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Climate-Resilient Agriculture in Coastal and Floodplain Regions of Bangladesh: Community-Based Adaptation Strategies for Livelihood Resilience and Sustainable Development

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ABSTRACT

Climate change is creating increasing stress on agriculture production and on rural livelihoods, especially in coastal and floodplain/riverine areas, which are climate sensitive. This study investigates climate resilient agricultural practices and provides an analysis of the effect of local knowledge, livelihood diversification and institutional support on the community level adaptation. The qualitative research design was adopted, and primary data was collected through five Focus Group Discussions (FGD) and 25 Key Informant Interviews (KII) in five districts, of which three were from coastal areas (Bhola, Patuakhali and Barguna) and two from floodplain/riverine areas (Kurigram and Gaibandha). Braun and Clarke's approach to thematically analyse the data was utilised. Communities mentioned using salinity-tolerant and flood-tolerant crops and crop varieties, alternative crops, floating agriculture, stock raising, homestead gardening, and diversifying their livelihoods. Local knowledge was still a significant adaptation resource, such as seed preservation and seasonality decision making in agriculture. Women played a significant role in preserving seeds, managing livestock, performing their homestead production and other farming tasks. These limitations, however, were financial constraints, limited extension services, poor technical and logistic support, and unequal opportunities for decision-making. Locally suitable agricultural interventions, which connect community knowledge and formal agricultural services, livelihood diversification, available resources and gender responsive adaptation planning are needed to build resilience against climate change.

Keywords: Climate-Resilient Agriculture; Indigenous Knowledge; Community-Based Adaptation; Livelihood Resilience; Bangladesh; Sustainable Development.

1. INTRODUCTION

Bangladesh, with its high vulnerability to flooding, cyclones, salinity intrusion, riverbank erosion, and rainfall variability, is facing growing challenges to its agricultural systems and rural livelihoods due to climate change. The impacts of these pressures are especially severe in coastal and floodplain/riverine regions where agriculture is highly reliant on climate-sensitive land and water resources. The impacts go beyond yield losses to food security, income security, and the ability of households to adapt to and bounce back from climate shocks (Hoque et al., 2022; World Bank, 2022). Recent studies also reveal that the salinity and water-related stresses are still two important challenges for sustainable agriculture in coastal Bangladesh and locally appropriate adaptation measures are necessary (Shapna et al., 2024).

Climate-resilient agriculture (CRA) has thus become an important avenue to boost agricultural and livelihood resilience. Strategies for adaptation in Bangladesh comprise of stress-tolerant crop

improvements, diversification of foods, water management, raising livestock, home production and other local adaptations (FAO, 2021; Hoque et al., 2022). There is also some evidence that the effectiveness of these strategies is contingent on community involvement and the local knowledge and institutional and economic resources available (Rawlani & Sovacool, 2011; Khatun et al., 2025). Floodplain community studies also reveal the ongoing significance of indigenous strategies to cope with climate change impacts and the diversification of livelihoods (Monwar et al., 2018).

Previously however, there has been a tendency to look at specific adaptation practices or ecological setting in isolation, with relatively less focus on the interplay between local knowledge, community-based adaptation, agricultural livelihood options, livelihood diversification and institutional constraints in coastal and floodplain/riverine settings. To fill the above gap, the present study has sought to investigate the situation of climate-resilient agriculture in three coastal and two floodplain/riverine districts of Bangladesh by conducting qualitative analysis of the primary data collected from Focus Group Discussions (FGD) and Key Informant Interviews (KII). It explores the adaptation of communities with agriculture and livelihoods to climatic stress, the role of these agriculture and livelihood practices in livelihood resilience and institutional and socio-economic challenges to the broader uptake of these practices.

2. Literature Review

Climate changes have gradually turned into a structural problem of farm production and livelihoods in rural areas of Bangladesh. Because of the low elevation and high population density along with reliance on climatic dependent natural resources and exposure to multiple climatic hazards, agricultural communities are especially vulnerable (IPCC, 2023; World Bank, 2022). But climate vulnerability is not even across the board. Climate effects like salinity intrusion, cyclones and tidal surge, water scarcity are more likely in coastal communities while floodplain and riverine communities are more likely to be exposed to seasonal flooding, riverbank erosion and changing water conditions. These differential ecological stresses impact on the productivity of crops, household food security, income and livelihood stability. Studies have thus indicated that agricultural adaptation should be related to environments and socio-economic circumstances in which communities are situated. Climate change, along with soil degradation, water logging, soil erosion and other anthropogenic stresses, is a growing challenge for agriculture production in Bangladesh and demands greater sustainability and adaptability of agricultural systems (Hoque et al., 2022). Likewise, the study in the coastal zone shows that salinity of soil and water is one of the main challenges to sustainable agriculture, and the variability of rainfall and the presence of pests are additional factors that affect farmers' adaptation decisions. Similarly, in the coastal zone, soil and water salinity are identified as the major challenge to sustainable agriculture, and changing rainfall pattern and the invasion of pests are other factors that affect the farmers' adaptation decisions. While these studies demonstrate the extremity of the agricultural issues and problems related to climate change, they also highlight the need to study the response of communities to agriculture challenges.

Climate resilient agriculture (CRA) has thus become an important strategy to bolster agricultural systems in the face of changing climatic conditions. CRA focuses on the ability of agriculture to sustain production, withstand environmental pressures and recover from climatic shocks and stresses, while at the same time being environmentally friendly (FAO, 2021). In the context of Bangladesh, its practical implementation in Bangladesh is achieved through adopting stress-tolerant crop varieties, crop diversification, better water management techniques, integrated crop-livestock farming, floating farming, home farming etc. (BRRI, 2022; BARI, 2022; Hoque et al., 2022). The literature, however, suggests that CRA should not be equated with specific technologies and improved crop varieties; rather, it should be viewed as a process. But according to literature CRA should not be confined to specific technologies and improved crop varieties but rather a process. In a study that synthesizes the knowledge on the adaptation strategies of the

farming communities in Bangladesh, Khatun et al. (2025) conclude that crop diversification, water management, technological innovations, resilient crop varieties, and community-based adaptation are the significant adaptation strategies, with their effectiveness depending on the type of crop, climatic conditions, community engagement, and resource availability. This shows that agricultural resilience is created by the interplay between technological choices and the social, ecological and institutional factors influencing the availability of and ability to access and apply these choices. Similarly, Rawlani and Sovacool (2011) suggest for Bangladesh that the social, institutional, infrastructural and knowledge dimensions must be integrated for effective adaptation and that technology cannot be the sole solution. The CRA literature, however, offers a valuable foundation, but needs to be expanded to be more attentive to how agricultural adaptation becomes locally meaningful and practically feasible.

This is where community-based adaptation (CBA) comes into the picture. Collective decision-making and the involvement of local communities, along with the experiential knowledge of community members, are key points raised by CBA in the process of creating solutions to climate risks (Ayers & Huq, 2009). What makes it important is that the individuals who suffer from climatic hazards have their own local understanding of environmental changes, availability of resources and adaptation capabilities. Adaptation is not just a technical response provided to vulnerable populations but is also a social process that is influenced by community relations, institutions, knowledge sharing and collective action. Adger (2006) emphasises social capital and institutional networks as means to reinforce adaptive capacity, while Huq and Reid (2007) point out that the sustainability of a community-based initiative is increased if it is based on local realities and sociocultural contexts. This is echoed by Rawlani and Sovacool (2011) who have shown that good adaptation must involve an integrated approach that goes beyond technology. Then, more recent debates on locally led adaptation highlight the need to address the needs of the people (UNDP, 2022), local ownership, participation and inclusiveness. All these papers question external approaches to adaptation and technology-based perspectives. An important question does remain, however, about the link between the processes of community-level adaptation and the resulting agricultural practices, and then to livelihood resilience.

Another analytical dimension is the relationship between agricultural adaptation and livelihoods resilience. Livelihood resilience is about the ability of households and communities to anticipate, absorb, adapt and recover from environmental, economic and social shocks and stresses without compromising their wellbeing (Scoones, 1998). The Sustainable Livelihoods Framework also highlights the need for human, social, natural, physical and financial resources to influence livelihood opportunities (Chambers & Conway, 1992). Agricultural adaptation is not just important for the protection of agricultural production; it can also contribute to augmenting the wider resource and activity base of how households deal with uncertainty. Livelihood diversification especially is crucial in this respect. Rural households' diversification is identified as one of the important diversification strategies for reducing climate-sensitive activities by Ellis (2000). Crop production can then also be integrated with livestock production, aquaculture, wage labour, or small-scale businesses, which could help diversify the livelihood strategies in Bangladesh.

Crop farming may also then be mixed with livestock farming, aquaculture, wage labour, or small-scale businesses to distribute risk in multiple livelihood sources. This is supported by evidence from floodplain communities: Monwar et al. (2018) identified livestock rearing, homestead vegetable gardening, increased fishing activities, and changes in livelihood options as important coping strategies that have been used by indigenous people to adapt to the pressures. Likewise, the study on coastal aquaculture reveals that coastal farmers can adapt to the salinity and hydrological changes by diversifying and adjusting their farming practices, which has implications for economic and nutritional security (Bhowmik et al., 2023). The findings indicate that livelihood resilience is not only a product of increased agricultural productivity, but it is an ongoing process.

Local or indigenous knowledge is an important element of this process which is sometimes underdeveloped. Indigenous knowledge is a body of skills, experiences, observations, and practices gained over a long period of time through the interaction of the community and the

environment (Berkes, 2012). It has value for climate adaptation because of its place-specific and experiential nature. Local farmers could use some of the observations they made to make decisions on planting, farming, seed storage, and their livelihoods, including soil, water, weather, river behaviour, seasonal changes, crops, and livestock. Knowledge can help make communities ecologically resilient by helping them identify change and cope with uncertainty, as Berkes, Colding, and Folke (2000) put it. The local adaptation practices in Bangladesh consist of seed conservation, home garden cultivation, rainwater collection, and flexibilities in the cropping schedule and multiple livelihoods (UNESCO, 2017). Monwar et. al. (2018) also find that indigenous coping mechanisms are strongly correlated with physical, human, financial, natural and social assets of communities in the floodplains. This means that local knowledge, or traditional practices, are not in isolation but are part of broader livelihood systems and community capacities.

However, not including indigenous knowledge would simplify the adaptation process. Nyong et al. (2007) also advocate the integration of indigenous knowledge and scientific and technological innovations, and that synergies between knowledge systems can result in effective adaptation. This is especially important for CRA, where farmers might be adopting locally created practices along with new crop varieties, farming technologies, extension services and various formal interventions. Research in Bangladesh, also recently, shows that successful adaptation requires a mix of local practices and external resources and institutional support. In this context, Khatun et al. (2025) note the necessity for Government and external assistance in scaling up adaptation measures for the resource-constrained farmers and Shapna et al. (2024) show the importance of locally appropriate measures in addressing the challenges of coastal salinity and water scarcity. Literature thus suggests a "hybrid" interpretation of adaptation, where local knowledge, community response, agriculture technologies, and institutional capacities are intertwined rather than separate.

Although these understandings have been generated, there is still a lack of knowledge about the linkage among these dimensions in various ecological contexts of Bangladesh. While the literature has been informative about specific hazards, technologies, adaptation by communities, coping strategies of indigenous people, and livelihood diversification, these areas are often explored individually or in one particular ecological setting. For instance, Shapna et al. (2024) discuss adaptation issues in coastal communities related to salinity issues in agriculture and water management, and Monwar et al. (2018) consider indigenous coping strategies in the floodplain context. While Khatun et al. (2025) offer a more comprehensive review of adaptation strategies in Bangladesh, they also find considerable diversity based on agroecology and resources. Bhowmik et al. (2023) also provide examples of how farming systems are adapted by farmers in saline coastal areas and diversification of farming activities when hydrology changes. Less studied is the process by which local knowledge and community-based adaptation are translated into climate-smart agricultural practices, the role these practices play in developing livelihoods' resilience, and how institutional and socio-economic limitations influence the adoption of these practices in the coastal and floodplain/riverine environments.

This study is looking into this gap by analysing primary qualitative evidence from communities in three coastal districts of Bhola, Patuakhali and Barguna, and two floodplain/riverine districts of Kurigram and Gaibandha. The study integrates both community and key informant voices to go beyond accounting for adaptation practices and focus on the social processes, livelihood considerations and constraints. In the process, it brings on the issue of understanding the concept of climate-resilient agriculture from a more context-specific perspective in Bangladesh, thereby highlighting that agricultural resilience is not just technology-driven; it is a product of the interplay between local knowledge, community-based adaptation, livelihood diversification and institutional support.

3. Methodology

3.1 Research Design

The research design used in this study was a Qualitative Research Design with Primary Data Collection technique which included Focus Group Discussions (FGD) and Key Informant Interviews (KII). A qualitative approach was the most suitable for investigating the perceptions of the climate-vulnerable communities, adaptation measures being taken to environmental changes, local knowledge, and the diversification of livelihoods as well as the opportunities and constraints faced by the communities. The study has been specific in examining the processes involved in social and situational response to climate-related agricultural problems, and not the statistical impacts of specific adaptation practices.

3.2 Study Areas and Participants

The study was carried out in five districts of two contrasting ecological settings in Bangladesh, which are vulnerable to climate change. The coastal areas were Bhola, Patuakhali and Barguna, and the floodplain/riverine areas were Kurigram and Gaibandha. They were purposefully chosen because of their vulnerability to climate hazards such as cyclones, salinity intrusion, tidal and seasonal flooding, riverbank erosion, waterlogging and the related impact on agricultural production and rural livelihoods.

The primary data was gathered via five FGDs with 35 participants and 25 KIIs. In order to keep these discussions confidential, FGDs were assigned codes of FGD-1 to FGD-5 and KIIs were assigned codes of KII-1 to KII-25. The participants of the FGD were drawn from members of the community who have first-hand experience of agriculture and climate-sensitive livelihood activities. Key informants were purposefully selected due to their knowledge and engagement in agriculture, climate adaptation, local governance, community development and related activities.

3.3 Data Collection

The data were collected by the research team through semi-structured FGD and KII guidelines. The questions were intended to generate discussion about the impacts of climate change on the environment, adaptation to climate change in agriculture, local knowledge, livelihood strategies, gender roles and institutional support. The following were some of the important FGD questions: (i) What are the key climatic-environmental changes that have impacted agriculture in your community? (ii) How have farmers adapted their crop, farming, cropping time, irrigation, stock, fish or home garden production in response to these changes? (iii) Coping with mechanisms through traditional or local knowledge and practices to deal with climate related stresses. (iv) What are the patterns of sharing agricultural knowledge, seeds, labour and resources in the community? (v) What impact have these adaptations had on food security and income of households, and (vi) What are the challenges in the way of uptake or scaling up climate resilient agricultural practices?

The KIIs discussed similar concerns, including the importance of agricultural extension services, institutional support, adaptation measures, resource limitations, and local challenges. The FGDs were held with purposive participants in the community, and KIIs were held one-on-one with knowledgeable respondents. Interviews and discussion were recorded and transcribed for analysis and were anonymized with code instead of name of the participants.

3.4 Data Analysis

The analysis of the data was done thematically, following the six phases approach of Braun and Clarke (2006): familiarization with the data, initial coding, development of themes, review of themes, defining and naming themes and final analysis. The coding process centered on participants' descriptions of climate-related farming activities, local knowledge, adaptation of communities, and livelihood diversification, institutional support, and gender. The analysis was primarily inductive, and concepts of climate-resilient agriculture, community-based adaptation, local/indigenous knowledge, and livelihood resilience were used to interpret.

Four interconnected themes emerged: (1) Climate-Resilient Agricultural Practices; (2) Indigenous/Local Knowledge and Community Based Adaptation; (3) Livelihood Diversification and Resilience; and (4) Institutional Support, Gender and Constraints to Adaptation. The findings were then analyzed by comparing the coastal and floodplain/riverine contexts and looking for similarities and differences. Representative quotations from FGDs and KIIs were employed to draw the interpretations.

3.5 Ethical Considerations and Trustworthiness

Confidentiality of the participants was ensured and informed consent obtained before data collection. Transcripts and reports were anonymized by omitting any personal information and citing only by FGD or KII codes.

Triangulation of FGDs and KIIs, comparisons between the two ecological settings, systematic thematic coding, and representative participant quotations helped enhance the trustworthiness. The aim of the study is to gain 'analysis' and 'context' rather than 'generalization' through the statistical process; the findings are therefore credible because of the participants' experiences and systematic interpretation of the qualitative data.

4. Findings

Primary qualitative data analysis of the five FGDs and 25 KIIs sessions revealed four key themes related to climate-resilient agriculture and livelihood adaptation. Adaptation was described as an ongoing adaptation process in which households change the way they produce their livelihood, rely on local knowledge they have accumulated and diversify their livelihood activities, and seek institutional support. Meanwhile, the participants recognized financial constraints, poor institutional service, resource constraints, and gendered decision making as key challenges for adaptation. The results are shown under the four main themes identified from the qualitative analysis.

Table 1. Themes, Codes, and Illustrative Quotations

Themes	Codes	Illustrative Quotations
Climate-Resilient Agricultural Practices	Salinity-tolerant crops; Flood-tolerant varieties; Alternative crops; Floating agriculture	"Floating agriculture is our option during prolonged flooding."
Local Knowledge and Community-Based Adaptation	Seed preservation; Seasonal knowledge; Environmental observation; Knowledge sharing	"We learned seed preservation techniques from our parents."
Livelihood Diversification and Resilience	Livestock; Homestead gardening; Aquaculture; Alternative income	"Keeping livestock helps us when crops are destroyed."
Institutional Support, Gender, and Constraints	Extension support; Financial constraints; Women's participation; Decision-making	"Women contribute significantly to seed storage and livestock management."

Theme 1: Climate Resilient Agricultural Practices in Coastal and Floodplain / Riverine Regions

In all the study areas, the respondents reported significant adjustments in farming practices because of the changes in the environment. The types of changes, however, varied from site to site depending on the ecological properties of the study sites. In the coastal areas of Bhola, Patuakhali and Barguna, salinity, water related stresses, cyclones and the associated changes in agricultural output were highlighted by the participants. The farmers showed a reaction by changing the crop mix and introducing varieties that they believe would perform better in saline or other challenging production environments.

Recurring themes included the need for salinity-tolerant rice varieties as an important adaptation strategy. Participants also mentioned that alternative crops (such as mung bean and watermelon) that were more difficult to grow were getting more attention. The choice of alternative crops was also driven by their suitability for the environment, as well as their potential for household income. Hence, climactic tolerance and economic value of crops were taken into consideration by the farmers in making production decisions.

The results suggest that adaptation in coastal communities did not include a switch away from agriculture, but rather a shift in agricultural decisions. Farmers tested new varieties, made changes in the timing of their cultivation, and introduced new crops to a production system. These practices enabled households to maintain agricultural activities during more volatile environmental conditions.

The floodplain/riverine areas of Kurigram and Gaibandha were found to be the most affected areas where the participants reported flooding and chronic water logging as one of the major hindrances for traditional farming methods. Farmers reported having used locally grown rice varieties that were resistant to flooding such as Gainja, Noyraj and Dudhraj rice, as well as adapting their cropping calendars to the timing and duration of flooding. An alternative identified was floating agriculture in areas where agricultural land would be flooded for longer durations.

A participant from the floodplain/riverine district Kurigram stated that it is very important to consider different types of agricultural responses during extended flooding:

> *"Under the condition of long flooding, the only choice is floating agriculture or using locally available rice varieties"* (FGD-4, Kurigram).

The statement shows that there is a close relationship between agricultural adaptation in flood-prone communities and the physical availability of cultivable land. Farmers resorted to the production systems that are able to adapt to and perform under different environmental conditions when conventional cultivation is no longer possible due to prolonged inundation.

The KII participants also highlighted the importance of adopting agriculture practices based on environmental conditions. They also suggested that adaptation is not a one-size-fits-all solution for communities. Instead, the right agricultural reaction will be determined by the specific climatic and ecological stresses faced by farmers.

> *"Salinity-tolerant rice has helped us maintain production during the dry season despite increasing soil salinity." (*KII-12)

An agricultural officer also mentioned-

> "*Coastal and flood areas need different farming methods. In coastal areas, farmers need crops that can tolerate salinity. In flood areas, they need crops that can survive water*" (KII-08).

In general, the results indicate the use of salinity tolerant crop varieties, alternative methods of farming, use of local varieties that are resistant to flooding, changes in crop scheduling, floating agriculture, water-management practices, and diversification in farming activities as methods adopted for climate resilience in agriculture in the study areas. These practices were chosen with a close linkage to the observations of the changing environmental conditions and available resources for the farmers.

Theme 2: Local Knowledge and Community Based Adaptation

The importance of local and indigenous knowledge arose as an important element in agricultural adaptation. Seeds, crop selection, seasonal conditions, rainfall, water, and agricultural timing were cited as resources gained from a long-term experience. These practices were not considered to be static knowledge but were continuously modified to suit the environmental conditions.

Seed preservation was particularly important. Farmers reported to maintain locally appropriate seed stocks and knowledge about their use through inter-generational transmission. This enabled households to keep farm surplus items they deemed suitable for their environments.

One participant explained:

> *"We have been taught how to preserve seeds by our parents and still use these techniques today"* (FGD-3, Barguna).

It is in this account that we see the idea of adaptation knowledge integrated into family and community relationships. Knowledge was obtained from parents, older farmers, neighbours and from the general experience of agricultural activities as well as from formal agricultural institutions.

Participants also reported on relying on observations of the environment to inform agricultural decisions. The farmers listened to rainfall; watched the seasons; observed the water; understood the soil; and noticed the river's movements to determine when to plant and what to grow and when to harvest. When controlling cropping periods and agricultural activities in floodplain/riverine settings, knowledge of river and flood behaviour was especially important.

KII participants also noted that local farmers often learn from each other to see what practices perform well at specific times and locations. An NGO official explained -

> *"Farmers do not just follow new advice. First, they see if it works in their local area and then they decide"* (KII-15)

Knowledge then spreads via informal and community interaction. Farmers could see how other farmers had used a crop or adaptation and then decide whether to adopt the practice or adapt it to suit their own situation.

> *"Our elders taught us when to plant and harvest based on rainfall patterns and river behavior"* (KII-08).

The results also indicate that there was no divide between local knowledge and agricultural practices introduced. Adaptation was reported to be the process of blending local knowledge, new varieties, and knowledge and technology associated with agriculture. In this way a process of ongoing learning and adjustment took place, as farmers considered various options based on their own experience.

Therefore, community-based adaptation was manifested in regular activities like seed saving, sharing information, community learning, seasonal planning and sharing agricultural experience. Local knowledge was used as a practical resource that enabled the communities to read about the environment and develop their agricultural strategies.

Theme 3: Livelihood Diversification and Household Resilience

Participants' statements showed that livelihood diversification was a key aspect that emerged. Households reported diversifying agricultural production with other livelihoods and food producing activities to lessen reliance on one source of livelihood. This was especially crucial during times of agricultural normalcy disruptions and damage to crops caused by climate related events.

In the coastal areas of Bhola, Patuakhali and Barguna, some of the activities, like aquaculture activities, crab fattening, duck rearing and homestead gardening were found as complementary livelihood activities. These activities enabled households to generate income or food that was not available from their crops due to environmental conditions.

Livestock rearing, wage labour, small scale business and seasonal livelihood among the participants were highlighted in floodplain/riverine areas of Kurigram and Gaibandha. This was

especially significant for livestock, which could serve as a type of household asset when crop production was affected.

One of the participants from Gaibandha, a floodplain/riverine district, explained:

> *"When it floods our crops do not grow every year, we need to keep livestock to survive"* (FGD-5, Gaibandha).

This account illustrates not only the role of livestock as an agricultural enterprise, but also as a means of household security during times of agricultural failure. The participants also mentioned similar links between cropping and other livelihood activities, suggesting that the householders tried to sustain multiple livelihoods at once.

Participants also recognized some households who did relatively easy activities like homestead gardening and keeping some ducks. These may be activities that could help contribute to the food supply of the household and also help the income generation. At the production level, livelihood diversification took place and at the consumption level also.

But household resource differences are limited to diversification. Households with less capital, land, labour, or market access were less likely to have opportunities to invest in other activities, participants commented. Diversification, therefore, was well known to be desirable, but was not experienced by all households.

This finding was validated by KIIs, which highlighted access to finance, productive resources, technical assistance and markets as conditions that impact household diversification capacities. The results thus show that livelihood diversification was a process of adaptation and a resource dependent process.

Theme 4: Institutional Support, Gender and Constraints to Adaptation

Institutional support was a key part of participants' adaptation experiences. Agricultural extension services and other government and development organizations were cited as sources of agricultural information, technical advice, better varieties, and other types of support. Among the departments, those relevant to the various agricultural and livelihood activities were the Department of Agricultural Extension, fisheries and livestock-related services. An Agriculture Extension Worker expressed-

> *"Giving information is not enough. Many farmers know about new methods, but they do not have money to use them"* (KII-12)

But participants did not find institutional support to be readily available and adequate in all cases. Some of the key barriers identified were limited extension coverage, lack of logistical support, financial constraints, lack of technical assistance and access to institutional services. For the participants, availability of adaptation technology or recommendation did not imply availability of resources for farmer adoption.

The KII participants shared further institutional views, especially on the challenges of providing services related to agriculture and climate at the community level. Their reports emphasized the need for on-farm engagement, frequent contact with extension agents, accurate and timely information and technical support, and access to resources for putting adaptation measures into practice at the household level.

Gender was another added layer of adaptation in agriculture. Women were reportedly engaged in a wide variety of domestic agricultural work, most notably in seed storage, care of livestock, duck breeding, home gardening, post-harvest processing, etc. Their labour was very significant in sustaining household agricultural production and food security.

> "*Women are involved in almost every agricultural activity, yet most decisions are still made by men*" (KII-19)

However, the qualitative evidence suggests a difference in terms of women's role in agriculture and their role in decision making. The processes involving women were more visible around the household, whereas those related to production, expenditure, land use, and livelihood investments were more under the control of men.

The results thus show that social relations influence climate adaptation, alongside the environment. Women's work is important in helping to adapt, but this is limited by their domestic roles and decisions.

The four themes collectively show that the communities of the five study districts are using a variety of and interconnected ways of coping with pressures on their agriculture and livelihoods due to climate change. Responses to salinity and other coastal environmental stresses were expressed mainly by the coastal communities (Bhola, Patuakhali, Barguna), whereas the floodplain/riverine communities (Kurigram, Gaibandha) focused on flooding, inundation and disruption of agriculture due to the rivers. In both, adaptation included changes in farming practices, the use of local knowledge, livelihood diversification and institutional support. Meanwhile, some households' ability to adapt were limited by resource constraints, unequal access to resources and services, and gendered decision-making. The results of these findings will then be discussed in the Discussion section where the patterns observed will be interpreted with respect to the literature.

5. Discussion

The results reveal the context-specific and multi-dimensional nature of climate-resilient agriculture in the study areas. Communities in the coastal districts of Bhola, Patuakhali and Barguna mainly spoke about crop and variety changes in response to salinity and water-related stress issues; communities in the floodplain/riverine districts of Kurigram and Gaibandha mainly highlighted the use of flood-tolerant varieties, modified cropping schedules and floating agriculture. This is in line with the literature which describes CRA as an approach that is productive, but not dependent on a single technology, but instead has the potential to be adaptive and environmentally sustainable (FAO, 2021). The results also indicate that farmers are taking proactive measures to adapt to the ecological conditions, suggesting a need to consider a place-based approach to adaptation strategies, as opposed to a region-wide one, in climate-susceptible areas.

One of the key findings is the persistence of local knowledge in agricultural adaptation. Seed preservation, participatory decision making and environmental observation were practical resources passed on across generations and described by participants. This is in close parallel to Berkes's (2012) understanding of ‘indigenous knowledge' as ‘place-specific knowledge that has been developed over time through continuing contact with the environment'. Literature consulted for this study also states that local indicators of salinity, planting season, river behavior, flood condition and soil condition are also important factors in the agricultural adaptation in Bangladesh. More importantly, the results indicate that local knowledge is not to be regarded as substitute for scientific knowledge. The ability of farmers to blend indigenous knowledge with better varieties and new technologies and information is suggestive of their capacity to merge the two knowledge systems in contrast to the view of Nyong et al. (2007) that argues that these two systems should be integrated.

The results also illustrate the strong linkage between agricultural and livelihood resilience. Households were not monofunctional agro-farmers, but took advantage of mixed farming, complementing it with livestock, aquaculture, homestead gardening, and wage work and small-scale economic activities. This is consistent with Ellis's (2000) insights into the benefits of livelihood diversification for reducing the dependency of households on climate-sensitive livelihoods, and with the focus Tanner et al. (2015) place on the need for diversified livelihoods to recover from shocks. Importantly, however, the findings show that diversification is a function of access to land, capital, labour, markets, and other resources. Therefore, resilience is not only a

function of the number of livelihood activities that are undertaken, but also on the ability of households to continue and enhance livelihood activities.

Lastly, the results emphasize the social and institutional aspects of adaptation. While government and agricultural services deliver relevant technical information, extension coverage remains weak, logistical support is limited, financial factors remain a constraint, and services are not available. This is in line with the literature, which finds that inadequate institutional support and lack of technical and financial resources are still challenges for scaling up CRA in Bangladesh. The high level of involvement of women in seed conservation and livestock management and homestead agriculture is another indication that adaptation is part of the household labour relations. The emphasis in community-based adaptation literature is on participation, collective action and local decision-making, where these are key elements of effective adaptation (Ayers & Huq, 2009; Adger, 2006). The findings of the present document advance that line of thinking, by revealing that community engagement is not enough to ensure adaptation that matters – there's also a question of who is doing the adaptation work and who is making decisions about adaptation.

The study overall suggests that climate resilience is realised when the four elements of ecologically appropriate agriculture, local knowledge, livelihood diversification and institutional support intersect. The evidence has thus cast doubt on the technology-driven interpretations of CRA and suggests an alternative perspective of using a locally based and socially integrated model of agricultural adaptation.

6. Theoretical Contribution and Practical Implications

6.1 Theoretical Contribution

This study can be seen as a contribution to the climate adaptation literature by showing that the practices of climate-resilient agriculture, local knowledge, community-based adaptation, and livelihood resilience are not mutually exclusive but rather are connected elements of the community's response to climate change. The results confirm the idea of ecological, economic, social and institutional adaptation. The study, in particular, shows how much value there is in locally acquired knowledge as a foundation for agricultural decision making and how livelihood diversification can help households to cope with the impact of disrupted agriculture due to the climate. It also underscores the need to consider the gender dimension of participation and institutional access in the study of adaptive capacity. The study therefore provides a contextualised understanding of resilience based on experiences of coastal and floodplain/riverine communities.

6.2 Practical Implications

The results indicate some practical priorities. Increase and adapt agricultural extension services to the particular risks of coastal and floodplain/riverine areas. More technical and financial assistance should be provided for salinity and flood tolerant varieties, floating agriculture, water management and diversified farming systems. Local knowledge needs to be integrated into adaptation planning and not considered separately from formal agricultural knowledge. There should also be an increase in access to climate finance, inputs, markets and livelihood diversification for resource poor households. Lastly, agricultural and climate programs need to be gender-inclusive and consider women's agricultural contributions and enhance their involvement in household and community decision-making.

7. Conclusion

This study clearly shows that the development of climate resilient agriculture in the coastal and floodplain/riverine communities of Bangladesh is not a one-off event, but a dynamic process that is influenced by environment, local knowledge, livelihood requirements and institutional support.

We found that farmers in Bhola, Patuakhali and Barguna responded to coastal stress by shifting the crop mix, cultivation of salinity-tolerant varieties and alternative farming activities, and communities in Kurigram and Gaibandha adapted to flooding by using flood-tolerant crops, adjusting cropping calendars, floating farming and diversifying livelihoods. Local knowledge, especially about seeds, seasonal conditions, and agricultural practices is a valuable asset for adaptation. Nevertheless, financial constraints, poor institutional services, insufficient resources and gender inequalities remain as constraints to adaptive capacity. The study, therefore, recommends that measures to strengthen climate resilience should include locally appropriate agricultural strategies, bolstered by gender-responsive adaptation planning, as well as better extension services, access to resources and finance, and recognition of local knowledge and livelihood diversification.

8. Limitations and Future Research Directions

There are a number of limitations to this study. It was done in only five selected districts, and thus does not cover all climate sensitive areas of Bangladesh. The findings from the five FGDs, with 35 participants and 25 KIIs, are qualitative and are used to provide contextual and experiential insights into the study rather than as a statistically representative estimate. Further studies provide scope for mixed-method or longitudinal designs to study changes in adaptation practices over time, and to measure its measurable impact on agricultural productivity, household income, food security and livelihood resilience. Further comparative studies within other coastal, floodplain, haor, drought-prone and char regions would be able to detect the differences in adaptation across ecological settings. Enhancing the capacity of institutional and financial mechanisms to support climate resilient agriculture and exploring gendered decision-making are also areas that could benefit from further research.

References

Adger, W. N. (2006). Vulnerability. Global Environmental Change, 16(3), 268–281. https://doi.org/10.1016/j.gloenvcha.2006.02.006

Ahmed, A. U., Alam, M., & Hassan, S. (2019). Climate resilience in Bangladesh agriculture. Journal of Environmental Studies, 14(2), 45–59.

Ayers, J., & Huq, S. (2009). Supporting adaptation to climate change: What role for official development assistance? Development in Practice, 19(6), 675–682. https://doi.org/10.1080/09614520903122363

Bangladesh Agricultural Research Institute. (2022). Annual report 2021–2022. Bangladesh Agricultural Research Institute.

Bangladesh Bureau of Statistics. (2023). Statistical yearbook of Bangladesh 2023. Ministry of Planning, Government of Bangladesh.

Bangladesh Delta Plan 2100. (2018). Bangladesh Delta Plan 2100. General Economics Division, Planning Commission, Government of the People's Republic of Bangladesh.

Bangladesh Rice Research Institute. (2022). Annual report 2021–2022. Bangladesh Rice Research Institute.

Berkes, F. (2012). Sacred ecology (3rd ed.). Routledge.

Berkes, F., Colding, J., & Folke, C. (2000). Rediscovery of traditional ecological knowledge as adaptive management. Ecological Applications, 10(5), 1251–1262. https://doi.org/10.1890/1051-0761(2000)010[1251:ROTEKA]2.0.CO;2

Bhowmik et all. (2023). Salinity extrusion and resilience of coastal aquaculture to the climatic changes in the southwest region of Bangladesh Heliyon. https://doi.org/10.1016/j.heliyon.2023.e13935

CGIAR. (2022). Climate-smart agriculture in South Asia. CGIAR Research Program on Climate Change, Agriculture and Food Security.

Chambers, R., & Conway, G. R. (1992). Sustainable rural livelihoods: Practical concepts for the 21st century (IDS Discussion Paper No. 296). Institute of Development Studies.

Climate Change Cell. (2020). Climate change impacts and adaptation in Bangladesh. Ministry of Environment, Forest and Climate Change, Government of Bangladesh.

Dasgupta, S., Hossain, M. M., Huq, M., & Wheeler, D. (2015). Climate change, soil salinity, and the economics of high-yield rice production in coastal Bangladesh (Policy Research Working Paper No. 7140). World Bank.

Ellis, F. (2000). Rural livelihoods and diversity in developing countries. Oxford University Press.

Faria, F. et al. (2026). Integrated Climate-Resilient Coastal Zone Management in Bangladesh:Policy, Practice, and Implications. *Chinese Journal of Urban and Environmental Studies*, 14(1): 2650003-1 to 2650003-42.

Folke, C. (2006). Resilience: The emergence of a perspective for social–ecological systems analyses. Global Environmental Change, 16(3), 253–267. https://doi.org/10.1016/j.gloenvcha.2006.04.002

Food and Agriculture Organization. (2021). Climate-smart agriculture sourcebook (3rd ed.). FAO.

Huq, S., & Reid, H. (2007). Community-based adaptation: A vital approach to the threat climate change poses to the poor. International Institute for Environment and Development.

Intergovernmental Panel on Climate Change. (2023). Climate change 2023: Synthesis report. IPCC.

International Fund for Agricultural Development. (2021). Rural development report 2021: Transforming food systems for rural prosperity. IFAD.

Islam, M. M., & Nursey-Bray, M. (2017). Adaptation to climate change in Bangladesh: A social-ecological perspective. Climate Risk Management, 16, 112–123. https://doi.org/10.1016/j.crm.2017.02.004

Khatun, M. N., M. S. Iftekhar, A. Naranpanawa, and M. N. I. Sarker. (2025). Climate Resilience Through Adaptation Among Bangladeshi Farming Communities. Food and Energy Security 14, no. 6: e70147. https://doi.org/10.1002/fes3.70147.

Mallick, B., Ahmed, B., & Vogt, J. (2018). Living with floods: Resilience and adaptation in flood-prone communities of Bangladesh. Natural Hazards, 91(2), 455–473. https://doi.org/10.1007/s11069-017-3136-7

Ministry of Agriculture. (2020). National agriculture policy 2018. Government of the People's Republic of Bangladesh.

Monwar, M.M., Mustafa, M.G., Khan, N.A. et al. Indigenous Adaptation Practices for the Development of Climate Resilient Ecosystems in the Hail Haor, Bangladesh. Glob Soc Welf 5, 125–136 (2018). https://doi.org/10.1007/s40609-014-0014-9.

Nyong, A., Adesina, F., & Osman Elasha, B. (2007). The value of indigenous knowledge in climate change mitigation and adaptation strategies in the African Sahel. Mitigation and Adaptation Strategies for Global Change, 12(5), 787–797. https://doi.org/10.1007/s11027-007-9099-0

Rahman, M. A., Alam, K., & Rahman, S. (2020). Climate adaptation and agriculture in Bangladesh: A review of adaptation practices and policy implications. Sustainability, 12(14), Article 5732. https://doi.org/10.3390/su12145732

Rahman, S., Hossin, A., & Rahman, S. (2025). Climate-Resilient Low-Cost Housing Solutions for Rural Bangladesh: A GIS-Based Assessment of Flood and Cyclone Risk. Research Journal in Civil, Industrial and Mechanical Engineering, 2(2), 131–147. https://doi.org/10.61424/rjcime.v2i2.635

Rawlani, A.K., Sovacool, B.K. (2011). Building responsiveness to climate change through community-based adaptation in Bangladesh. *Mitig Adapt Strateg Glob Change* 16, 845–863. https://doi.org/10.1007/s11027-011-9298-6

Scoones, I. (1998). Sustainable rural livelihoods: A framework for analysis (IDS Working Paper No. 72). Institute of Development Studies.

Shapna, K. J.; Li, J.; Kabir, M. H.; Salam, M. A.; Khandker, S.; Hossain, M. L. Strengthening adaptation in coastal Bangladesh: community-based approaches for sustainable agriculture and water management. *Dis. Prev. Res.* 2024, 3, 5. http://dx.doi.org/10.20517/dpr.2023.41

Tanner, T., Lewis, D., Wrathall, D., Bronen, R., Cradock-Henry, N., Huq, S., Thomalla, F., et al. (2015). Livelihood resilience in the face of climate change. Nature Climate Change, 5(1), 23–26. https://doi.org/10.1038/nclimate2431

UNDP. (2022). Human development report 2021/2022: Uncertain times, unsettled lives—Shaping our future in a transforming world. United Nations Development Programme.

UNDRR. (2021). Global assessment report on disaster risk reduction 2021. United Nations Office for Disaster Risk Reduction.

UNESCO. (2017). Local and indigenous knowledge systems (LINKS) programme. United Nations Educational, Scientific and Cultural Organization.

United Nations. (2024). The sustainable development goals report 2024. United Nations.

World Bank. (2022). Bangladesh country climate and development report. World Bank.