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**RESEARCH ARTICLE**

# Assessing Disaster Resilience in Climate-Vulnerable Communities: A Financial Resilience-Based Grading Framework for Bangladesh

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**Abstract**
Bangladesh, one of the world's most climate-vulnerable nations, faces increasing challenges due to high population density and frequent extreme weather events. Coastal communities, in particular, suffer substantial economic losses from climate-related hazards. This study aimed to develop a conceptual framework for identifying disaster resilience indicators, focusing on financial resilience, and creating a grading system for community disaster resilience. Drawing from resilience assessment frameworks like the Climate Disaster Resilience Index (CDRI) and the 5 Capitals Model, the research crafted a tailored framework for the local context. Using the Grade Point Index (GPI) method, scores were calculated for each parameter and dimension. The study focused on the climate-vulnerable, low-income communities of Koyra, Shyamnagar, and Monirampur, identified through consultations and vulnerability assessments, with support from Islamic Relief Bangladesh. Findings revealed critical gaps in financial capacity, limited income diversification, and low household savings, weakening overall resilience. Access to social safety nets was also limited, particularly in the most vulnerable areas. The newly developed resilience grading tool showed nearly 90% of indicators in critical categories, underscoring significant shortcomings in community resilience. This tool allows for quick assessments, ongoing monitoring, and comparative analysis, offering valuable insights for planning, management, and policy development. The study recommends policymakers and development agencies adopt this grading method to prioritize interventions and support to make resilient of any vulnerable community.

**Keywords:** Climate-vulnerable; Disaster resilience; Financial resilience; Resilience assessment frameworks; Resilience grading tool

## Introduction

Bangladesh, with a current population density of 1,015 per km² and an annual growth rate of 1.37%, is widely recognized as one of the most vulnerable countries to climate change. This density is expected to exceed 1,200 per km² by 2025 (Shaw, 2015). The country's coastal areas have suffered escalating economic losses due to climate-related challenges, positioning Bangladesh as the seventh most affected country globally from 2000 to 2020, according to the 2021 Climate Risk Index. During this period, 185 extreme weather events resulted in

economic losses of nearly US$1.9 billion (Eckstein et al., 2021). These challenges have driven a shift in research towards disaster resilience. Disaster resilience has gained increasing attention in hazards and disaster research, policy, and risk reduction programs. The United Nations Commission on Sustainable Development (2001) and scholars such as Burby (1998), Godschalk et al. (1999), and Mileti (1999) have emphasized the importance of building disaster-resilient communities. Research views disaster resilience as a key goal in disaster management and planning (Burby et al., 2000).

Efforts to measure disaster resilience typically focus on identifying characteristics or attributes of resilient individuals, communities, or systems. These measurements often incorporate multiple dimensions, such as physical, economic, social, and institutional factors. However, as noted by Winderl (2014), no general measurement framework for disaster resilience has been empirically verified. Among the frameworks reviewed are the Climate Disaster Resilience Index (CDRI) (Shaw and Team, 2009), Texas Community Disaster Resilience Index (TX-CDRI1) (Peacock et al., 2010), and Coastal Community Resilience (CCR1) (Courtney et al., 2008). While these frameworks provide valuable insights, each has limitations in design and implementation. The CDRI, introduced by the International Environment and Disaster Management Laboratory of Kyoto University, measures resilience across five dimensions: physical, social, economic, institutional, and natural. Financial resilience is also linked to the ability to raise emergency funds and maintain savings to manage financial shocks (Lusardi et al., 2011; Salignac et al., 2019). Research by Tavares and Hall (2016) and Aiyar et al. (2019) has highlighted the importance of financial buffers, such as savings, in mitigating the impact of financial shocks on long-term well-being. Scholars like Lusardi and Tufano (2015) and Hanna et al. (2014) emphasize savings' role in protecting long-term assets, while Sherraden (2018) suggest policy interventions to promote household financial resilience. Further research is needed to explore resilience dynamics comprehensively and develop effective strategies for promoting financial resilience at the household level.

This study aims to develop a conceptual framework for identifying indicators of disaster resilience, particularly economical resilience, within coastal communities, and to create a grading system for comparing and monitoring community resilience. While the study primarily focuses on the most climate-vulnerable and low-income groups in a specific regional context, the tool itself has broader applicability. Socio-economic structures and vulnerabilities vary significantly across countries and communities; therefore, contextual adaptation of the indicators is essential for meaningful use in other settings. The grading tool is based on mean values, which may not accurately reflect the resilience status of a heterogeneous population. Applying it to a highly diverse or mixed sample without contextual adjustments could lead to misleading conclusions. However, when used within relatively homogenous vulnerable communities and adapted to local conditions, the tool remains a robust and transferable framework for assessing resilience.

## Review of literature

The framework for assessing community resilience and disaster preparedness was developed through a comprehensive literature review and extensive stakeholder and expert consultation. This approach ensured a consensus on key indicators, which were then weighted to evaluate resilience effectively. The framework integrates both quantitative and qualitative methods, incorporating public opinions and expert evaluations. Economic capital is a primary focus in resilience assessment, with indicators such as household income, savings, access to insurance, credit, employment rates, and social safety nets. According to Buckle (2001), these indicators are crucial in understanding how households navigate financial shocks. Resilience, defined as the ability to withstand and recover from adversity, provides the theoretical basis for this framework. Scholars like Bonanno (2004) and Norris et al. (2008) have highlighted the significance of individual and collective resilience in various domains, including finance.

**Table 1.** List of Selected Indicators

| Indicators/ Variables/Source of resilience | Indicator explanation |
|---|---|
| Household financial savings that protect long term assets | This is a financial (liquid asset – i.e., money or money equivalent) resource. The more liquid, the better. In between there would be some reserve but not enough to cover expected losses; some reserve but it is not reliable and/or the household often taps into it for non-disaster expenses. When this is aggregated, it should be weighted by percentage of houses with and without adequate financial buffers. Consider the interaction between savings, insurance or credit (households may use one as their buffer and may not need all three). |
| Communal social safety net | This source looks at financial protections at the local level. This is again financial protection specifically set aside or contingent on disaster. Include provision from local government, local religious organizations, community emergency funds etc. |
| Household Credit Access | This source looks at the availability of credit for members of the community. Key aspects of the assessment are:<br>It can be formal or semi-formal;<br>community access to financial services does not diminish during and after a disaster and even improves (greater access to financial services) |
| Risk transfer mechanism/insurance | community access to financial services so that it could be transferred the risk to come back better. |
| Household income continuity strategy | This source looks at the economic activity within the community and the ways in which income is derived and maintained during disasters. It considers any livelihood strategy that allows a household to maintain or quickly restore a flow of income (e.g., ability to work remotely, have access to business lines of credit, have alternate livelihoods that can be switched to, have remittance from family members outside the disaster area, etc.). |

The relationship between communal social safety nets and resilience is well-documented. Scholars such as Putnam (2000) and Berkes and Ross (2013) emphasize that strong social ties, effective local governance, and active community engagement contribute significantly to informal and formal support systems, enabling communities to better navigate crises. Cultural and traditional practices also play a significant role in resilience, as explored by Adger (2003) and Manyena (2006). These practices can foster a sense of identity, solidarity, and adaptive capacity, contributing to the development of communal safety nets. Household income continuity strategies are another key aspect of resilience. Strategies for maintaining household income during shocks are key to financial resilience. Studies by Stephens and Szafarz (2012), Duflo and Udry (2004), and Barrett et al. (2001) highlight how income diversification helps mitigate financial disruptions. In parallel, Dercon and Krishnan (2000) and Fafchamps (2003) emphasize the role of informal networks in preserving income continuity. Savings and financial planning are crucial for resilience, with Lusardi and Mitchell (2011) emphasizing the need for well-structured financial plans to buffer against income volatility. Government

assistance programs, including unemployment benefits and cash transfers, are vital in supporting households during periods of income instability, as discussed by Bitler and Hoynes (2016).

As Armendariz de Aghion and Morduch (2005) explain, "access to credit helps poor households manage cash flow, invest in small enterprises, and build resilience against economic shocks." Insurance mechanisms are vital for resilience, particularly in risk transfer and recovery. Dercon and Hill (2009) assert that "insurance is not merely a financial instrument, but a mechanism that allows households to take productive risks and protect long-term welfare." Browne and Hoyt (2000) state, *"catastrophic insurance provides crucial financial support that enables households and businesses to recover from severe natural disasters and economic shocks."*

In summary, the framework emphasizes the importance of Household savings that protect long term assets, communal social safety nets, income continuity strategies, credit access, and insurance in building resilience (Table 1). However, further research is needed to address challenges related to credit and insurance access, affordability, and the long-term effects of these strategies on resilience. The integration of these indicators into the framework provides a comprehensive approach to understanding and enhancing resilience at both household and community levels.

## Materials and Method

### Area of study

The study area was selected purposefully. At first the researcher wanted to access in the most vulnerable community and cooperation of NGOs who are working in these areas. It was found that Islamic Relief Bangladesh has good presence in the selected most vulnerable communities and working to enhance resilience of a large number of HH that were needed of the researcher as selection of population and sample size for study. Islamic Relief Bangladesh accepted the request of the researchers and agreed to collaborate.

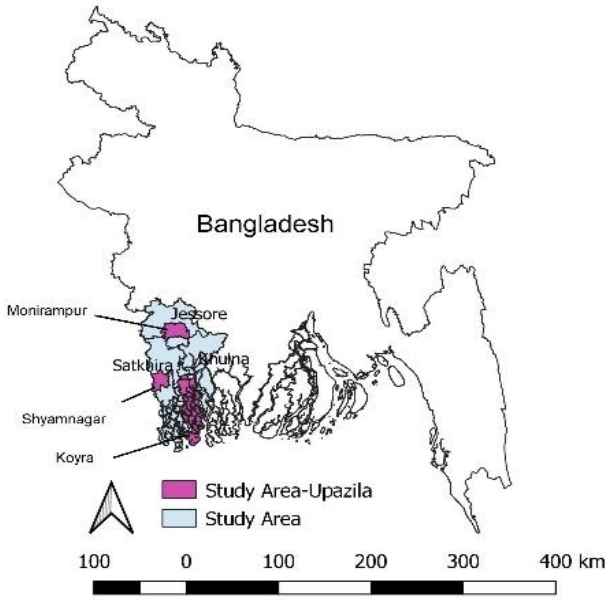


**Figure 1.** Study area

To select the study area, national secondary data was reviewed and identified Shyamnagar subdistrict under Satkhira district is in 5th position, Koyra of Khulna is in 9th position and Jashore was in 40th position in terms of multi hazard. Though Jashore was in 40th position but water logging is serious issue for this area (Draft report, CVI , UNDP,2023). The unions and wards were selected through consultation with the different level key informants. Each key informant was given a score sheet to put score using three-point Likert scale considering the vulnerable situation like poverty status, food security, job opportunity, transport system, availability of services, presence of NGO activities, exposure to the hazard of each union then it was computed the score and prioritized the vulnerability. Top most vulnerable unions and wards were selected for this study. Most vulnerable= 3, Vulnerable= 2, Good= 1. The score sheet of Unions prioritization is given in Table 2. Same methodology was used in selection the unions of Monirampur and Koyra

**Table 2:** Vulnerability Scoring of Shyamnagar

| Sl # | Name of Union | UNO | PIO (Upazila) | Upazila Women Affair's Officer | Upazila Agriculture Officer | Upazila Education Officer (Primary/High School) | Upazila Social Service Officer | Upazila Cooparative Officer | Press Club (Upazila) | Upazila Livestock Officer | Action Aid Bangladesh (NGO) | Friendship (NGO) | World Vision (NGO) | BRAC (NGO) | ICRA team | Total score |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | Bhurulia | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 14 |
| 2 | Kashimari | 2 | 2 | 2 | 1 | 2 | 2 | 1 | 1 | 2 | 2 | 3 | 2 | 3 | 2 | 27 |
| 3 | Shyamnagar | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 14 |
| 4 | Nurnagar | 1 | 1 | 2 | 2 | 2 | 2 | 1 | 1 | 1 | 2 | 2 | 1 | 2 | 1 | 21 |
| 5 | Koikhali | 2 | 2 | 2 | 3 | 3 | 2 | 3 | 2 | 3 | 2 | 3 | 3 | 2 | 2 | 34 |
| 6 | Ramjannagar | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 2 | 3 | 3 | 3 | 41 |
| 7 | Munshigonj | 2 | 2 | 3 | 3 | 2 | 2 | 3 | 2 | 3 | 3 | 2 | 3 | 2 | 2 | 34 |
| 8 | Ishwaripur | 2 | 2 | 2 | 2 | 2 | 1 | 1 | 1 | 2 | 3 | 2 | 1 | 1 | 2 | 24 |
| 9 | Burigoalini | 3 | 3 | 3 | 2 | 3 | 2 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 40 |
| 10 | Atulia | 2 | 2 | 2 | 3 | 2 | 2 | 2 | 2 | 3 | 2 | 2 | 3 | 2 | 2 | 31 |
| 11 | Poddopukur | 2 | 3 | 2 | 3 | 3 | 3 | 3 | 2 | 3 | 2 | 3 | 3 | 2 | 2 | 36 |
| 12 | Gabura | 2 | 3 | 2 | 3 | 3 | 3 | 3 | 2 | 3 | 2 | 3 | 3 | 2 | 2 | 36 |

Under these most vulnerable Unions most vulnerable wards and villages were selected as the research site following the perception-based score from the different stakeholders and Key informant like Union Chiarman, union secretary, Sub assistant Agricultural officer, Union community clinic in charge, teacher, religious leader, UP Women member, NGO representative. The key informants put score as 1,2,3 according to low, medium and highly vulnerable against each parameter like poverty, food insecurity, river proximity, community educational status, intensity of natural hazard, Job availability, quality of transportation access, status of market system, status of agricultural input service, access to different support services, status of NGO development activities

and Gender equality against each villages. After getting the scores from all KI it was summed and prioritized to select the research village.
Wellbeing analysis was done of the prioritized villagers through participation of HH representatives of the community, used PRA tools to segregate the HHs in three categories like extreme poor, poor and rich. from the extreme poor list bottom most 600 HHs were selected as population of this study from each upazila, total 1800 HHs from three subdistrict/upazilas were taken as population size. Sample size (318) was determined using the following formula. The households for interview were selected randomly. The selected unions were Burigoalini and Ramjan nagar under Shymanagar of Satkhira district, Koyra Sadar and Moharajpur under Koyra of Khulna, Horidashkati and Kultia are under Monirmpur of Jashore.

**Sample Size Determination**

Sample Size (n') for finite population i.e. direct beneficiaries has been calculated using the following statistical formula:

$$n' = \frac{n}{1+\frac{z^2 \times p(1-p)}{e^2 N}}$$

Where,
n= Sample size for unlimited population considering 0.5 population proportion, 95% confidence and 5% error (318)
N= The finite population i.e. direct beneficiaries (1800)
z = z-score i.e. 1.96 (for 95% confidence level)
p = Standard Deviation i.e. 0.5, q = 1-p
e = Margin of error (percentage in decimal form) i.e., 0.05 (for 5% error)
So,

$$Sample\ size\ n' = \frac{384.16}{1+\frac{1.96^2 \times 0.5(1-0.5)}{0.05^2 \times 1800}} = \frac{384.16}{1+\frac{3.8416 \times 0.25}{0.0025 \times 1800}} = \frac{384.16}{1.21} = 316.61 \approx 317+$$

To test our formulated resilience measuring tools we objectively obtained consent from the Islamic Relief Bangladesh (IRB); an INGO who is implementing enhancing climate resilience project in the Monriampur, Shyamnagar and Koyra subdistrict under the district Jashore, Satkhira, and Khulna subsequently.

**Method**

In measuring community resilience concerning financial capital, we adopted the Climate Disaster Resilience Index (CDRI), a planning tool developed by the Climate and Disaster Resilience Initiative of Kyoto University (Shaw et al. 2010). Additionally, we considered the 5 Capitals Model, inspired by DFID's Sustainable Livelihoods Framework (SLF) (DFID, 1999; Keating et al., 2014), which identifies five complementary forms of capital sustaining communities: human, social, physical Also fitting with this thinking is Practical Action's Vulnerability to Resilience (V2R) framework natural, and financial (Pasteur, 2011). Each capital is made up of a number of "sources". Under the financial capital there are 5 sources. Resilience sources are classified according to the 5 Capitals, each symbolizing a unique element that enhances overall resilience. It also followed the Zurich Flood Resilience Measuring Tools (FRMT) (Karen,et al 2019). The selection of variables was

adapted to the local context, gathering corresponding indicators and, when needed, finding appropriate alternatives. The framework's development began with compiling an initial set of indicators and variables, informed by a thorough literature review. Stakeholder and expert input were also crucial, as their perspectives were used to reach a consensus on the key indicators. Additionally, weights were assigned to these indicators to evaluate community resilience and disaster response capability. This framework integrates both quantitative methods and qualitative approaches, including public opinions and expert judgments.

**Weighting**

We used Grade Point Index (GPI) method to compute the scores for each parameter and dimension, respectively. Data were computed in excel to calculate scores and describe them in different charts diagrams.
All sources are given equal weight of each capital. Financial capital has five sources of resilience named (x1, x2 , . . x5 ). Each source is graded A, B,C,D were given weight 4,3,2,1 respectively.

Where the categories denote
A: Best practice for managing the risk
B: Good industry standard, no immediate need for improvement
C: Deficiencies, room for visible improvement
D: Significantly below good standard, potential for imminent loss

Source Grade Point index was calculated for each source of resilience using following formula

$$\text{Grade Point Index (GPI)} = \frac{(\text{Grade weight} \times \text{Number of respondent})}{(\text{Grade weight} \times \text{Total respondent})} \times 100$$

Example,

$$X1A = \frac{(4 \times n1)}{(4 \times N)} \times 100$$

Where,

X1= Source of resilience

A= Grade or resilience

n1= number of respondents against grade A of resilience source 1

N= Total number of respondents

**Sample Distribution for Qualitative Survey**

The breakdown of FGDs and KIIs conducted within the qualitative study has been provided in Table 3.

**Table 3:** Sample Distribution for Qualitative Survey

| Beneficiary Type | FGD | KII |
|---|---|---|
| Community Groups | 6 | - |
| Disaster Management Committees (Ward, Union, Upazila) | - | 6 |
| Local Govt. Representatives / Officials | - | 10 |
| IRB Focal Persons/Representatives | - | 3 |
| Total | 6 | 19 |

**Data Collection and analysis**

Our research examines whether the instrument of building resilience of a community works together that reflect the capacity of community to institutions. Obtaining reliable quantitative data on activities of both government and NGOs is a chronic issue in Bangladesh; our research therefore applied mixed method qualitative, quantitative, tools and techniques. Both primary and secondary data sources were used for empirical investigation and policy analysis. To collect the primary data from local communities, we applied participatory rural appraisal tools, such as wealth being analysis, focus group discussions (FGDs), household interviews and key informant interviews. We analyzed data procured from a total of 318 households distributed across the unions, which were systematically selected to conduct the interviews and FGDs. We received 100% response from the targeted households for household interview. It was considered different sex, age for interview. Six FGDs were carried out by administering a semi-structured questionnaire to the village. For policy analysis, we relied chiefly on secondary data, which were supplemented by primary data. Official documents from the government, study reports from NGOs and other organizations, journal articles, newspaper clippings and internet resources from reliable and responsible sources provided additional information for our analysis. It was collected information from different key informant structured score sheet was used as well as informal discussions were done.

Following a comprehensive plan, the Enumerators completed the field works within the stipulated timeline using pre-designed checklists and questionnaires. Well trained enumerators collected the household level data using Kobo Toolbox data management platform. Researchers oversaw spot checks on a subset of respondents to maintain accuracy and consistency. After collection, open-ended responses were coded and entered suitable software like MS-Excel, then cleaned by the Data Analyst, with thorough checks on at least 10% of the data. For qualitative data, researcher conducted FGDs, KIIs. Emphasis was placed on meticulous documentation and analysis, adhering to professional standards. Qualitative data was analyzed through thematic analysis to identify the pre-defined themes from the transcribed data. Through the analysis, the similar issues were identified and then they were put together theme-wise.

**Results and discussion**

**Demographic information**

The demographic information of the surveyed households reveals that 91% of participants were women, while nearly 9% were men. The age distribution indicates that 47% of respondents fall within the 31-50 age group, 26% are aged 16-30, and 7% are 60 years or older. In terms of housing conditions, 78% of the respondents live

in katcha houses, with 10% residing in semi-pucca houses. Regarding education, 65% of respondents have completed 1-5 grades, 28% have completed 6-10 grades, 3% have obtained their Secondary School Certificate (SSC), 2% have reached the Higher Secondary Certificate (HSC) level, and 3% have attained a graduation degree. The literacy rate for those aged 7 years and above is 74% at the national level. Occupation-wise, 48% of respondents are daily laborers, 18% engage in fishing, 12% in livestock or poultry rearing, 7% in rickshaw or van driving, 4% in crop production, and 1% in auto rickshaw driving, with various other occupations also represented (Table 4)

**Table 4:** Demographic information of study area

| Indicators | Features | Monirampur | Koyra | Shyamnagar | Over all percent |
|---|---|---|---|---|---|
| Sex | Women | 104 | 80 | 106 | 91 |
| | Men | 2 | 26 | 0 | 9 |
| Age | 16-30 | | | | 26 |
| | 31-50 | | | | 47 |
| | 51-60 | | | | 19 |
| | 60+ | | | | 7 |
| Category of Houses | Katcha | 67 | 70 | 96 | 78 |
| | Pucca | 2 | 0 | 0 | 1 |
| | Semi-Pucca (Wall and Floor-Pucca, Roof-Tin) | 28 | 1 | 2 | 10 |
| | Tin Made (Floor-Pucca, Wall and Roof-Tin) | 3 | 29 | 2 | 11 |
| Educational Qualification | Class 1-5 | 71 | 65 | 70 | 65 |
| | Class 6-10 | 28 | 35 | 25 | 28 |
| | SSC | 3 | 5 | 1 | 3 |
| | HSC | 3 | 1 | 3 | 2 |
| | Graduate | 1 | 0 | 7 | 3 |
| Occupation | Crop production | 13% | 0.00% | 0.00% | 4.41% |
| | Fishing | 3% | 14.39% | 35.40% | 18.06% |
| | Fish business | 1% | 0.72% | 0.00% | 0.44% |
| | Livestock/Poultry farming | 22% | 14.39% | 0.00% | 12.11% |
| | Shopkeeping | 5% | 0.72% | 0.00% | 1.98% |
| | rickshaw/van driving | 8% | 7.91% | 4.35% | 6.61% |
| | Autorickshaw driving | 1% | 1.44% | 1.86% | 1.32% |
| | Daily labour | 39% | 54.68% | 48.45% | 47.58% |
| | Small business | 6% | 0.72% | 1.24% | 2.86% |
| | Housekeeper | 3% | 0.00% | 6.21% | 3.08% |
| | Job | 0% | 5.04% | 2.48% | 2.42% |

**Hazard prioritization**

Respondent identified the hazard as in (Table 5) on the basis of their perception on hazard frequency and intensification.

**Table 5:** Hazard prioritization

| Hazard | Monirampur | Koyra | Shyamnagar |
|---|---|---|---|
| Cyclone and tidal surge | 0 | 84 | 68 |
| Heavy rain/Flood/Water logging | 57 | 2 | 0 |
| Drought /Heat | 35 | 5 | 9 |
| Strom | 14 | 0 | 0 |
| Salinity | 0 | 15 | 29 |

It has been revealed that cyclone and tidal surge is the major hazard in the Koyra and Shyamnagar whereas water logging following heavy rain is the major at Monirampur. It happens often and destroying effect is high. Following tidal surge salinity is being increased that affecting the life and livelihoods.

## Trend of climate induced hazard

Using Participatory Rural Appraisal (PRA), a climatic hazard trend analysis was conducted for each subdistrict. The findings indicate that over the past 10 to 20 years, there has been a noticeable increase in the frequency and intensity of various climatic hazards in coastal areas: The occurrence of Cyclones and Tidal Surges has escalated from medium to very high. The frequency of Heavy Rain/Flood/Waterlogging has increased from medium to high. Drought/Extreme Heat conditions have intensified, rising from low to high. The frequency and impact of storms have increased from low to high. The severity of salinity issues has significantly increased, moving from low to very high. These trends highlight the growing vulnerability of coastal areas to climatic hazards.

### Household financial savings that protect long term assets

When it was asked about the income and expenditure 67% of total respondent said their income is 5001-10000tk per month where as 70% respondent mentioned their monthly expenditure is around 5001-10,000tk. It means that 3% respondent who has monthly income around 5001-10000tk are in debt and they need to get loan or borrow. It reveals that 70% respondent in this category has no scope to save from their monthly income. Similarly, the income group of >5000tk are 24% and 21% respondent do expenditure this range of amount. It seems that 3% of the low-income group has some scope to save something (Table 6).

When respondents were asked about the head of their family expenditure it was found that almost 100% people expense for food purchasing and that was average 4500BDT in all area. Among the three subdistricts Shyamnagar was found high then Monirampur and then Koyra spent food purchasing. Less expense was found in productive asset purchase. (Figure 2.)

**Table 6:** Income and expenditure status

| Tk | Koyra | | Shyamnagar | | Monirampur | | Overall | |
|---|---|---|---|---|---|---|---|---|
| % of respondent | Income | Expenditure | Income | Expenditure | Income | Expenditure | Income | Expenditure |
| < 5000 | 14 | 12 | 22 | 20 | 35 | 30 | 24 | 21 |
| 5001-10000 | 74 | 74 | 75 | 76 | 54 | 59 | 67 | 70 |
| 10001-20000 | 12 | 14 | 4 | 4 | 11 | 10 | 9 | 9 |

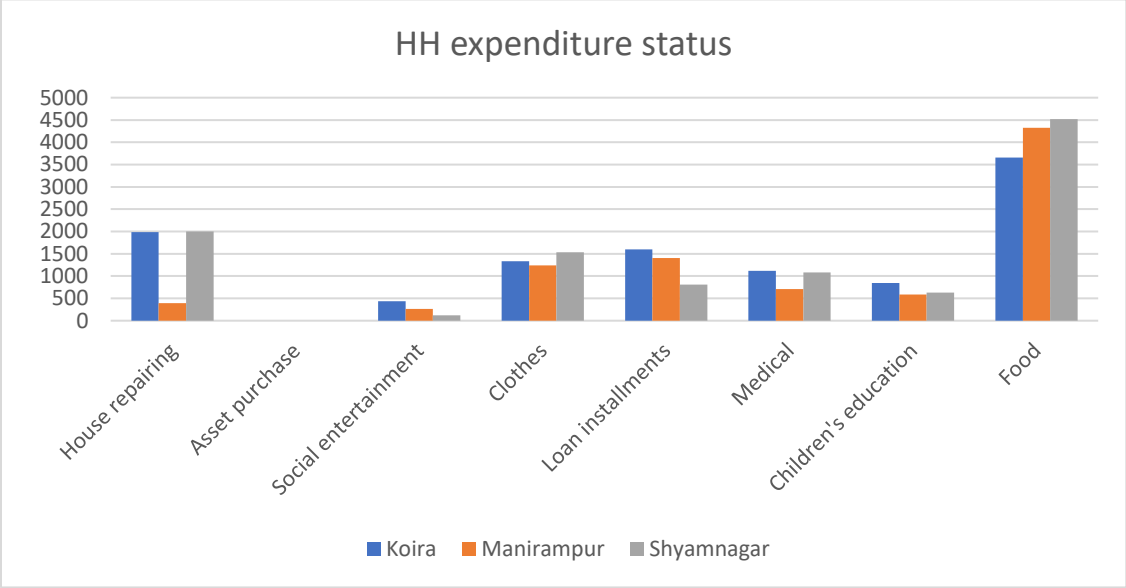


**Figure 2.** HH expenditure Heads

When it was asked about the savings habits, approximately 62% confirmed that they have no savings a portion of their monthly income. About 23% respondent saved negligible amount 1-100BDT. 2% respondent can save 400-500BDT per month. These findings highlight the financial capacity of the targeted community.

**Communal social safety net**

When it was asked about receiving social assistance or allowances through Social Security Programs, approximately 58% of respondents indicated that they did not receive government any support. In contrast, 42% reported benefiting from government assistance under social safety net program as presented in the following graph but there was not found any support as climate fund. (Figure 3)

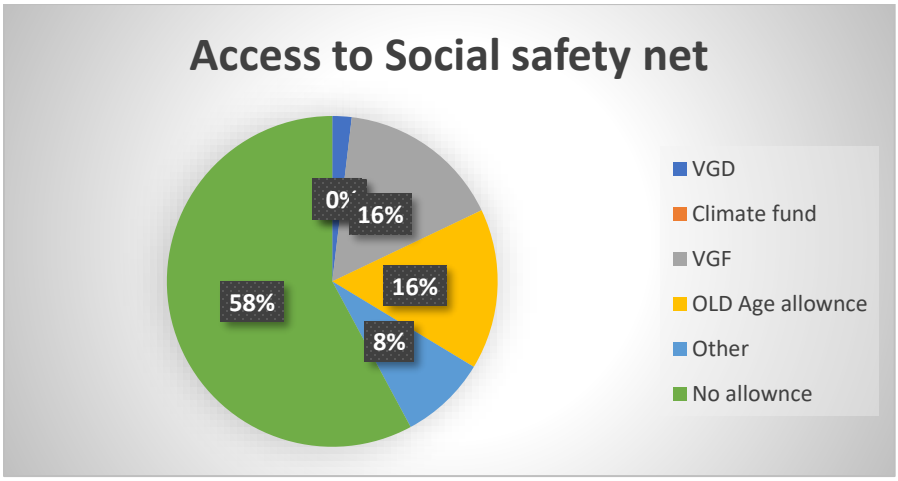


Figure 3. Status of access to social SafetyNet

The communities of Ramjan Nagar and Burigoalini Union in Shyamnagar, Satkhira, Koyra and Mohesherpur Union in Koyra Subdistrict, Khulna, Kultia and Haridashkati unions of Monriampur subdistrict, Jessore are situated in the south western coastal part of Bangladesh which are heavily impacted by climate change.

**Household income continuity strategy**

The study carefully recognized and examined how incomes change for respondents in different seasons. It shows that during July to September 69% respondent have no strategy to continue their income and 19% respondent could not continue their income in October to December (Figure 4). The monsoon triggers heavy rainfall and floods, significantly impacting agriculture and fishing. This leads to reduced income due to crop damage and restricted fishing access.

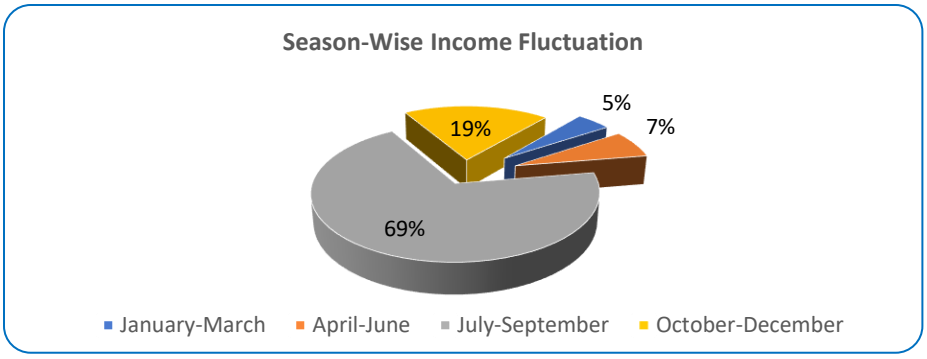


**Figure 4**. Seasonal variance of HH income

**Confident level of resume income following disaster**

The study says 91% people are not confident enough to able to start earning again very soon if suddenly cut off by a flood or cyclone. (Figure 5)

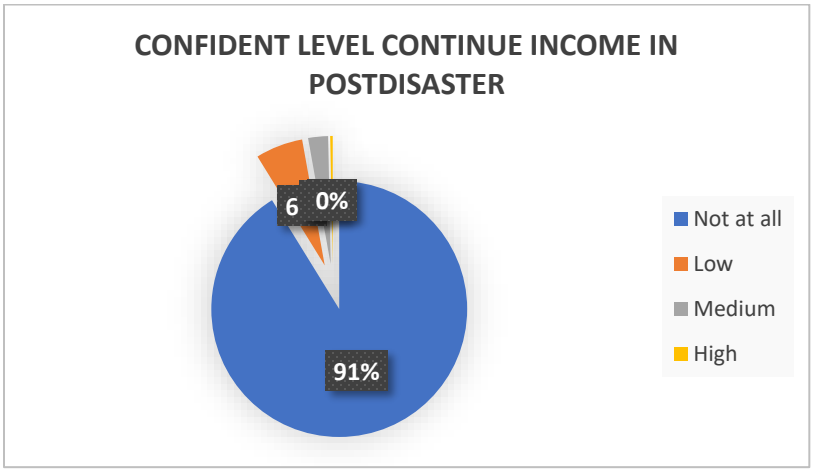


**Figure 5:** Confident level of resume income following disaster

**Ability to continue HH expenditure during disruption of income**

When the respondents were asked how long they will be able to continue their family expenditure during disruption of income due to any disaster 98% respondent said it will be less than one month.
A mere 1% expressed the ability to cover expenses for 1-3 months, while only 1% believed they could sustain expenses for 3-6 months with adopting different type of coping mechanism.

**HH expenditure Coping strategy**

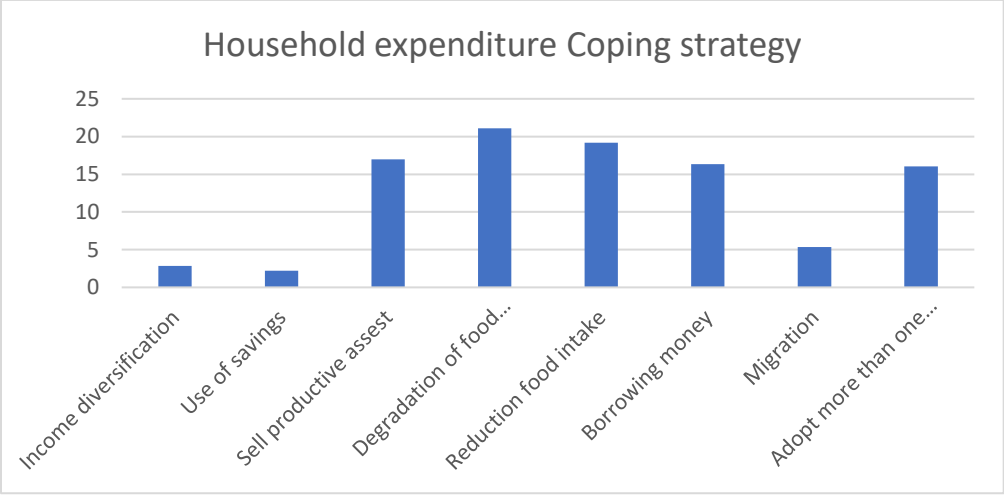


**Figure 6:** HH expenditure Coping strategy

To cope with this adverse situation, they adopt different type of coping strategy. At first, they compromise with their number of meal and quality of meal, 16% respondent said they borrow money, 17% said they sell

productive asset, 16% respondent adopt more than one strategy, 5% do seasonal climate induced migration (Figure 6)

**Credit Access**

From this study, it has been revealed that overall 25 % respondents have no access to any kind of receiving credit whenever they need. It is 30% in Koyra and Shyamnagar separately. The respondents have access to MFI 33% overall which is 34% and 45% in Koyra and Monirampur respectively The rest of respondents have different type of sources as shown in the (Table 7).

**Table 7.** HH Credit access

| Credit source | Koyra% | Monirampur % | Shyamnagar % | Over all |
|---|---|---|---|---|
| MFI | 34 | 45 | 19 | 33 |
| Neighbor | 9 | 21 | 13 | 14 |
| Neighbor and Local Money lenders | 2 | 1 | 0 | 1 |
| Neighbors and relatives | 18 | 18 | 29 | 22 |
| No where | 30 | 13 | 30 | 25 |
| Relatives | 7 | 2 | 8 | 6 |

**Access to Insurance for risk diversification**

The study found that no people have the insurance coverage to diversify their risk. As the people of the community are very low income and no alternate IGA so it is beyond their capacity to have an insurance product.

**Overall Community resilience status**

From this study it was identified that in terms of Household financial savings that protect long term assets in Koyra 83%, Shyamnagar 82% Monirampur 94% respondents said “Households have no financial reserve for disaster losses and do not hold any contingent contracts to a reserve of financial capital” that falls in D category, rest respondents mentioned that “Households have some financial buffer but it is not expressly for disaster recovery and is often used for alternative expenses.” that falls in C category. (Figure 7,8,9). In terms of resilience source “Access to communal social safety net” in Koyra 76%, Shyamanagar 63% and Monirampur 63% respondents indicated that “No access to any social safety net fund” that falls in D category. 24%, 37% and 37% respondents of Koyra, Shaymanagr and Monirampur respectively said “Community has some access to Social safety net funds but which is not available and difficult to access” that falls in C category.

In terms of resilience source “Household income continuity strategy” 84%, 92%, 94% Koyra, Shaymanagr and Monirampur respectively mentioned “Households have the no ability to maintain their livelihood income stream and no diversified income option” that falls in D category. Except very few rests of the respondents mentioned that “households have the very limited ability to maintain their livelihood income stream and no diversified income option” that falls in C category.

In terms of resilience source “HH Credit Access” 34%, 30% and 13% respondents of Koyra, Shaymanagr and Monirampur mentioned that “HHs Have no access to credit before and after disaster” that falls in D category . 35%, 51% and 42% respondents of Koyra, Shaymanagr and Monirampur mentioned that “ HH have rare access to credit before a disaster and this diminished post disaster” that falls in C category. 31%,19%, 45% of Koyra,

Shaymanagr and Monirampur respectively respondents mentioned that " HHs Have limited access to credit before a disaster and this does not diminish post disaster." It falls in B category.
In terms of insurance all the respondents said "Households have no access to some contingent insurance" that falls in D category.

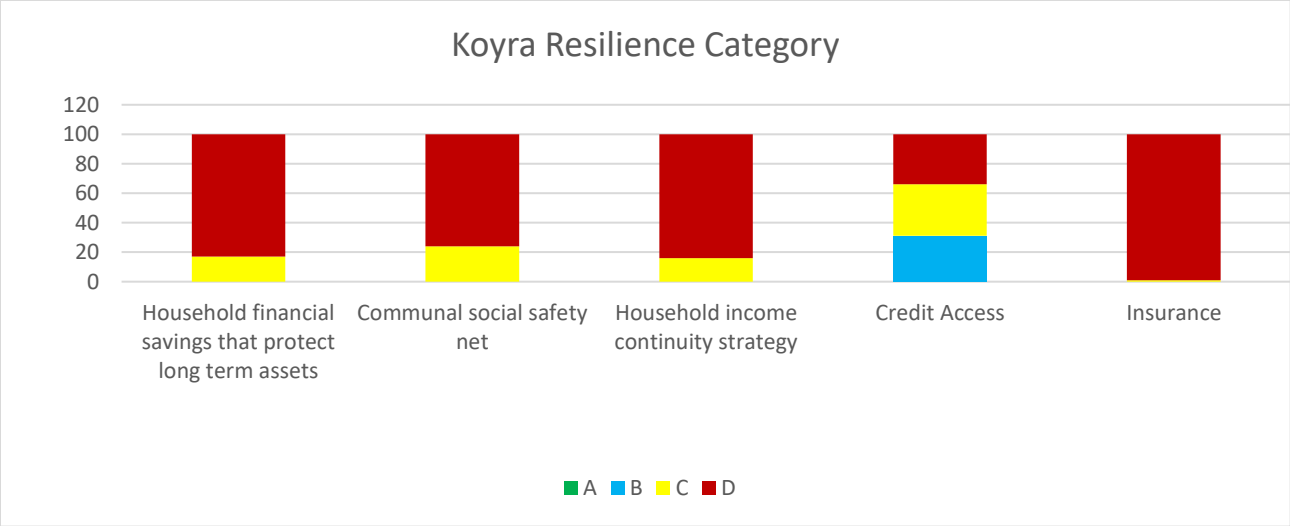


**Figure 7:** Resilience Status of Koyra

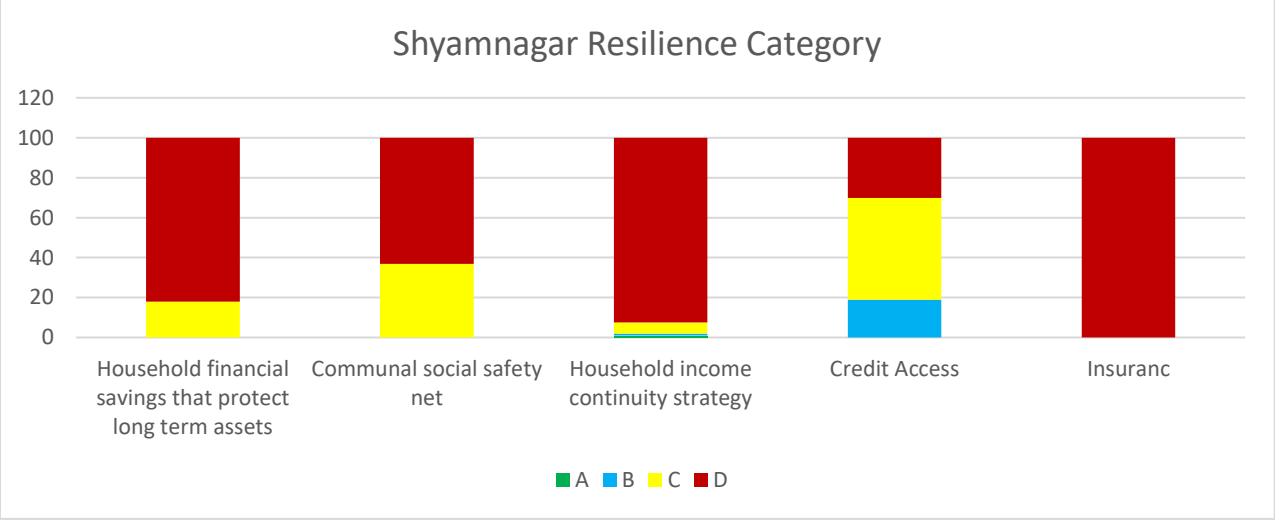


**Figure 8:** Resilience Status of Shyamnagar

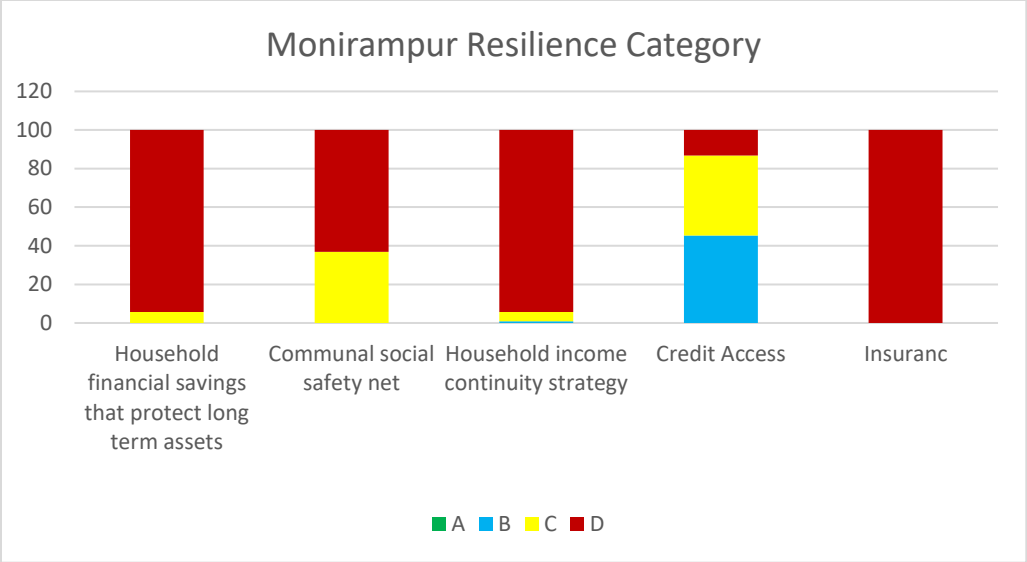


**Figure 9:** Resilience Status of Monirampur

From this study it was analyzed the trend to compare among the selected communities of the selected subdistricts. The range value is 4 to 0. It has been revealed that in terms of credit access Monirampur is somewhat better than any other subdistrict. Interms of insurance all the targeted communities have no insurance access. In terms of other sources of resilience all the targeted communities are almost similar (Figure 10).

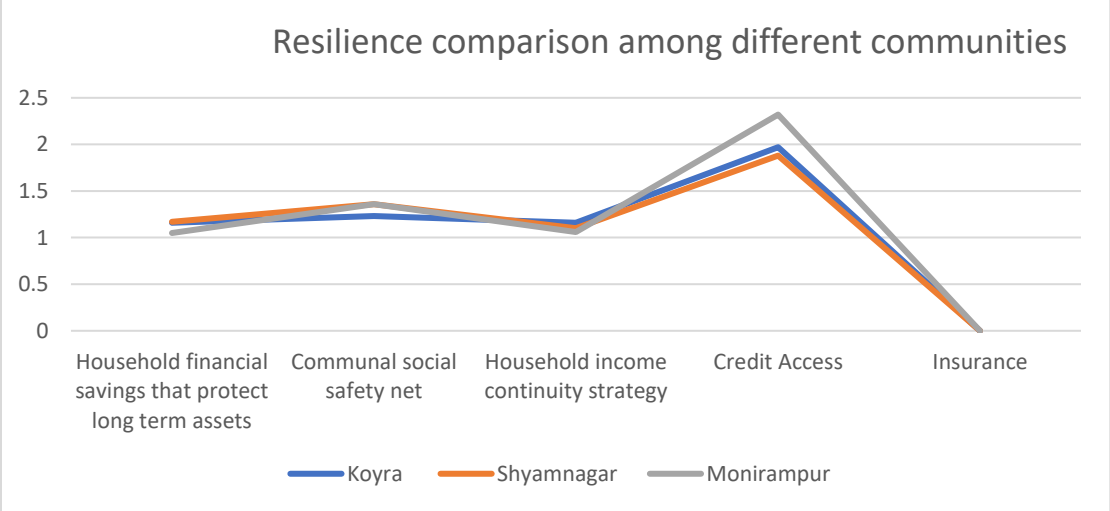


**Figure 10:** Comparison of the resilience status

**Context Resilience**

Analyzing various indicators of community level, it becomes evident that 75% indicators are in red category, 16% are in yellow 9% in amber category (Figure 11). It says that households are operating at a minimal financial capacity, with unfavorable outcomes in numerous aspects. The study underscores the lack of alternative income options, absence of household financial savings for safeguarding long-term assets, and the absence of a strategy ensuring household income continuity

The enabling environment presents a stark picture, with nearly 67% are in D category and only 39 indicators in the yellow category. No respondents found in A and B category. Noteworthy issues include no access to insurance, limited access to social safety net and climate fund, limited access to Govt. support services at community level demands enabling environment and the need for policy attention in grounding locally led adaption fund.

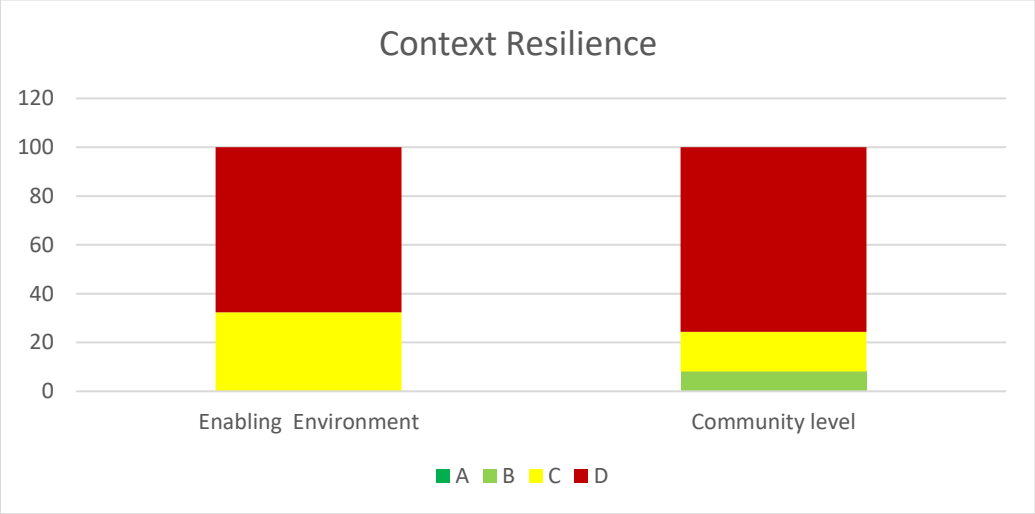


**Figure 11.** Context resilience

**Discussion**

This study offers a comprehensive understanding of climate vulnerability and resilience challenges in Koyra, Shyamnagar, and Monirampur—three regions facing distinct but overlapping hazards such as cyclones, tidal surges, heavy rain, and waterlogging. The trend analysis shows a rising frequency of extreme events since 2013, with significant impacts on lives and livelihoods despite reduced casualties, thanks to improved early warning systems. These findings align with Wisner et al. (2004) in their Pressure and Release (PAR) model, which explains disasters as the outcome of hazards intersecting with conditions of vulnerability. The persistent use of fragile building materials, low awareness, and poor infrastructure in the studied regions reinforces the notion that underlying socio-economic drivers continue to exacerbate climate risks.

Economic insecurity emerges as a key dimension of vulnerability in all three locations. The lack of income diversification and the reliance on climate-sensitive livelihoods—such as fishing, daily labor, and leaf collection—mirror the concerns raised by Ellis (2000), who stressed the importance of diverse livelihood portfolios for enhancing resilience. Furthermore, the study's evidence of poor nutrition, inadequate savings, and erosion of home structures due to soil salinity reflect what Davies (1993) describes as "erosive coping strategies"—short-term survival tactics that undermine long-term well-being. These issues perpetuate the poverty-vulnerability trap, as discussed by Chambers (1989), and severely limit adaptive capacity during and after disasters. Water scarcity, inadequate sanitation, and deteriorating health conditions further compound the resilience deficit. These findings are in line with the IPCC (2014), which emphasizes that climate change has direct implications for public health and development. In particular, the persistent issue of salinity intrusion in Koyra and Shyamnagar echoes the work of Rabbani et al. (2013), who found that saline water not only affects

agriculture and housing but also significantly threatens drinking water availability and health outcomes, especially among the poorest households.

Despite an increased allocation in the national social protection budget, access to social safety nets remains limited. Although programs like the VGD, VGF, OAA, and FFW are in place, the study shows that only 41% of vulnerable citizens benefit from them—far below the target of 3% of GDP set by the National Social Security Strategy (NSSS). This aligns with Barrientos (2010) and Sabates-Wheeler & Devereux (2008), who argue that systemic issues in targeting, implementation, and resource distribution often render social protection programs ineffective in reaching those most in need. The high number of residents in the "yellow" category of the resilience matrix indicates that while some support exists, accessibility and coverage remain inadequate.

Financial exclusion is another major barrier to resilience. The absence of insurance coverage among surveyed populations highlights a critical gap in risk transfer mechanisms. This supports the findings of Kunreuther and Pauly (2006) and Crichton (2006), who argue that insurance is vital for financial stability in disaster-prone areas. However, in low-income communities, uptake remains low due to affordability, lack of trust, and the reluctance of providers to enter high-risk markets. Likewise, microfinance institutions in cyclone-prone areas show hesitancy in lending to vulnerable groups, reinforcing insights by Dercon and Christiaensen (2011), who note that financial risk-sharing tools often fail to reach the poorest, thereby hindering recovery and reinforcing vulnerability cycles.

The study reaffirms insights from the broader literature that building resilience requires a systemic approach that goes beyond hazard response. It calls for investments in livelihood diversification, climate-smart social safety nets, access to microinsurance, and inclusive financial services. These interventions must be coupled with stronger governance and policy alignment to bridge the gap between national strategies and local implementation. By highlighting these interlinked challenges and gaps, the study contributes meaningfully to ongoing global dialogues on resilience, risk reduction, and climate justice.

**Conclusion and recommendations**

In conclusion, achieving resilience in these vulnerable communities is crucial, as it directly impacts their well-being and development. The study underscores the severe limitations in financial capacity, the absence of alternative income options, and the lack of household financial savings for safeguarding long-term assets. While the government has implemented several social safety net programs, their allocation remains disproportionately low compared to the high demand. Nearly 90% of indicators fall into the red category, with only 10% in the yellow category, indicating significant challenges in accessing insurance, inadequacies in adaptation financing, and a pressing need for policy initiatives to develop off-farm IGA skills, reduce dependency on natural resources, expand insurance coverage, and improve access to climate funds such as loss and damage, adaptation, and resilience funds. Key informant interviews and national policy reviews reveal a disconnect between the government's robust disaster management and adaptation policies and the bottlenecks in local financing mechanisms, depriving the most vulnerable communities of essential government allocations. Additionally, the Bangladeshi government faces limitations in its capacity to meet the growing demands. Therefore, there is a pressing need for global attention and support to ensure that these vulnerable communities in Bangladesh receive the necessary assistance for building resilience and achieving sustainable development.

Finally, it could be said that the formulated resilient grading tools under this study for community disaster resilience is enable for quick assessment of a vulnerable community to understand the gap and essential need to make the community resilient. It also able to compare different communities in terms of resilient and encompass the decision makers in prioritization interventions. This resilient grading system is capable to

continuous monitoring of resilience levels of a community that contributes in operational planning, management, decision-making, and policy formulation.

The policy makers, development agencies and private sector could consider this resilience grading method in prioritizing vulnerable area, planning interventions, management, decision-making, policy formulation and monitoring. Further research is needed to validate and standardize the resilience grading system across diverse ecological zones, ensuring its applicability and reliability in varied contexts. Utilizing longitudinal data will be crucial to evaluate the tool's effectiveness in tracking changes in community resilience over time. Additionally, future studies should focus on developing a comprehensive resilience framework that incorporates multiple dimensions of resilience—including social, institutional, environmental, and infrastructural aspects—beyond just economic resilience.

***Declaration***

We, the undersigned authors, declare that this manuscript is our original work and has not been published or submitted for publication elsewhere. All authors have significantly contributed to the research, writing, and final approval of the manuscript.

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**Consent to participate:** Consent to participate was obtained where necessary.

**Consent for publication:** Consent for publication was obtained where necessary

**Data availability:** Data is available on request

**Authors contribution:** The first author contributed to data collection, analysis, and manuscript writing. The second author reviewed the manuscript draft and provided guidance accordingly.

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