**Constraints Faced by the Farmers towards Adaptation to Extreme Climatic Events on Agriculture: A Study in the Coastal Region of West Bengal, India**

**ABSTRACT**

Agriculture in the coastal regions of West Bengal is increasingly threatened by extreme climatic events such as cyclones, erratic rainfall, sea-level rise, and saline water intrusion. These events jeopardise food security and rural livelihoods, particularly for small and marginal farmers with limited adaptive capacity. This study aims to identify and analyse the constraints faced by farmers in adapting to such climatic adversities in the coastal districts of South 24 Parganas and Purba Medinipur. An ex-post facto research design was adopted using a mixed-methods approach. Data were collected through structured interviews with 300 randomly selected farmers across four vulnerable blocks - Mathurapur II, Kultali from South 24 Parganas; and Ramnagar I and Ramnagar II from Purba Medinipur district. The perceived constraints were categorised into personal, technological, communicational, and institutional domains, and analysed using descriptive statistics and Garrett’s ranking technique. Findings revealed that high input costs, fragmented landholdings, and poor investment capacity were the most severe personal constraints. Technological constraints included over-dependence on monsoons, lack of technical guidance, and non-availability of salt-tolerant varieties. Inadequate extension services, limited access to information resources, and weak farmer membership in different organisations emerged as major communicational constraints. Institutionally, the absence of timely credit and inefficient compensation mechanisms was most prominent. Across both districts, farmers prioritised economic support measures - such as subsidies, input supply, and minimum support prices - as key adaptation needs. Notably, respondents of South 24 Parganas emphasised training and knowledge enhancement, whereas respondents of East Medinipur highlighted market access and soil health improvement. The study underscores the urgency of district-specific, multi-dimensional adaptation strategies that integrate financial support, policy reform, infrastructure investment, and capacity-building initiatives. Strengthening institutional and technical support systems is found to be critical for enhancing resilience in climate-vulnerable farming communities.

***Keywords****: Climate change, adaptation, constraints, coastal agriculture, extreme climatic events*

1. **INTRODUCTION**

Climate change is universally recognised as one of the most significant challenges to global agricultural sustainability, particularly in climate-sensitive regions like coastal zones. The Intergovernmental Panel on Climate Change (IPCC, 2014) underscores that increasing global temperatures, erratic precipitation, and frequent extreme weather events are expected to significantly disrupt food production systems and endanger rural livelihoods. Significantly, anthropogenic activities, such as pollution, urbanisation, industrialisation, agricultural activities, change in land use patterns, and deforestation, lead to an increase in the atmospheric concentrations of water vapour and carbon dioxide (CO2) and all the other greenhouse gases (GHGs), further accelerating the rate of climate change. An increased level of GHGs (CO2, water vapour, nitrous oxide [N2O], methane [CH4], sulfur hexafluoride (SF6), hydrofluorocarbons, and perfluorocarbons) due to anthropogenic activities is gradually contributing to the overall increase in the Earth’s temperature, thereby leading to global warming (Wijerathna-Yapa & Pathirana, 2022; Farooq et al., 2022). Coastal areas, being geographically vulnerable to tidal surges, cyclones, saline intrusion, and sea-level rise, are particularly at risk (Nirmala et al., 2025).

India’s extensive 7,500-kilometre coastline sustains millions of small and marginal farmers, many of whom depend on traditional, rain-fed agriculture. In West Bengal, the coastal districts of South 24 Parganas and Purba Medinipur have become increasingly vulnerable to climatic disruptions such as cyclones (Aila in 2009, Amphan in 2020, and Yaas in 2021), saline water intrusion, and waterlogging. These climatic events have severely damaged agricultural land, degraded soil quality, and reduced productivity (Danda *et al*., 2020; Dasgupta *et al*., 2009). It is estimated that 70% to 80% of the population in West Bengal, particularly in rural coastal areas, faces the risk of storm surge flooding. The floods induced by climate change have severely affected the lives and livelihoods of people, especially in rural coastal regions (Mukhopadhyay et al., 2025). Danda *et a*l. (2020) noted that coastal blocks in West Bengal face amplified risks due to weak infrastructure and recurring sea surges. Dasgupta *et al.* (2009) added that the Ganges Delta region, home to millions, is highly exposed to long-term sea-level rise and increasing salinity in groundwater and soils. Farmers in these coastal belts face not only biophysical risks but also socio-economic and institutional challenges. They are highly vulnerable because of the weak capacity of the people to adjust to extreme weather conditions, widespread poverty, over-dependence on rain-fed farming, lack of resources, inefficient social security schemes and weak educational structures (Fadairo et al., 2023). Sahu and Mishra (2013) found that limited access to institutional services, delayed disaster response, and poor weather forecasting often worsen farmers’ vulnerability in eastern Indian states like Odisha. Similarly, Ahmed and Neelormi (2008) noted that livelihood adaptation strategies in the coastal zones of Bangladesh are often constrained by weak access to formal credit, infrastructure, and organisational support. Adaptive capacity is also influenced by farmers’ education levels and awareness of climate change. Knowledge of climate-resilient practices and the ability to access accurate information significantly shape climate adaptation outcomes in coastal Bangladesh (Shahjahan et al., 2019). However, as Tripathi and Mishra (2017) observed in India, many farmers engage in passive or reactive strategies due to a lack of training and structured institutional engagement. Moreover, Aryal *et al.* (2014) argue that climate-resilient agriculture in South Asia requires not only improved seed systems and water management but also enhanced access to institutional finance, training, and cooperatives to support smallholders. Indian farmers face practical constraints like delayed input supply, non-availability of salt-tolerant varieties, and weak extension linkages, all of which deter the uptake of adaptive technologies (Pokiya et al., 2024)

This study seeks to address that gap by systematically identifying and analysing the key constraints faced by farmers in adapting to extreme climatic events in the coastal regions of West Bengal. By integrating both primary data (from 300 farmers across four highly affected blocks) and secondary sources, the study employs the Garrett Ranking Technique to evaluate the severity and prioritisation of constraints. The research categorises constraints under four major domains - personal, technological, communicational, and institutional and examines the differential perceptions across blocks and districts. The ultimate objective is to provide evidence-based recommendations for strengthening climate adaptation strategies at the local level. Proposed solutions include improving access to climate-resilient technologies, strengthening institutional credit systems, upgrading rural extension services, promoting climate-smart agricultural practices, and facilitating community-based adaptation mechanisms like farmer cooperatives and joint water management systems.

Despite the growing policy emphasis on climate adaptation across India, implementation at the grassroots level often remains fragmented and under-resourced. It is essential to understand the precise constraints faced by farmers, not only from a technological perspective but also from personal, communicational, and institutional dimensions. Therefore, this study seeks to explore and analyse these multi-faceted constraints in the coastal districts of West Bengal through empirical investigation. The goal is to inform district-specific strategies that can build farmer resilience to extreme climatic events in a comprehensive and participatory manner.

1. **METHODOLOGY**

The study was conducted in the coastal ecosystems of West Bengal, responding to the Fourth Assessment Report of the IPCC, which highlighted the increased vulnerability of coastal areas to the adverse effects of climate change (IPCC, 2007). An ex-post facto research design was employed for the study. To ensure a representative sample, two districts, namely, South 24 Parganas and East Medinipur, from the coastal region were purposively selected. From two districts, four blocks, namely, Mathurapur II and Kultali from South 24Parganas, and Ramnagar I and Ramnagar II from East Medinipur, were chosen, and within each block, three villages were selected based on their susceptibility to climate change impacts. In total, twelve villages were studied. Respondents were randomly sampled from these villages, with 75 farmers from each block, all of whom were involved in agriculture and related activities. In total, 300 farmers were interviewed from the four selected blocks. A structured interview schedule was used to gather data on their perceptions of constraints faced by the farmers for adaptation to extreme climatic events that pose a threat to agriculture was assessed through their responses to a series of statements, rated on a three-point scale of very severe, severe, and less severe with corresponding weightages of (3 to 1). Constraints, as a construct, for the present study have been traced through different dimensions like personal constraints, technological constraints, communicational constraints and institutional constraints. Under each major area, there were a number of statements, like personal constraints had 5 statements, Technological Constraints had 7 statements, Communicational Constraints had 3 statements, and Institutional Constraints had 3 statements. Data analysis was performed using appropriate statistical techniques with descriptive statistics like mean, standard deviation and garret ranking following the formula:

**Percent Position= 100 (Rij-0.5)/ Nij**

Here, **Rij** denotes the rank assigned by the respondent, and **Nij** refers to the total number of items ranked. The percentage positions were then converted into Garrett scores using a standard Garrett table. These scores were used to compute the mean Garrett score for each constraint. The constraints were then arranged in descending order based on their mean scores to derive their relative importance.

1. **RESULTS AND DISCUSSION**

This section presents the key constraints faced by farmers in the coastal districts of **South 24 Parganas** and **Purba Medinipur** of West Bengal, in adapting to extreme climatic events. Data were analysed using the **Garrett Ranking Technique,** and results are presented domain-wise: personal, technological, communicational, and institutional. Suggestions made by farmers were also analysed district-wise. After collecting data on all identified constraints, each farmer was asked to rank the constraints based on their perceived severity. These individual rankings were then analysed using Garrett’s Ranking Technique, as described below.

**3.1 Personal Constraints Faced by the Respondents**

To systematically explore the limitations experienced by farmers in adapting to extreme climatic events, personal constraints were examined using Garrett’s ranking technique. A total of 300 respondents were asked to rank all five personal constraints based on their perceived severity in hindering effective adaptation. These constraints included issues such as small and fragmented landholdings, high input costs, poor investment capacity, low literacy levels, and a lack of proper knowledge.

The calculated ranks were first converted into per cent positions using the Garrett formula. The detailed result of this analysis is presented in Table 1

**Table 1 Distribution of Farmers' Ranking and Garrett Mean Scores of Personal Constraints (PC)** *(n = 300)*

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Rank** | **Small landholding (PC1)** | **High input cost (PC2)** | **Poor investment (PC3)** | **Low literacy (PC4)** | **Lack of knowledge (PC5)** |
| 1 | 55 (13.75) | 93 (23.25) | 75 (18.75) | 35 (8.75) | 42 (10.50) |
| 2 | 69 (13.80) | 83 (16.60) | 44 (8.80) | 59 (11.80) | 45 (9.00) |
| 3 | 75 (12.50) | 35 (5.83) | 58 (9.67) | 76 (12.67) | 56 (9.33) |
| 4 | 67 (8.93) | 46 (6.13) | 60 (8.00) | 64 (8.53) | 63 (8.40) |
| 5 | 34 (2.72) | 43 (3.44) | 63 (5.04) | 66 (5.28) | 94 (7.52) |
| **Total Mean Score** | **51.70** | **55.26** | **50.26** | **47.03** | **44.75** |
| **Rank** | **2** | **1** | **3** | **4** | **5** |

*(Figures in parentheses indicate the Garrett score for that rank)*

The most critical personal constraint identified was **high input cost**, with a Garrett mean score of 55.26. Farmers emphasised that the rising prices of essential agricultural inputs - seeds, fertilisers, pesticides, and hired labour have made farming operations unsustainable, particularly under frequent climate stress. In the context of adaptive agriculture, the financial burden directly limits the adoption of recommended practices like stress-tolerant seed varieties, raised-bed planting or integrated nutrient management.

**Small and fragmented landholdings** were the second-most severe constraint (51.70). This structural feature of Indian agriculture hampers economies of scale, prevents mechanisation, and makes land levelling or bunding measures difficult. For climate adaptation, fragmented plots further complicate the uniform implementation of irrigation systems or crop pattern changes, especially in flood-prone or saline zones.

**Poor investment capacity** ranked third (50.26), reflecting the inability of smallholders to mobilise capital for long-term improvements. Many respondents reported being trapped in a cycle of reactive short-term coping - such as re-sowing or migration - rather than investing in proactive resilience measures due to income insecurity.

The lower-ranking constraints, like **low literacy level** (47.03) and **lack of proper knowledge** (44.75) - were still significant. Illiteracy hinders understanding of weather bulletins, technical advisories, or application procedures for schemes. Lack of knowledge pertains specifically to awareness of adaptive strategies (e.g., mulching, trenching, mixed cropping), rather than general education. Together, these barriers create a knowledge deficit that weakens the feedback loop between risk exposure and adaptive decision-making.

In conclusion, the ranking of personal constraints emphasises the critical role that both economic and knowledge-based factors play in shaping the adaptive capacity of farmers in the face of extreme climatic events. Addressing these constraints would require multi-pronged policy measures, including input subsidies, improved credit access, a land consolidation programme, adult literacy campaigns, and targeted capacity-building initiatives.

**3.2 Technological Constraints Faced by the Respondents**

Technological constraints play a crucial role in determining the adaptive capabilities of farmers in response to extreme climatic events. The constraints considered included non-availability of salt-tolerant varieties, shifting cropping patterns, lack of market linkage, lack of access to weather forecasting technologies, non-availability of inputs in time, lack of technical guidance, and dependence on monsoon. Following the ranking, the percentage position for each rank was calculated using Garrett’s formula. The detailed results of the Garrett analysis for technological constraints are presented in Table 2

**Table 2 Distribution of Farmers’ Ranking and Garrett Mean Scores of Technological Constraints (TC)** *(N = 300)*

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **Rank** | **No salt-tolerant varieties (TC1)** | **Shifting cropping patterns (TC2)** | **Lack of market linkage (TC3)** | **No weather forecasting access (TC4)** | **Input delay (TC5)** | **Lack of technical guidance (TC6)** | **Dependence on monsoon (TC7)** |
| 1 | 37 (9.62) | 32 (8.32) | 34 (8.84) | 31 (8.06) | 39 (10.14) | 65 (16.90) | 62 (16.12) |
| 2 | 38 (8.36) | 42 (9.24) | 40 (8.80) | 31 (6.82) | 36 (7.92) | 49 (10.78) | 64 (14.08) |
| 3 | 43 (8.17) | 54 (10.26) | 38 (7.22) | 41 (7.79) | 21 (3.99) | 52 (9.88) | 51 (9.69) |
| 4 | 65 (10.83) | 31 (5.17) | 54 (9.00) | 22 (3.67) | 18 (3.00) | 57 (9.50) | 53 (8.83) |
| 5 | 51 (7.31) | 46 (6.59) | 41 (5.88) | 53 (7.60) | 31 (4.44) | 42 (6.02) | 36 (5.16) |
| 6 | 45 (5.10) | 31 (3.51) | 50 (5.67) | 40 (4.53) | 88 (9.97) | 22 (2.49) | 24 (2.72) |
| 7 | 21 (1.54) | 64 (4.69) | 43 (3.15) | 82 (6.01) | 67 (4.91) | 13 (0.95) | 10 (0.73) |
| **Mean Score** | **50.93** | **47.79** | **48.56** | **44.48** | **44.38** | **56.53** | **57.34** |
| **Rank** | **3** | **7** | **4** | **5** | **6** | **2** | **1** |

**Dependence on monsoon** emerged as the most severe technological constraint (57.34). In both districts, especially in non-canal areas, groundwater depletion, absence of pump sets, and lack of rainwater harvesting have left farmers highly reliant on seasonal rainfall. This makes sowing, transplanting, and pesticide scheduling vulnerable to delay or failure. In the context of increasing monsoon unpredictability, this constraint translates directly into yield loss and cropping failure.

Closely following was the **lack of technical guidance** (56.53). Many farmers reported irregular or ineffective contact with agricultural officers and Krishi Vigyan Kendras (KVKs). Without location-specific recommendations on varietal selection, crop planning, or post-flood recovery, farmers revert to traditional methods, which may not be suited to evolving climatic risks.

The **non-availability of salt-tolerant varieties** (50.93) ranked third and reflects a critical input gap. With saline water intrusion rising post-cyclones like *Aila* and *Amphan*, the demand for resilient paddy or vegetable cultivars is growing. However, seed supply chains remain weak, and varieties like “Luna Sankhi” or “CSR43” are rarely found in local markets. Farmers reported either non-awareness or late availability, rendering the adaptation option ineffective.

**Lack of market linkage** ranked fourth (48.56) and was also a strong constraint. Without guaranteed procurement or reliable buyers, farmers are hesitant to diversify into more adaptive cropping systems like legumes or off-season vegetables. Market risks often outweigh the benefits of adopting resilient practices.

Low access to **weather forecasting** and **timely input supply** both hovered around (44.4) mean scores and ranked fifth. These constraints are operational in nature and deeply affect preparation timelines, especially before major climatic events. **Shifting cropping patterns** (47.79) were less accepted due to risk aversion and uncertainty about profitability or extension support.

The overall findings indicate that technological constraints, particularly those linked to natural resource dependence and weak institutional support systems, remain significant barriers to adaptation. These cumulatively prioritise interventions that promote irrigation access, real-time technical assistance, localised weather systems, and seed system reforms as vital in improving farmers’ resilience to extreme climatic events.

**3.3 Communicational Constraints Faced by the Respondents**

Effective communication plays a pivotal role in ensuring that farmers receive timely and accurate information related to climate risks, adaptive practices, and available support mechanisms. In the context of extreme climatic events, the accessibility and effectiveness of communication systems can significantly influence farmers' capacity to respond, adapt, and recover. The study considered three major constraints: poor extension service on climate risk, poor access to information resources, and low farmer organisation membership. The summarised results of this analysis are presented in Table 3

**Table 3 Distribution of Farmers’ Ranking and Garrett Mean Scores of Communicational Constraints (CC)** *(n = 300)*

|  |  |  |  |
| --- | --- | --- | --- |
| **Rank** | **Poor extension service (CC1)** | **Poor access to info resources (CC2)** | **Low organisation membership (CC3)** |
| 1 | 123 (28.29) | 98 (22.54) | 79 (18.17) |
| 2 | 87 (14.50) | 111 (18.50) | 102 (17.00) |
| 3 | 90 (9.30) | 91 (9.40) | 119 (12.30) |
| **Mean Score** | **52.09** | **50.44** | **47.47** |
| **Rank** | **1** | **2** | **3** |

Communication bottlenecks directly influence awareness and decision-making on climate adaptation. The top-ranked constraint, **poor extension service** (52.09), revealed that very few farmers had received climate-specific advisories or were informed of stress-resilient technologies. Most agricultural workers in the area were seen as detached from the realities of seasonal risks.

**Poor access to information resources** (50.44) ranked second and reflects digital divides and infrastructural deficits. Many respondents lacked smartphones or had low digital literacy, limiting their engagement with Agro-met bulletins, WhatsApp groups, or government apps like “Mausam” or “Kisan Suvidha.” In such cases, reliance on informal channels (fellow farmers or input dealers) often leads to misinformation.

**Low farmer organisation membership** (47.47) ranked third and indicated weak social capital. Producer groups or cooperatives could serve as platforms for training, shared input procurement, or lobbying for local infrastructure. However, organisational participation was limited either due to poor awareness or a lack of local facilitation. The absence of collectivised efforts significantly weakens community-level adaptive responses.

These findings underscore the importance of strengthening rural communication networks and extension systems with a climate-risk focus. A robust, multi-channel information dissemination strategy - including revitalised extension personnel, ICT-based tools, and stronger farmer networks - is essential to improve awareness, responsiveness, and resilience among farming communities in the face of climate variability and extremes.

**3.4 Institutional Constraints Faced by the Respondents**

Institutional support is critical for building agricultural resilience in the face of extreme climatic events. Institutions serve as a conduit for delivering credit, compensation, infrastructure, and policy guidance to farming communities. In this context, understanding the institutional constraints that hinder farmers from effectively adapting to climate-related shocks is essential. Three institutional constraints were considered in this study: non-availability of institutional credit, poor support of local and national authorities with climate-related issues, and poor arrangement for compensation of losses by the government. All the 300 respondents were asked to rank these constraints based on the severity of the difficulties they posed. The results of this analysis are detailed in Table 4

**Table 4 Distribution of Farmers’ Ranking and Garrett Mean Scores of Institutional Constraints (IC)** *(n = 300)*

|  |  |  |  |
| --- | --- | --- | --- |
| **Rank** | **No institutional credit (IC1)** | **Poor authority support (IC2)** | **Poor loss compensation (IC3)** |
| 1 | 115 (26.45) | 87 (20.01) | 98 (22.54) |
| 2 | 95 (15.83) | 102 (17.00) | 103 (17.17) |
| 3 | 90 (9.30) | 111 (11.47) | 99 (10.23) |
| **Mean Score** | **51.58** | **48.48** | **49.94** |
| **Rank** | **1** | **3** | **2** |

The leading institutional constraint, **lack of access to institutional credit** (51.58), highlights the limited penetration of Kisan Credit Cards (KCC), self-help group (SHG) loans, or cooperative lending in the study region. Farmers pointed out procedural complexity, collateral requirements, and delays in sanctioning as key deterrents. This credit vacuum forces them to depend on informal moneylenders or avoid investment altogether.

The second major constraint was **inadequate compensation mechanisms** (49.94). Farmers shared experiences of extensive crop loss due to cyclones or floods, but received either delayed or insufficient relief. Many were not enrolled in crop insurance schemes, or their claims were rejected due to a lack of documentation. This weakens confidence in institutional safety nets and promotes risk-averse behaviour.

**Poor climate engagement by local and national authorities** (48.48) reflected the perception that decision-making remains top-down and non-participatory. Farmers expressed frustration over limited inclusion in planning meetings or the absence of consultations before launching schemes. Coordination between agriculture, irrigation, and disaster management departments was also found lacking on the ground.

The results emphasise the urgent need for institutional reform and enhanced delivery mechanisms at both local and state levels. Ensuring easy access to credit, streamlining compensation systems, and strengthening institutional outreach and responsiveness will be essential to support farmers in building adaptive capacity against increasing climate variability.

**Suggestions for Improving Adaptation to Extreme Climatic Events**

Farmers in both South 24 Parganas and East Medinipur identified a set of ten adaptation measures (S1–S10) that could enhance resilience to extreme climatic events. Table 1 summarises the mean scores, standard deviations, and rank order of each suggestion in the two districts. Higher mean scores indicate stronger farmer endorsement of the suggestion; ranks are determined by mean values. The following analysis compares these district-wise ratings to highlight both common priorities and regional differences in adaptive preferences.

**Table 5 District‐wise mean scores, standard deviations (SD), and ranks for suggested adaptation measures (S1–S10).**

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **Label** | **Suggestions** | **South 24 Parganas** | | | **East Medinipur** | | |
| **Mean** | **SD** | **Rank** | **Mean** | **SD** | **Rank** |
| S1 | Timely information | 2.75 | 0.44 | V | 2.58 | 0.50 | V |
| S2 | Improving information | 2.21 | 0.47 | X | 2.22 | 0.71 | X |
| S3 | Access to institutional credit | 2.26 | 0.64 | IX | 2.32 | 0.64 | IX |
| S4 | Arranging capacity building programmes | 2.55 | 0.55 | VI | 2.46 | 0.56 | VII |
| S5 | Improving knowledge level | 2.52 | 0.54 | VII | 2.40 | 0.57 | VIII |
| S6 | Facilitate the various training programmes | 2.79 | 0.41 | IV | 2.50 | 0.51 | VI |
| S7 | Supply of production inputs | 2.86 | 0.37 | **II** | 2.77 | 0.42 | **III** |
| S8 | Subsidies/compensation | 2.91 | 0.28 | **I** | 2.79 | 0.41 | **II** |
| S9 | Minimum Support Price | 2.80 | 0.54 | **III** | 2.90 | 0.30 | **I** |
| S10 | Soil testing | 2.45 | 1.12 | VIII | 2.70 | 0.46 | IV |

**Comparative Analysis of Suggested Adaptation Measures**

The highest‐ranked suggestions in both districts involve direct economic support. In South 24 Parganas, S8 (subsidies/compensation) received the highest mean score (2.91, rank 1), closely followed by S7 (production inputs) at 2.86 (rank 2) and S9 (minimum support price, MSP) at 2.80 (rank 3). East Medinipur showed a similar pattern of priorities: S9 (MSP) was top-rated (mean 2.90, rank 1), followed by S8 (subsidies) at 2.79 (rank 2) and S7 (inputs) at 2.77 (rank 3). These results indicate that farmers in both districts place greater importance on measures that bolster farm incomes and reduce financial risk in the face of climate shocks. The standard deviations for these top suggestions are relatively small (generally 0.28–0.54), reflecting broad consensus among farmers about their importance. Notably, East Medinipur farmers rated MSP slightly higher than subsidies (2.90 vs. 2.79), whereas South 24 Parganas farmers showed the reverse (2.91 vs. 2.86 for inputs vs. subsidies, respectively). This nuance suggests a marginally greater emphasis on assured market prices in East Medinipur and on direct subsidisation in South 24 Parganas. S3 (access to institutional credit) was ranked low (9th) in both districts (mean ≈2.26–2.32), implying that while financial support is valued, ease of credit is not seen as a top adaptation priority in this context.

In contrast, several suggestions related to capacity-building and knowledge enhancement received moderate ratings, especially in South 24 Parganas. S6 (training programme) was rated 2.79 (rank 4) in South 24 Parganas but only 2.50 (rank 6) in East Medinipur. Similarly, S4 (capacity-building programme) and S5 (improving knowledge level) had means of 2.55 and 2.52 in South 24 Parganas (ranks 6–7) versus 2.46 and 2.40 in East Medinipur (ranks 7–8). These differences suggest South 24 Parganas farmers express somewhat greater interest in technical training and education than those in East Medinipur. The relatively high rankings in the 2.40–2.79 range for these items indicate they are regarded as important but secondary to direct financial measures. The standard deviations (≈0.41–0.57) are moderate, indicating some variability in perceived importance. The higher score of S6 in South 24 Parganas implies that implementing a training programme may be a more pressing need there, perhaps due to lower existing knowledge or resource access.

Suggestions relating to information access (S1 and S2) were rated lowest in both districts. S1 (timely information) had a mean around 2.75 in South 24 Parganas and 2.58 in East Medinipur (both rank 5), while S2 (improving information) had the lowest means (≈2.21–2.22) and rank 10 in both. This uniform ranking indicates farmers in both regions give limited priority to improved climate information services as a standalone adaptation measure. The wider SD for S2 in East Medinipur (0.71) compared to South 24 Parganas (0.47) suggests that views on information gaps were more varied in East Medinipur. The low ranking of S2 may reflect scepticism about the efficacy of information alone or perhaps existing access; conversely, S1’s moderate rank suggests some value is seen in receiving timely alerts, but it remains less critical than material supports.

A notable regional contrast emerges for S10 (soil testing). East Medinipur farmers rated soil testing relatively highly (mean 2.70, rank 4), whereas South 24 Parganas farmers assigned it a low priority (mean 2.45, rank 8). The extremely high SD in South 24 Parganas (1.12) indicates polarised responses: some farmer’s value soil testing, but many do not. In East Medinipur, the SD is much lower (0.46), implying consensus that soil health is important. This suggests that soil testing is a relatively valued adaptation strategy for East Medinipur farmers—perhaps due to local soil degradation issues—whereas it is a more divisive or less understood concept in South 24 Parganas.

In summary, both districts’ farmers overwhelmingly emphasise economic incentives (subsidies, input support, and guaranteed prices) as their highest priorities for climate adaptation, reflecting common concerns about income protection. Secondary preferences differ: South 24 Parganas shows stronger support for training and knowledge enhancement (S6, S4, S5), while East Medinipur places comparatively more weight on market-related measures (S9) and soil health (S10). Lower-ranked suggestions (S2, S3) were consistently least favoured. These findings imply that the adaptation programme should be tailored regionally: policy-makers in South 24 Parganas might focus on strengthening extension and training services, whereas those in East Medinipur might emphasise stabilising farm income through price supports and promoting soil testing. By aligning initiatives with these district-wise preferences, interventions can more effectively meet farmers’ needs and enhance resilience to extreme climatic events.

**CONCLUSION**

This study provides a comprehensive assessment of the constraints faced by coastal farmers in West Bengal in adapting to extreme climatic events. Using the Garrett Ranking Technique, the research identified and prioritised personal, technological, communicational, and institutional barriers among 300 respondents across four climate-vulnerable blocks of South 24 Parganas and Purba Medinipur. Among personal constraints, high input costs and fragmented landholdings significantly limited farmers’ ability to invest in adaptive practices. Technological barriers were led by overdependence on monsoon rainfall, lack of technical guidance, and unavailability of salt-tolerant crop varieties. Communicational challenges included poor extension services and inadequate access to timely weather-related and agricultural information. Institutional constraints such as the lack of formal credit access and delays in compensation schemes further reduced farmers’ resilience to climatic shocks. Farmers strongly favoured economic interventions like subsidies, input support, and minimum support prices as key adaptive measures. However, regional variations were evident—South 24 Parganas farmers prioritised capacity-building and training, while East Medinipur farmers emphasised market access and soil health management. These insights highlight the need for tailored district-specific adaptation policies that reflect local vulnerabilities and farmer preferences. To build long-term resilience, multi-dimensional strategies are needed. These include improving institutional credit systems, strengthening extension networks with localised climate services, promoting climate-resilient technologies, and encouraging farmer-based organisations and cooperatives for collective action. In conclusion, the study underscores the urgent need for integrated policy responses, combining financial, technological, and institutional support. Empowering farmers with timely knowledge, accessible resources, and robust support systems is crucial for sustaining agriculture and securing livelihoods in the face of escalating climate risks. Future research should expand to other coastal agro-climatic zones to develop scalable, location-specific models of climate adaptation.

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