been increasingly overlooking the potential leverage media can offer as a strategic resource. Policy guidance and intervention may clarify the role of media and encourage its proactive use as part of a coordinated disaster management strategy. Therefore, enhancing the regulation and strategic use of media could gradually strengthen its contribution to comprehensive disaster risk reduction, ensuring that communities receive timely and relevant information throughout all stages of a disaster.

Policy implications

As this study identifies both the constraints and enablers of adopting strategies for disaster risk reduction, the findings of this study correspond to both the aims and objectives of the National Disaster Management Policy 2015 introduced by the Ministry of Disaster Management and Relief, the Government of Bangladesh (MODMR, 2015). The policy explicitly advocates developing strategies to ensure direct citizen participation in disaster risk management, and that resonates strongly with the findings of this study since it articulates both inhibiting and supporting factors for vulnerable communities' capacity to adopt certain risk reduction strategies. Upon recognizing the crucial factors, this study offers the vantage point required for designing an inclusive strategy to involve citizens in developing effective approaches to manage disaster risk. In addition, since the findings of this study are primarily informed by firsthand data collected from the members of the vulnerable groups and thus are reflective of their lived realities and experiences specific to their particular socio-cultural settings, they also comply with the National Disaster Management Policy 2015's specific commitment towards undertaking risk management initiatives that are consistent with the specific social context and sensitive to

the local cultural values. By specifically shedding light on the shortcomings and strengths of government and non-government agencies working with communities, the findings of this study further align with the policy's pledge to reinforce organic, collaborative, and participatory efforts from both government and non-governmental stakeholders. Above all, the findings unequivocally conform to the Sustainable Development Goal 13 (SDG 13) (United Nations, 2015), which pledges to take immediate actions to combat the challenges and impacts of climate change. Additionally, at the policy level, enhancing media outreach to the cyclone-prone coastal areas can facilitate efficiency and prompt disaster communication at the organizational level and further reduce the risk. Likewise, investment in building more cyclone shelters can strengthen the institutional preparedness. Upon communicating field-level scenarios to the policymakers, this study aims to bridge the epistemological gap that hinders the development and deployment of effective action plans to reduce disaster risk and thus adheres to the overarching SDG 13 to combat the impacts of climate change.

Strengths and limitations

The design of the research, which includes the procedures, data analysis, and measures to guarantee rigor, is its strongest point. In order to guarantee accurate information, it chose and spoke with residents of coastal communities devastated by disasters. Thorough qualitative techniques provide comprehensive comprehension, while in-person and virtual interviews use the firsthand accounts of participants. Comprehensive background and results enhance transferability (Mathison, 1988). Using a variety of approaches results in a more diversified, valid, and trustworthy construction of reality. Findings are triangulated from the views of several stakeholders to reveal parallels and discrepancies.

This study has limitations. Since it is qualitative, findings cannot be statistically generalized. Theoretical generalization and transferability are adopted in qualitative research (Maxwell & Chmiel, 2014). Concepts could be transferred to other contexts. The recruitment process could lead to selection biases. Views during FG may have been influenced by group members. Absence of visual cues during telephone interviews could lead to data loss.

Conclusion

The qualitative study guided by the SEM helped to identify multiple barriers and facilitators to adapting disaster risk reduction strategies by southwestern coastal communities in Bangladesh. At the individual level, the physical inability to move hinders the elderly from participating in outdoor work following a disaster, whereas the youth can leverage their strength to aid in recovery from the disaster's effects. While adaptation efforts are delayed due to household financial instability, strong family ties make it stronger, rooted at the family-level. The lack of early cyclone warning systems often leaves vulnerable communities unprepared, while community awareness facilitates adaptation after a disaster, identified in the community and social-level. While relief aid supports adaptation strategies, inadequate local cyclone shelters make the adaptation process difficult. Finally, media exposure helps to keep people informed about disasters, while a lack of media exposure makes people less informed about disasters. Future study can be undertaken by employing a mixed-methods approach to understand the comprehensive nature of disaster vulnerabilities.

Acknowledgment

The researcher is very grateful to the participants who took part in the study, which was very important to the success of the study. This study would not have been possible without their help.

Ethical issues

Although this study, conducted as part of a Bachelor thesis at the Social Science School of Khulna University in Bangladesh, did not require ethical clearance, the researchers affirm adherence to the principles outlined in the Declaration of Helsinki (World Medical Association, 2025) for research involving human participants. This included obtaining informed consent from caregivers prior to commencing the survey.

Competing interests

No competing interests are declared by the authors

Consent for publication

Not applicable.

Funding

Not applicable.

Credit author statement

Nadim Morshed: Writing-final draft, Methodology Selection, Conceptualization, Topic Guide Preparation, Data Collection, Data Analysis, Discussion and Findings;
S M Faizul Haq: Review & Editing, Data Analysis; Recommendations
Sanjoy Kumar Chanda: Supervision, Review & Editing, Recommendations

References

Abe, S., & Hoontrakul, P. (2014). Natural Disasters and Fragile Supply Chains: The Great East Japan Earthquake and the Thai Floods in 2011. In P. Hoontrakul, C. Balding, & R. Marwah (Eds.), The Global Rise of Asian Transformation: Trends and Developments in Economic Growth Dynamics (pp. 217-232). Palgrave Macmillan US. https://doi.org/10.1057/9781137412362_9

Ahmed, S., Hasan, M., Pongsiri, M., Ahmed, M., & Szabo, S. (2018). Impact of Extreme Weather Events on Injury, Disability, and Death in Bangladesh. https://doi.org/10.2139/ssrn.3299124

Aksa, F. I., & Afrian, R. (2022). Community adaptation strategies toward tidal flood: A Case study in Langsa, Indonesia. Jàmbá: Journal of Disaster Risk Studies, 14, 1-8. https://doi.org/10.4102/jamba.v14i1.1258

Almutairi, A., Mourshed, M., & Ameen, R. F. M. (2020). Coastal community resilience frameworks for disaster risk management. Natural Hazards, 101(2), 595-630. https://doi.org/10.1007/s11069-020-03875-3

Amin, M. R., Shozib, S. H., Rahman, M. N., Azim, S. A., Mahbub, F., & Sarker, M. N. I. (2022). Disaster Psychology and Psychological Adaptation of Disasters: Evidence From Riverine Islands (Char) of Rural Bangladesh. Journal of Climate Change, 8, 7-15. https://doi.org/10.3233/JCC220025

Andrade, C. (2021). The Inconvenient Truth About Convenience and Purposive Samples. Indian Journal of Psychological Medicine, 43(1), 86-88. https://doi.org/10.1177/0253717620977000

Banu, N. (2020). Climate Change and Coastal Disasters of Bangladesh. In A. Singh, R. L. S. Fernando, & N. P. Haran (Eds.), Development in Coastal Zones and Disaster Management (pp. 215-224). Springer Singapore. https://doi.org/10.1007/978-981-15-4294-7_14

Barasa, B. (2018). Increased Incidences, Intensity and Scope of Disasters: Manifestation of Unsustainable Development Practices. Environment Pollution and Climate Change, 02. https://doi.org/10.4172/2573-458X.1000154

Brislin, R. W. (1970). Back-Translation for Cross-Cultural Research. Journal of Cross-Cultural Psychology, 1(3), 185-216. https://doi.org/10.1177/135910457000100301

Chowdhury, M. A., Hasan, M. K., Hasan, M. R., & Younos, T. B. (2020). Climate change impacts and adaptations on health of Internally Displaced People (IDP): An exploratory study on coastal areas of Bangladesh. Heliyon, 6(9), e05018. https://doi.org/https://doi.org/10.1016/j.heliyon.2020.e05018

Creswell, J. (2013). Qualitative Inquiry & Research Design: Choosing Among Five Approaches. SAGE Publications, 11.

Golden, S. D., McLeroy, K. R., Green, L. W., Earp, J. A. L., & Lieberman, L. D. (2015). Upending the social ecological model to guide health promotion efforts toward policy and environmental change. In (Vol. 42, pp. 8S-14S): Sage Publications Sage CA: Los Angeles, CA.

Haque, D. M. E., Mimi, A., Mazumder, R. K., & Salman, A. M. (2020). Evaluation of natural hazard risk for coastal districts of Bangladesh using the INFORM approach. International Journal of Disaster Risk Reduction, 48, 101569. https://doi.org/https://doi.org/10.1016/j.ijdrr.2020.101569

Islam, M., Amir, A. A., & Begum, R. (2021). Community awareness towards coastal hazard and adaptation strategies in Pahang coast of Malaysia. Natural Hazards, 107, 1-28. https://doi.org/10.1007/s11069-021-04648-2

Jia, H., Chen, F., & Du, E. (2021). Adaptation to Disaster Risk-An Overview. Int J Environ Res Public Health, 18(21). https://doi.org/10.3390/ijerph182111187

Klöck, C., & Fink, M. (Eds.). (2019). Dealing with climate change on small islands: Towards effective and sustainable adaptation. Universitätsverlag Göttingen. https://doi.org/10.17875/gup2019-1208.

Ma, P. H. X., Chan, Z. C. Y., & Loke, A. Y. (2017). The Socio-Ecological Model Approach to Understanding Barriers and Facilitators to the Accessing of Health Services by Sex Workers: A Systematic Review. AIDS Behav, 21(8), 2412-2438. https://doi.org/10.1007/s10461-017-1818-2

Malaker, T., Islam, L., & Das, S. (2022). Reason Behind Living in a Disaster-Prone Coastal Region: A case study on Sarankhola Upazila, Bangladesh. International Journal of Humanities, Social Sciences and Education, 9, 1-15. https://doi.org/10.20431/2349-0381.0907001

Mallick, B., Witte, S., Sarkar, R., Apurba, S., Mahboob, & Vogt, J. (2012). Local Adaptation Strategies of a Coastal Community during Cyclone Sidr and Their Vulnerability Analysis for Sustainable Disaster Mitigation Planning in Bangladesh. Journal of Bangladesh Institute of Planners, 2. https://doi.org/10.3329/jbip.v2i0.9576

Mallick, B. J., Witte, S. M., Sarkar, R., Mahboob, A. S., & Vogt, J. (2009). Local adaptation strategies of a coastal community during cyclone Sidr and their vulnerability analysis for sustainable disaster mitigation planning in Bangladesh. Journal of Bangladesh Institute of Planners, 2, 158-168.

Mathison, S. (1988). Why Triangulate? Educational Researcher, 17(2), 13-17. https://doi.org/10.2307/1174583

Maxwell, J. A., & Chmiel, M. (2014). Generalization in and from qualitative analysis. The SAGE handbook of qualitative data analysis, 7(37), 540-553.

McLeroy, K. R., Bibeau, D., Steckler, A., & Glanz, K. (1988). An Ecological Perspective on Health Promotion Programs. Health Education Quarterly, 15(4), 351-377. https://doi.org/10.1177/109019818801500401

McLeroy, K. R., Bibeau, D., Steckler, A., & Glanz, K. (1988). An ecological perspective on health promotion programs. Health Educ Q, 15(4), 351-377. https://doi.org/10.1177/109019818801500401

MODMR. (2014). Conducting and Developing Disaster Management Plan at Upazila Level: Sharankhola Upazila, Bagerhat.

MODMR. (2015). National Plan for Disaster Management, Bangladesh. https://modmr.gov.bd/

Mohammed, M., Shatil, A., & Das, A. (2019). Global Environmental Politics and Developing Nations' Climatic Vulnerability Nexus: A Systematic Review and Meta-Analysis.

Noorunnahar, M., Mila, F. A., & Ila Haque, F. T. (2023). Does the supply response of maize suffer from climate change in Bangladesh? Empirical evidence using ARDL approach. Journal of Agriculture and Food Research, 14, 100667. https://doi.org/https://doi.org/10.1016/j.jafr.2023.100667

Parida, Y., Agarwal Goel, P., Roy Chowdhury, J., Sahoo, P. K., & Nayak, T. (2021). Do economic development and disaster adaptation measures reduce the impact of natural disasters? A district-level analysis, Odisha, India. Environment, Development and Sustainability, 23(3), 3487-3519. https://doi.org/10.1007/s10668-020-00728-8

Parvin, G. A., Dasgupta, R., Abedin, M. A., Sakamoto, M., Ingirige, B., Kibria, M. G., Fujita, K., Basu, M., Shaw, R., & Nakagawa, H. (2023). Disaster experiences, associated problems and lessons in southwestern coastal Bangladesh: exploring through participatory rural appraisal to enhance resilience. Sustainable and Resilient Infrastructure, 8(sup1), 223-236. https://doi.org/10.1080/23789689.2022.2138165

Parvin, G. A., Rahman, R., Fujita, K., & Shaw, R. (2018). International Journal of Public Policy, 14(5–6), 423.

Petrucci, O. (2012). The Impact of Natural Disasters: Simplified Procedures and Open Problems. In. https://doi.org/10.5772/29147

Pozzi, T. (2021). Understanding the Barriers and Facilitators of Lidar Adoption for Flood Risk Management in the Pacific Northwest, US. Boise State University. https://doi.org/https://doi.org/10.18122/td.1836.boisestate

Rahman, M. M. (2014). Community perceptions and adaptation to climate change in coastal Bangladesh.

Ritchie, J., Lewis, J., Nicholls, C. M. N., & Ormston, R. (Eds.). (2013). Qualitative Research Practice: A Guide for Social Science Students & Researchers (2nd ed.). SAGE Publications. https://books.google.com.bd/books?id=5UgQlwEACAAJ.

Sams, I. (2019). Impacts of Climate Change Induced Migration on Gender: A Qualitative Study from the Southwest Coastal Region of Bangladesh. International Journal of Social Science Studies, 7, 57. https://doi.org/10.11114/ijsss.v7i4.4292

Sarker, M. N. I., Wu, M., Alam, G. M., & Shouse, R. (2019). Livelihood Vulnerability of Riverine-Island Dwellers in the Face of Natural Disasters in Bangladesh. Sustainability, 11. https://doi.org/10.3390/su11061623

Somasundaram, D., Norris, F. H., Asukai, N., & Murthy, R. S. (2003). Natural and Technological Disasters. In B. L. Green, M. J. Friedman, J. T. V. M. de Jong, S. D. Solomon, T. M. Keane, J. A. Fairbank, B. Donelan, E. Frey-Wouters, & Y. Danieli (Eds.), Trauma Interventions in War and Peace: Prevention, Practice, and Policy (pp. 291-318). Springer US. https://doi.org/10.1007/978-0-306-47968-7_13

Suharyono, S., & Indraningsih, K. S. (2022a). Strategies of Adaptation Capacity Improvement Among The Natural Disaster Victims. https://doi.org/10.24843/soca.2022.v16.i01.p04

Suharyono, S., & Indraningsih, K. S. (2022b). Strategies of Adaptation Capacity Improvement Among The Natural Disaster Victims. SOCA:Jurnal Sosial Ekonomi Pertanian, 16, 42 - 54. https://ojs.unud.ac.id/index.php/soca

Sultan, H., Abubakar, I., Arfah, S., Sulaeman, & Demmallino, E. (2021). Socio-economic adaptation strategy of farming communities after natural disasters. IOP Conference Series: Earth and Environmental Science, 681, 012074. https://doi.org/10.1088/1755-1315/681/1/012074

Sultana, Z., & Mallick, B. (2015). Adaptation Strategies after Cyclone in Southwest Coastal Bangladesh – Pro Poor Policy Choices. American Journal of Rural Development, 3, 24-33. https://doi.org/10.12691/ajrd-3-2-2

United Nations. (2015). Sustainable Development Goals (SDGs). Retrieved 7 April 2019 from https://www.un.org/sustainabledevelopment/sustainable-development-goals/

Ware, D., & Banhalmi-Zakar, Z. (2020). Strategies for governments to help close the coastal adaptation funding gap. Ocean & Coastal Management, 198, 105223. https://doi.org/10.1016/j.ocecoaman.2020.105223

Willroth, P., Massmann, F., Wehrhahn, R., & Revilla Diez, J. (2012). Socio-economic vulnerability of coastal communities in southern Thailand: the development of adaptation strategies. Natural Hazards and Earth System Sciences, 12(8), 2647-2658.

World Medical Association. 2025. The Declaration of Helsinki, https://www.wma.net/what-we-do/medical-ethics/declaration-of-helsinki/

Yulianto, E., Yusanta, D. A., Utari, P., & Satyawan, I. A. (2021). Community adaptation and action during the emergency response phase: Case study of natural disasters in Palu, Indonesia. International Journal of Disaster Risk Reduction, 65, 102557. https://doi.org/https://doi.org/10.1016/j.ijdrr.2021.102557