AN EMPIRICAL INVESTIGATION OF COASTAL WOMEN'S EMPOWERMENT BARRIERS IN DISASTER RISK MANAGEMENT IN THE CONTEXT OF CHANGING CLIMATIC CONDITIONS: EVIDENCE FROM DACOPE, BANGLADESH

Sadia Afroj*[1], Mohammad Ismail Hossain[2]

[1] *Institute of Disaster Management, Khulna University of Engineering and Technology,Bangladesh, e-mail: sadiaafroj85@gmail.com*

[2] *Institute of Disaster Management, Khulna University of Engineering and Technology,Bangladesh, e-mail: ihossain@idm.kuet.ac.bd*

ABSTRACT

Climate change poses disproportionate risks to women in coastal Bangladesh, where recurring cyclones, tidal surges, and salinity intrusion amplify vulnerabilities in disaster risk management (DRM). Despite growing emphasis on gender-sensitive adaptation, empirical evidence on the barriers coastal women face in engaging with DRM remains limited. The study addressed the lack of evidence on socio-economic, cultural and institutional barriers to women empowerment and participation in disaster risk management in the climate vulnerable areas of Dacope. A a mixed-methods approach was adopted conducting 450 household surveys along with focus group discussions (FGDs) and key informant interviews (KIIs). Quantitative responses were analyzed statistically using mean and standard deviation, while qualitative findings captured women lived experiences. The survey instrument demonstrated high internal consistency (Cronbach's $\alpha \geq 0.70$), confirming the reliability of the results. Additionally, the Analytic Hierarchy Process (AHP) was applied to prioritize barriers to women's participation in DRM. Findings indicate that women's involvemnt in disaster prepapredness and building climate resilience is still minimal and mainly constrained by financial dependency and economic limitation (α =.79, SD=.81) and limited access to formal educational and low attainment level (α =.78,SD=.85). Heavy household responsibilities, institutional constraints and socio-cultural norms also significantly restrict women's involvement in climate adaptation and disaster preparedness activities in Dacope Upazila. The study proposes a Barrier-to-Resilience Action Framework, linking identified barriers to strategic interventions and resilience outcomes, providing a practical guiding tool for practitioners involved in community-based adaptation.

Keywords: *Empowerment, disaster risk management, coastal Bangladesh, barriers, climate resilience*

1. INTRODUCTION

Globally, gender perspectives play a crucial role in shaping effective Disaster Risk Reduction (DRR) strategies, as women often face heightened vulnerabilities during disasters (UNDRR, 2023; Ministry of National Development Planning, 2025). In the coastal regions of Bangladesh, these challenges are intensified by socio-economic and climatic factors, highlighting the urgent need to link women's empowerment with resilience-building initiative. Most studies in Bangladesh discuss climate vulnerability in general but lack large-scale empirical evidence (like 450 respondents) on how gendered barriers restrict women's empowerment in disaster preparedness and resilience. Though research consistently shows that gender inequality shapes disaster impacts, recovery, and resilience capacity (Hemachandra et al., 2025). The Midterm Review of the Sendai Framework (UNDRR, 2023) highlights that gender-responsive DRR, ensuring women's leadership, gender-disaggregated data and inclusive policies is essential for effective risk reduction. Recent global economic analyses reveal that women, especially in rural and low-income settings, face severe livelihood challenges and asset losses in climate-related disasters (Fatema et al., 2023). leading to calls for women-centered climate finance. In Dacope Upazila, in Khulna District, women's participation in disaster risk management remains limited despite their crucial role in community resilience. Persistent socio-economic, cultural and institutional barriers often exclude women from decision-making (Rahman & Jahan, 2021) and preparedness activities and reducing the effectiveness of community adaptation strategies. Addressing these barriers is essential to enhance women's empowerment and strengthen climate resilience. This study employs a mixed-methods approach, combining household surveys, focus group discussions and key informant interviews to investigate the factors influencing women's engagement in disaster preparedness and climate adaptation . The key objectives are to examine the empowerment barriers that limit women's participation in climate resilience and identify their adaptive strategies, as well as to assess the role of local governance, institutions and community structures in supporting women's empowerment and provide evidence-based insights for enhancing gender-responsive climate adaptation strategies.

1.2 Understanding the Coastal Dynamics of Bangladesh: Empirical Insights from Dacope

In Cyclone Sidr (2007), Women in Dacope experienced a higher mortality risk because of restricted mobility and shelter inaccessibility. Limited early warning understanding further exacerbated fatalities. Aila (2009) was devastating for its prolonged water logging and salinity intrusion that destroyed agriculture and fisheries, eliminating women's homestead-based livelihoods,women were forced to walk long distances for drinking water, increasing physical burdens. Gender-based violences in cyclone shelters were also reported. During Bulbul (2019), women's access to cyclone shelters improved slightly, but issues of limited WASH facilities and privacy remained. After cyclone Amphan (2020), women reported psychological stress compounded by the COVID-19 pandemic. Disruptions in schooling of children and food insecurity severely impacted household. Cyclone Remal (2024), caused repeated displacement, intensified livelihood insecurity and health risks. Salinity intrusion continues to undermine women's health with rising incidences of reproductive health and skin diseases. Studies also reveal that political connectivity, gender and social status influence the access to facilities. Female-headed vulnerable households receive priority aid, but constraints limit full utilization of the support.

2. METHODOLOGY

2.1 Description of the study area

The study was carried out in Dacope Upazila, Khulna district, one of the most disaster-prone coastal areas of Bangladesh. Total area of this Upazila is approximately 991.98 sq. km, located in between 22°24`and 22°4` north latitudes and in between 89°24` and 89°35`east longitudes. It is bounded by Batiaghata Upazila on the north, Rampal and Mongla Upazila on the east, Paikgachha and Koyra

Upazila on the west. Livelihoods are mostly based on agriculture, shrimp farming and resources collected from the Sundarbans mangrove forest. Pasur, Shibsa, Manki, Bhadra; Palashbari, Churia, Nalian and Jugra canals are notable.

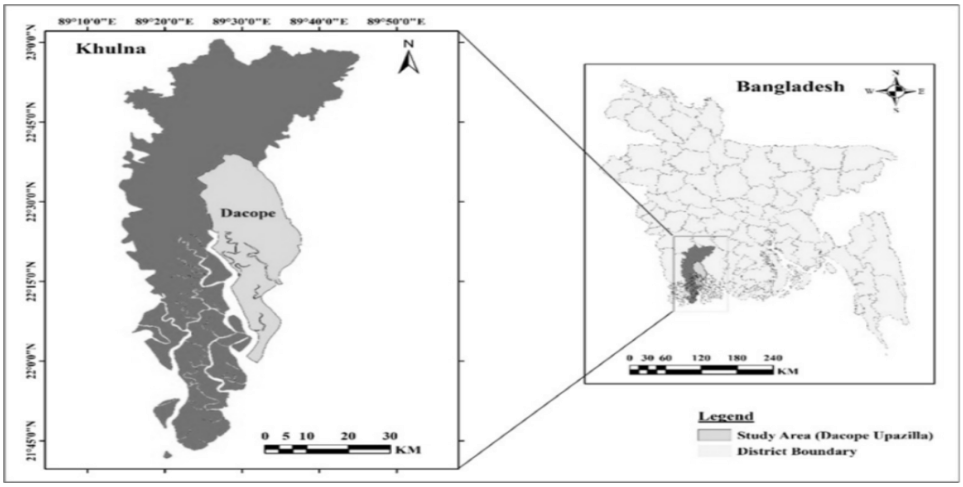

Figure 1: Dacope location map.

2.2 Data Alanysis and Methodological Framework

A mixed-methods approach was employed, including 450 household surveys. Focus group discussions (FGDs) and key informant interviews (KIIs) allowed both statistical analysis and deeper contextual understanding. 450 households, randomly selected from ten different unions mainly women (aged 18–60). Structured questionnaire with 5-point Likert scale covering socio-economic profile, participation in disaster preparedness and barriers to empowerment. Ten FGDs (8–10 participants each) with women's self-help groups (applying PRA technique), shelter committee members, and female community leaders were conducted. Fifteen KIIs with Union Parishad representatives, NGO workers, officials, health professionals & teachers. Combining surveys, FGDs and KIIs enabled a comprehensive understanding of both measurable indicators and lived experiences, supporting evidence-based recommendations.

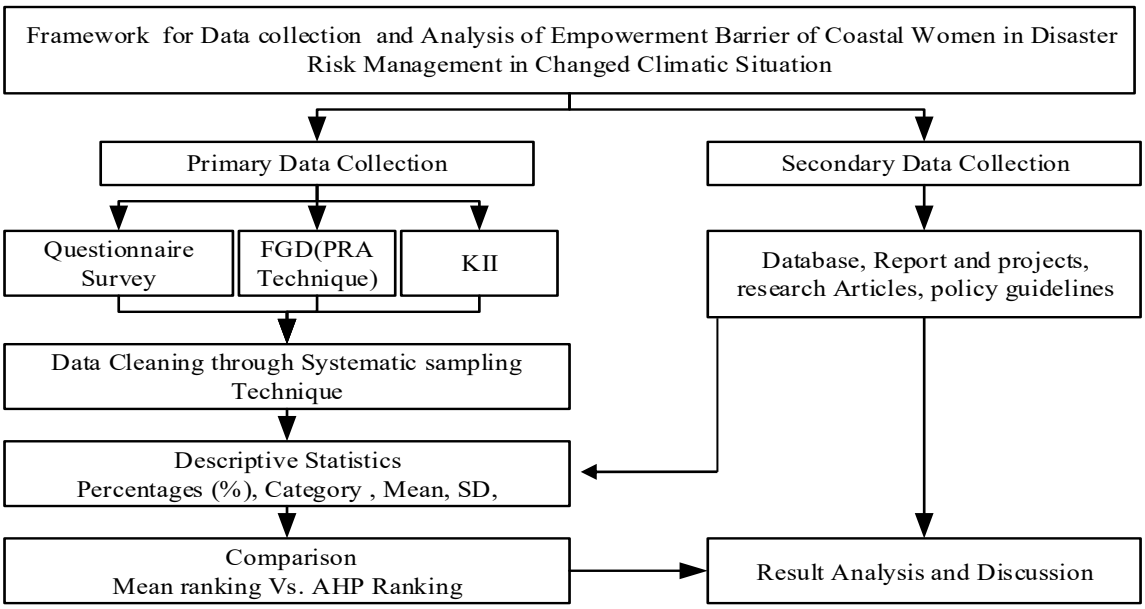

Figure 2 : Methodological frameworks

3. RESULT AND DISCUSSIONT

This section presents the empirical findings of the study and the analysis combines both quantitative and qualitative insights to explore the status of women's participation in disaster risk management (DRM) and to identify the socio-economic, cultural, and institutional challenges they face. It highlights patterns, underlying causes, and implications for gender-responsive climate resilience in coastal Bangladesh.

3.1 Key vulnerabilities in coastal Bangladesh

Bangladesh is globally recognized as one of the most climate-vulnerable countries in the world. About 80% of its landmass lies within low-lying floodplains, making the country extremely exposed to seasonal riverine floods, flash floods and coastal inundation. The coastal belt, particularly in Khulna, Barisal, and Chattogram divisions is increasingly threatened by sea level rise**,** leading to salinity intrusion, tidal surges, and land loss. These changes undermine agricultural productivity, freshwater availability, and long-term habitability. Another major threat is the recurrence of severe cyclones and storm surges. In addition, riverbank erosion annually displaces thousands of people, forcing them into climate-induced migration and creating pressure on urban areas. Bangladesh also faces temperature or rainfall variability due to climate change. Irregular monsoon, prolonged water logging and sudden heavy rainfall significantly affect agriculture, fisheries, and food security. Heat stress further threatens labor productivity and health, especially among vulnerable groups. Geographic exposure of Bangladesh and coastal vulnerabilities create a multidimensional risk environment.

Table 1: Key Vulnerabilities in coastal Bangladesh

Vulnerabilities	Key Points	State /Consequences
Natural dimension	Geographic exposure	About 80% of Bangladesh is floodplain, making it highly exposed to riverine floods, coastal flooding, cyclones.
	Sea level rise	Coastal belt faces salinity intrusion, tidal surges, and land loss due to rising sea levels.
	Cyclones and Storm Surges	Frequent severe cyclones (Sidr 2007, Aila 2009, Bulbul 2019, Amphan 2020, Remal 2024) devastate infrastructure and communities.
	Riverbank Erosion	Annual river erosion displaces thousands, contributing to climate-induced migration.
	Temperature & Rainfall Variability	Irregular monsoons, heat stress, and droughts affect agriculture and food security.
Socio-economic dimensions	Livelihoods	Nearly 54% (field survey, Dacope) of population depends on climate-sensitive sectors like agriculture, fisheries, and forestry.
	Poverty, inequality & gender vulnerability	Climate shocks disproportionately affect the poor, particularly women and marginalized groups. Limits resilience, increases violence and dependency
	Educations disruption	Destroyed during disaster, have social restrictions also. Loss of human capital, early marriage.
	Health risks	Waterborne diseases, malnutrition, and mental health stress are intensifying under climatic changes.
	Social cohesion & governance	Weak local institutions, poor coordination, corruption, Limits adaptation planning & resource mobilization
	Infrastructure fragility	Slows recovery, deepens disaster impact most of the cases
	Migration	Climate change drives rural-to-urban and cross-border migration, especially from coastal and riverine areas

Table 1, indicate the key Vulnerability features prevailing in coastal regions. The social fabric of Bangladesh shapes how communities experience and respond to climate change and disasters. These

constraints deepen women's vulnerability during disasters and undermine their empowerment process. Poverty and class discrimination also shape adaptive capacity. Marginalized groups such as; landless laborers, fishing communities and smallholder farmers are the most affected by salinity intrusion, crop failure and livelihood loss. Limited access to education, healthcare and institutional support makes these groups more vulnerable to disasters, forcing many to migrate to urban slums (The World Bank, 2024). Social contexts therefore determine not only who most at risk, but also who gets the opportunity to adapt and recover. Without addressing entrenched social norms, gender discrimination and inequitable resource distribution, disaster risk reduction and climate resilience initiatives are unlikely to achieve inclusive and sustainable outcomes.

3.2 Demographic Characteristics of the respondents of Dacope

The socio-demographic characteristics of the 450 female respondents provide a critical foundation for understanding the dynamics of women's empowerment barriers.

Table 2 : Demographic characteristics of the respondents

Variable	Category	Frequency (n)	Percentage (%)
Age group (Years)	18–30	120	26.7
	31–40	160	35.6
	41–50	100	22.2
	51 and above	70	15.5
Marital status	Married	370	82.2
	Unmarried	50	11.1
	Widowed/Separated	30	6.7
Education level	No formal education	150	33.3
	Primary (1–5)	140	31.1
	Secondary (6–10)	100	22.2
	Higher Secondary & above	60	13.4
Occupation	Housewife	260	57.8
	Agriculture/Fisheries	90	20.0
	Small business	40	8.9
	Service (NGO/Private/Govt)	30	6.7
	Others (day labor, etc.)	30	6.7
Household income	< 5000 BDT	180	40.0
	5000–10,000 BDT	150	33.3
	10,001–15,000 BDT	80	17.8
	> 15,000 BDT	40	8.9
Household size	1–3 members	70	15.6
	4–5 members	200	44.4
	6–7 members	120	26.7
	8+ members	60	13.3

Demographics aspects matter in resilience and empowerment, because age influences physical ability and experience whether education directly impacts information access and decision-making. Income affects capacity to invest in adaptation. Size of household helps to balances resource pressure with manpower. The survey results presented in table 2, indicate that the majority of the respondents fall within the 31–40 age group, representing women in their most socially and economically active years. Younger women (below 30) often had fewer decision-making opportunities, while older women (above 46) demonstrated greater vulnerability due to health constraints and dependency. Over 70% of respondents were married, highlighting

that household responsibilities and decision-making structures strongly influence women's participation. Widowed and divorced women were also significantly represented, particularly due to male out-migration or cyclone-related mortality. Less formal education (only 31.1% basic) emerged as a significant barrier to accessing climate-related knowledge and opportunities where higher education demonstrated greater awareness of disaster preparedness strategies. Limited income restricts investment in preparedness and forces dependence on external aid. Majority of the respondents lived in medium to large households (5–7 members), which can be both a resource and a challenge. Larger households provide greater labor support during crises but also increase the burden on women in crisis moment.

3.2 Major challenges in Disaster Risk reduction and women empowerment in Dacope

Women in Dacope, like many other coastal regions of Bangladesh, live at the intersection of poverty, climate vulnerability and entrenched socio-cultural norms. Despite their central role in managing households, preserving food, and protecting children during cyclones and tidal floods, their contributions remain largely invisible in formal disaster preparedness and resilience planning. Economic dependency forces women to rely on male family members for every financial decision, limiting their ability to prepare or recover independently from disaster losses.

Table 3 : Women's reported barriers by category and sub-category

Category	Sub-Category (Barrier)	5 (n, %) (Strongly agree)	4 (n, %) Agree	3 (n, %) Neutral	2 (n, %) Disagree	1 (n, %) Strongly disagree)
Economic barrier	Financial dependency limits decision-making	270 (60%)	120 (27%)	45 (10%)	10 (2%)	5 (1%)
	Limited income opportunities	210 (47%)	155 (34%)	65 (14%)	15 (3%)	5 (1%)
	Dependence on aid	200 (44%)	160 (36%)	70 (16%)	15 (3%)	5 (1%)
Education , knowledge and capacity building	Low literacy/education level	250 (56%)	130 (29%)	50 (11%)	15 (3%)	5 (1%)
	Lack of knowledge/ skills for preparedness	205 (46%)	160 (36%)	65 (14%)	15 (3%)	5 (1%)
	Exclusion from training	185 (41%)	165 (37%)	80 (18%)	15 (3%)	5 (1%)
Socio-Cultural barrier	Heavy household responsibilities	240 (53%)	140 (31%)	50 (11%)	15 (3%)	5 (1%)
	Gender role discrimination (traditional mindset)	220 (49%)	150 (33%)	60 (13%)	15 (3%)	5 (1%)

Category	Sub-Category (Barrier)	5 (n, %) (Strongly agree)	4 (n, %) Agree	3 (n, %) Neutral	2 (n, %) Disagree	1 (n, %) Strongly disagree)
	Limited mobility & safety issues	230 (51%)	145 (32%)	55 (12%)	15 (3%)	5 (1%)
	Limited voice in community decision-making	180 (40%)	170 (38%)	80 (18%)	15 (3%)	5 (1%)
Institutional infrastructure & psychologiacl contrains	Poor institutional support	195 (43%)	165 (37%)	70 (16%)	15 (3%)	5 (1%)
	Lack of healthcare facilities during disasters	190 (42%)	160 (36%)	80 (18%)	15 (3%)	5 (1%)
	Lack of transport/communication facilities	175 (39%)	170 (38%)	85 (19%)	15 (3%)	5 (1%)
	Infrastructure weaknesses (cyclone shelter, water, etc.)	170 (38%)	170 (38%)	90 (20%)	15 (3%)	5 (1%)
	Psychological stress & lack of motivation	160 (36%)	175 (39%)	95 (21%)	15 (3%)	5 (1%)

Legend: 1 = Strongly Disagree, 2 = Disagree, 3 = Neutral, 4 = Agree, 5 = Strongly Agree; n = number of respondents. n = 450; percentages are based on total respondents.

Table 3 presents the distribution of women's reported barriers to disaster preparedness and climate adaptation, organized into four main categories. Within Economic barriers, financial dependency was the most strongly reported issue, with 60% of respondents indicating "5 – strongly agree" and a combined 87% agreeing (4 or 5). Limited income opportunities and dependence on aid were also significant concerns, reflecting the financial constraints that affect women's decision-making and participation. education and knowledge barriers show that low literacy (56% strongly agree) and lack of preparedness skills limit women's capacity to engage in adaptive measures. Socio-cultural barriers highlight heavy household responsibilities (53% strongly agree) and mobility limitations (51% strongly agree), demonstrating the impact of traditional gender roles and domestic workload on participation. Finally, Institutional/Infrastructure & Psychological barriers indicate systemic challenges, such as poor institutional support (43% strongly agree) and lack of healthcare facilities (42%), alongside psychological stress (36% strongly agree), emphasizing both structural and emotional constraints. Since women had no significant personal savings, they could not take independent or immediate decisions during emergencies. 56 % women (table 3) strongly agreed that literacy rate and absence of any formal

education prevents them from accessing government support programs or training opportunities. For instance, many women cannot understand weather alert messages sent to them via mobile phones.

Table 4 : Rank, mean and standard deviation (SD) of reported barriers

Rank	Barrier	Mean	SD
1	Financial dependency limits decision-making	4.43	0.81
2	Low literacy/education level	4.35	0.85
3	Heavy household responsibilities	4.33	0.83
4	Limited mobility & safety issues	4.30	0.82
5	Gender role discrimination (traditional mindset)	4.28	0.84
6	Limited income opportunities	4.23	0.86
7	Lack of knowledge/skills for preparedness	4.21	0.85
8	Dependence on aid (Financial, other support system)	4.18	0.85
9	Poor institutional support	4.16	0.84
10	Lack of healthcare, WASH facilities during disasters	4.12	0.86
11	Exclusion from training	4.10	0.85
12	Limited voice in community decision-making	4.08	0.84
13	Lack of transport/communication facilities	4.06	0.83
14	Infrastructure weaknesses (cyclone shelter, water, etc.)	4.04	0.82
15	Psychological stress & lack of motivation	4.00	0.85

Table 4 ranks the individual barriers based on their individual mean scores, highlighting the relative significance of each challenge. Financial dependency emerged as the highest-ranked barrier with a mean of 4.43 (SD = 0.81), indicating that most women face a major constrains in decision-making due to financial dependence. Low literacy (Mean = 4.35, SD = 0.85) and heavy household responsibilities (Mean = 4.33, SD = 0.83) follow closely, demonstrating the combined effect of educational limitations and domestic duties. The SD values suggest moderate variability among responses, meaning while most women strongly agreed and a small proportion rated lower. This table captures the sub-category level statistics, which will feed into reliability assessment at the category level.

Table 5: Category-wise mean, SD, and reliability (Cronbach's α) of barrier Sub-items)

Category	Sub-items (n)	Mean (Average of items)	SD (Average)	Cronbach's α	α Condition
Economic/Financial	3	4.28	0.84	0.79	⩾ 0.70 (Acceptable)
Education/Knowledge	3	4.24	0.85	0.78	⩾ 0.70 (Acceptable)
Socio-Cultural/Household	4	4.23	0.82	0.81	⩾ 0.70 (Acceptable)
Institutional/Infrastructure & psychological	5	4.08	0.84	0.80	⩾ 0.70 (Acceptable)

Legend: Cronbach's α = measure of internal consistency; Mean = average of sub-item scores; SD = average standard deviation.

Table 5 summarizes the combined statistics at the main category level. The Economic/Financial category, including financial dependency, limited income, and dependence on aid, has a mean of 4.28

and SD of 0.84, with Cronbach's α of 0.79, indicating good internal consistency. Education/Knowledge barriers show a mean of 4.24 (SD = 0.85) and α = 0.78, reflecting that low literacy, lack of skills, and exclusion from training consistently affect women. Socio-cultural (Household) constraints, with a mean of 4.23 (SD = 0.82) and α = 0.81, confirm strong internal consistency among barriers related to domestic responsibilities and mobility limitations. Institutional/Infrastructure & Psychological barriers have a slightly lower mean (4.08) but still maintain α = 0.80. The α (alpha) condition column highlights that all categories meet the acceptable threshold (≥0.70), ensuring the reliability of combined sub-category measures (George & Mallery, 2003).

Table 6 : AHP ranking based on category, global and local weigh

Rank	Barrier	Category Weight	Local Weight
1	Financial dependency limits decision-making	0.205	0.343
2	Low literacy / education level	0.192	0.360
3	Limited income opportunities	0.205	0.322
4	Heavy household burden	0.148	0.393
5	Lack of knowledge / skills for preparedness	0.192	0.350
6	Weak institutional support	0.192	0.345
7	Gender norms restricting/discrimination	0.148	0.438
8	Mobility and safety issue (in disaster & training)	0.192	0.333
9	limited voice / Social exclusion from decision-making	0.148	0.425
10	Lack of access to credit or loans	0.205	0.303
11	Limited training opportunities, CB program	0.192	0.313
12	Healthcare/WASH facilities	0.192	0.298
13	Lack of transport & communication system	0.148	0.372
14	Inadequate infrastructure for preparedness/weak infrastructure	0.192	0.281
15	Psychological stress/trauma & less motivation	0.205	0.254

Legend: Weight = relative importance of barrier; Local Weight = weight within category; Global Weight = weight across all categories

$$\textit{Local weight} = (\textit{Priority of sub items} \div \textit{Sum of sub items in category}) \quad (1)$$

$$\textit{Global weight} = \textit{Category weight of sum items} \times \textit{Local weight} \quad (2)$$

Although mean score and SD analysis helped to identify the barriers, the Analytic Hierarchy Process (AHP) is applied to prioritize them systematically and to derive weighted priorities among multiple empowerment criteria, allowing structured survey data to be ranked according to stakeholder perceptions (Repetski, Sarkani, & Mazzuchi, 2022). here in table 6, AHP uses comparisons to assign relative weights to each category . Thus it ensured that the most critical barriers are ranked consistently and providing a structured basis for decision-making.

By comparing survey results with AHP results in table 7,decision makers may obtain a greater understanding of validation. Matching of both rankings confirms reliable perception of respondents. Both survey and AHP rankings indicate that financial dependency is the most challenging concern affecting women's participation in disaster risk management and significantly increase vulnerability (Zahan 2022)., underscoring the necessity of strategic economical empowerment effort. Limited education also significantly constrains women's capacity to engage in climate adaptation and risk management. Household responsibilities maintained a significant level of importance both the in survey

(ranked 3rd) and AHP (ranked 4th) highlighting a critical role in limiting women's active participation. in. Although the rank comparison slightly differs, mobility and safety concern, limited income opportunities,lack of knowledge and capital building and gender discrimination with traditional mindset emerged as top prioritized barriers.

Table 7: Survey rank Vs AHP rank comparison

Survey Based Ranking	Key barrier (From Sub category) Mean	AHP Ranking	Key barrier (From Sub category) Priority Based
1	Financial dependency limits decision-making	1	Financial dependency limits decision-making
2	Low literacy/education level	2	Low literacy/education level
3	Heavy household responsibilities	3	Limited income opportunities
4	Limited mobility and safety issue	4	Heavy household burden
5	Gender role discrimination and traditional mindset.	5	Lack of knowledge / skills for preparedness

3.3 Barrier to resilience framework

Barrier to resilience framework in figure 3, illustrates how identified barriers to women's empowerment in disaster preparedness can be systematically addressed through targeted strategies. Economic, sociolect-cultural, educational, and institutional barriers act as the inputs that restrict women's participation. By implementing capacity-building, inclusive planning, livelihood diversification, and policy reforms, these barriers are transformed through action strategies.

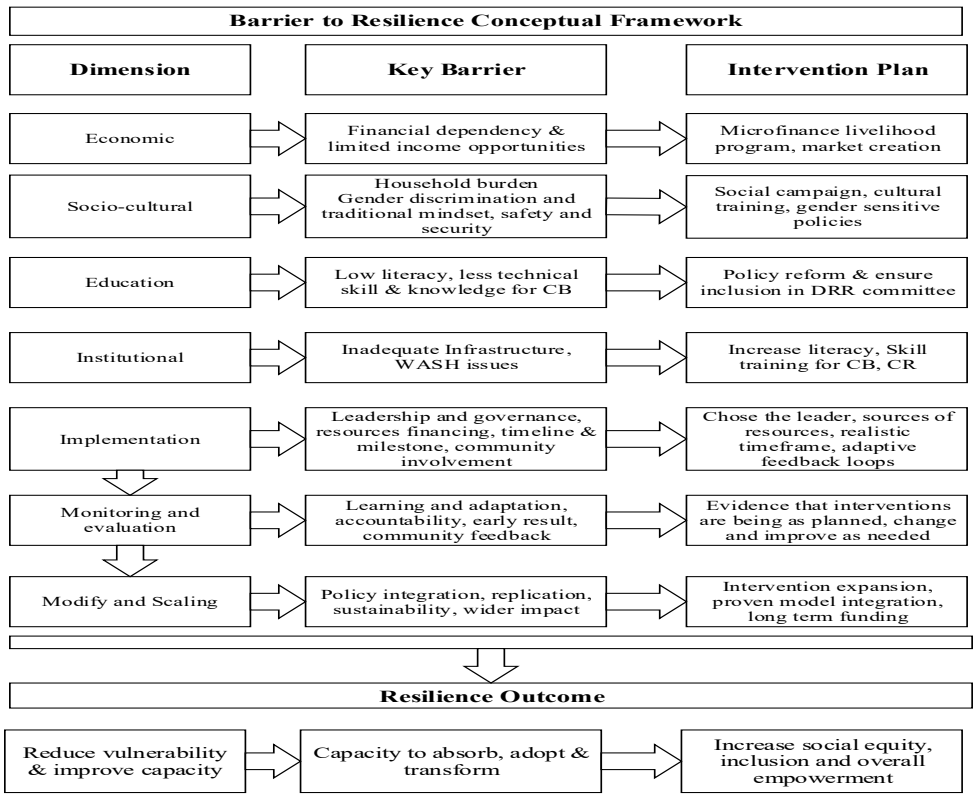

Figure 3 : Barrier to Resilience Conceptual Framework

The result is a set of resilience outcomes, including stronger adaptive capacity, gender-equitable decision-making and sustainable community resilience The Resilience-to-Barrier Framework in this study was developed to identify and interpret the key challenges that hinder women's empowerment and climate resilience at the community level, that is adopted for Dacope Upazila. Using both quantitative and qualitative analyses, critical outcomes and barriers were extracted based on percentage distribution, mean values, standard deviations, Analytic Hierarchy Process (AHP) scores, and rank comparisons. These results helped to categorize and prioritize the most significant obstacles to women's effective participation in disaster preparedness and climate adaptation activities.

4. CONCLUSION

The empirical analysis of this study provided a comprehensive understanding of the critical challenges to coastal women's empowerment in the context of disaster risk management under changing climatic condition. Through the integration of quantitative and qualitative method this study clearly provide a consistent pattern of exclusion limited access to resources and systematic gender bias that hindered women's active participation in disaster risk reduction process. The use of weighted mean and standard deviation helped quantify the perception of vulnerability and empowerment while the Analytical Hierarchy Process (AHP) allowed for the patronization of key barriers based on expert and community input. These analysis reveals that financial dependency, low literacy rate, limited technical skills, heavy household responsibilities and dependency on other aids are most critical obstacles. The development of Barrier to resilience framework offers a structured lens to understand the interconnected nature of this barrier, emphasize how financial, education, socio-cultural and institutional dimensions collectively act as strong constrain in building resilience and empowering coastal women. This framework not only illustrate the complexity of empowerment in DRR but also provide a practical foundation for stakeholders aiming to redesign more inclusive, gender-responsive adaptation strategies.

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DECLEARATION OF USE OF AI: AI tools were used solely for language improvement, spelling and grammar correction and reference formatting. . No content creation ,idea generation or analysis was performed by AI.

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