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Climate change mitigation and adaptation: The role of rural local government institutions in Bangladesh

Md. Golam Mostafa[1]
Nazmul Hasan[2+]

[1,2]*Department of Public Administration and Governance Studies, Jatiya Kabi Kazi Nazrul Islam University, Trishal, Mymensingh, Bangladesh.*
[1]*Email: golammostafa.pr@gmail.com*
[2]*Email: nazmul.pags23@gmail.com*

(+ Corresponding author)

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ABSTRACT

Bangladesh is more vulnerable to floods, cyclones, drought, and river erosion, which has become a part of climate change in rural landscapes. The identified risks represent a significant threat to agriculture-dependent livelihoods and rural development. The involvement of local government institutions (LGIs) in climate change mitigation and adaptation at the grassroots level is essential; however, their preparedness and capacity have not been adequately addressed. This paper examines the institutional capacity, preparedness, and awareness of rural LGIs regarding climate risks awareness, determines the bound barriers, and recommends the policy enhancements. The study followed a mixed-methods approach, which employs both quantitative (350 survey participants) and qualitative (key informant interviews) data. The results indicate that 80% of respondents were moderately aware of climate change and 85% of them believed that it was a severe threat to their locality; however, less than 6% had the impression that LGIs were well-prepared. The most significant limitations considered were lack of funding (46%), poor disaster preparedness, technical knowledge limitation, and lack of policy coordination. Despite the relative success of LGIs in responding to emergencies, as well as early warning systems, long-term plans, which include but are not limited to climate-resilient infrastructure, sustainable agriculture, and public education programs, are still weakly implemented. The current research demonstrates that LGIs desire to regulate climate action but lack the capacity. Strengthening LGIs requires training, climate finances, and strategy. Resilience and sustainable rural development against climate change require institutional autonomy, local-national alignment, and community engagement.

Contribution/ Originality: The study contribution of this study to the current literature is the analysis of mitigation and adaptation activities of local governments. This paper contributes to the description of institutional issues and challenges, and the identification of practical steps that can lead to improvement in local climate resilience.

1. INTRODUCTION

Bangladesh is highly vulnerable to climate change, with floods, cyclones, salinity in the soil and increases in sea level mainly harming its rural areas (Haque & Nahar, 2023). Because agriculture and nature form the basis of many livelihoods, these environmental threats make things worse for the poor and vulnerable. In this situation, rural LGIs are key in delivering development projects and services to the community. Despite playing key roles in climate action, these organizations often face challenges due to financial constraints, a lack of expertise and problems coordinating with climate policies at the national level (Chowdhury, Hasan, & Islam, 2022). Even though multiple national strategies are in place, there is still little information available about local governments' readiness, abilities and engagement in climate change matters (Ashik-Ur-Rahman et al., 2024; Kabir & Hossain, 2021). Islam

and Nursey-Bray (2017) noted that strong and efficient formal institutions are key to effective climate change adaptation, especially because local governments usually respond first in developing areas. The goal of this study is to understand how ready rural local government bodies are in Bangladesh to adjust and address the risks of climate change. Concentrating on local- and community-based means, this study strengthens discussions about how to act against climate change locally. Its conclusions are valuable for those in charge of laws and programs, as well as for members of society, working towards greater climate resilience. Although this study concentrates on the Gaibandha District and partly uses self-reported data, the findings serve as a useful basis for improving climate governance in rural settings such as Bangladesh and in other developing nations (Cuevas, Peterson, Morrison, & Robinson, 2016; Rahman, Rahman, Huda, Al, & Noman, 2020).

1.1. Aims and Objectives

The main objective of this study is to assess and enhance the capacity of rural local government institutions in Bangladesh to contribute to climate change mitigation and adaptation efforts effectively. This study aims to analyse how to help rural communities, which are highly sensitive to climate change, strengthen their resilience and develop sustainably. The main aims are as follows:

- To assess the current awareness of and readiness for climate change in rural local government institutions in Bangladesh.
- To determine the challenges faced by rural local government institutions in implementing climate change mitigation and adaptation strategies.
- To suggest tactics and recommendations for improving the ability of rural local government institutions to act on climate issues.

1.2. Rationale of the Study

In Bangladesh, the main threats from climate change are found in rural areas, since many people there rely heavily on farming and other natural resources. In rural areas, the government works to solve these challenges by choosing mitigation and adaptation methods. LGIs in Bangladesh and their management of issues linked to climate change are the focus of this study. LGIs need to be understood because they are generally the first to apply central policies locally (Uddin, Haque, & Khan, 2021). Previously, local governments were found to be able to help many peoples, but they fail because of a lack of funding, trained employees and support from policies (Islam & Nursey-Bray, 2017). The research examines the preparedness plans; and the understanding and ongoing activities of LGIs to suggest ways to strengthen them in response to climate change. The development and structure of rural areas in Bangladesh relies greatly on this research. I am examining just how ready rural LGIs in Bangladesh are to address the problems caused by climate change. LGIs are crucial for applying national policies, yet they often face problems because they lack both the resources and the expertise. It aims to discover gaps and offer ways to help these countries become more capable of dealing with climate change. The analysis of climate change mitigation and adaptation in rural Bangladesh is limited, mainly due to the use of self-reported evidence, the area studied, challenges with measuring changes and a lack of sufficient resources. Because of these restrictions, the findings and the study's results may not be easily applied to broader cases.

2. CONCEPTUAL FRAMEWORK

Assessing the Capabilities of Local Governments and the Impacts of Global Influences on Climate Change Mitigation and Adaptation.

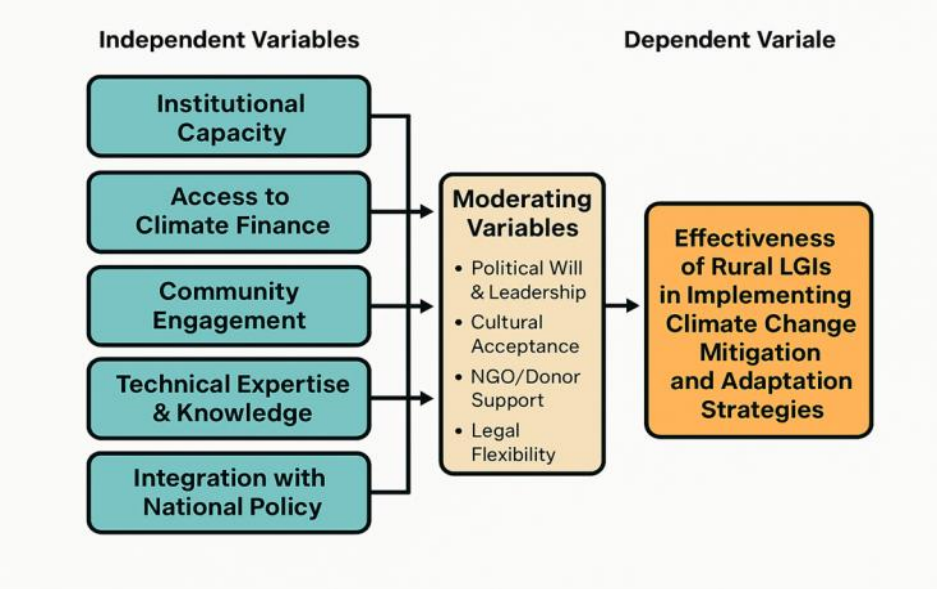

Figure 1. Illustrates the relationships among the independent, moderating and dependent variables

The framework explained how certain important aspects influence the success of rural local government institutions in handling climate change in Bangladesh. The impact of LGI on project delivery, highly dependent on having the right institutional capacity, access to climate finance, involvement of communities in decision-making, knowledgeable staff and cooperation with national policies. Nevertheless, the role of political will, cultural norms, NGO/donor backing and the possibility of updating laws defined how much and in what ways these influences affected education. The study revealed that even if an LGI had good resources, it would not perform as expected if it struggled with weak external support. The results revealed that financial limitations; and not having suitable training and coordination issues were big obstacles. If there was strong political will and help from outsiders, LGIs were able to form robust infrastructure and interact effectively with their communities. Adaptation was more successful when the community and cultural systems were involved. Moreover, when governance was overly rigid and trust was low, progress was slower. The model highlighted that it is necessary to match institutional readiness with enabling conditions to accomplish climate initiatives.

3. MATERIALS AND METHODS

The research was based on a mixed-methods design that relied on a careful combination of a quantitative survey of 350 stratified-sampled participants and deep qualitative involvement in 5 key informant Interviews (KIIs) of local officials and NGO representatives, comprising a total of 355 respondents. The design represents a complex study to enable both the general evaluation of communication, awareness, and activities, as well as an in-depth appreciation of underlying challenges and values. All the data were carefully collected in Gaibandha Sadar Upazila in Gaibandha District, Bangladesh, which is specifically selected because of its high level of vulnerability to diverse climate change effects. Quantitative data were statistically analysed to determine trends and correlations, whereas, qualitative data were rigorously analyzed thematically to discover common themes and subtle ideologies about the contributions of rural local government institutions (LGIs) to climate change mitigation and adaptation. Although the data were scrupulously gathered and partially discussed, the following limitations were recognized: the geographical specificity of the research (with findings potentially limited by generalizability), possible self-reported biases (survey answers) and lack of long-term evidence and incorporation of advanced climate technologies. During the study, a high level of ethical sensitivity was maintained, which included the acquisition of informed consent, guarantees of the anonymity and confidentiality of the participants, and careful consideration of possible biases.

4. FINDINGS OF THE STUDY

4.1 Quantitative Analysis

Table 1. Presents the demographic information of the respondents.

Gender	Frequency	Percentages (%)	Cumulative percentages (%)
Male	193	56%	56
Female	154	44%	100
Total	350	100	100
Education			
Undergraduate	175	50%	50
Graduated	105	30%	80
Post graduated	70	20%	100
Total			100
Age			
18-25	175	50%	50
26-33	126	36%	86
34 to above	49	14%	100
Total			100
Occupations			
Stakeholder	210	60%	60
Teacher	105	30%	90
Employee	35	10%	100
Total	350	100%	100

In the survey on Climate Change Mitigation and Adaptation: The Role of Rural Local Government Institutions in Bangladesh, the questionnaire was filled out by n = 350 participants. Most of the respondents were males (56%), 50% had an undergraduate degree, 30% had finished their studies, and 20% had obtained a postgraduate education. There was a strong youthful component in the sample, with 175 participants (50%) between 18 and 25 years of age and an additional 126 participants (36%) between 26 and 33 years of age, similar to the median national age of 27–28 years. Regarding their jobs, approximately 60% (n = 210) said they were local stakeholders; 30% (n = 105) said they were teachers; and 10% (n = 35) said they were employees. It is evident that those included in the study had a strong influence or role in rural adaptation. However, the table failed to include income level, geography, and vulnerability to poverty, all of which play important roles in the way people encounter climate risks and opportunities. Even though women and men face different literacy and climate challenges in rural Bangladesh, no attempt was made to include this information in the findings. It is still not clear if rural groups and vulnerable populations were truly represented in the survey because of these additional layers were absent.

4.1.1 Assessing Awareness of Climate Change Impacts at the Local Level

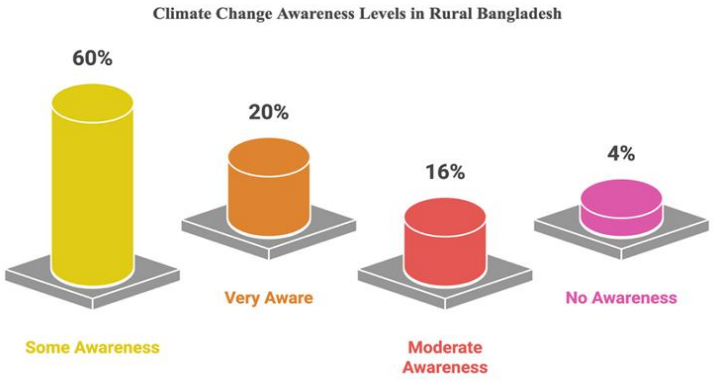

Figure 2. Presents the Awareness of climate change.

In the context of Bangladesh, a survey was performed with rural residents (n = 350) to determine the extent to which they are aware of the effects of climate change happening in their area. The results demonstrated that 60% had some awareness, whereas 20% said they were very aware, which means that 80% had a moderate to high level of understanding. On the other hand, 16% had a moderate level of awareness and 4% had none, thus, there was a clear difference in awareness levels.

The awareness of climate change was likely increased because of firsthand experiences with challenges such as floods, cyclones, and salinity intrusion. The survey did not provide detail about how much people knew or learned, making it difficult to understand how they acted as a result.

There is still a gap in understanding which groups have less information, without the benefit of demographic analysis. As a result, rural local governments should adjust their educational and outreach methods to involve all residents in taking local climate action together.

4.1.2 Community Perceptions of the Significance of Climate Change

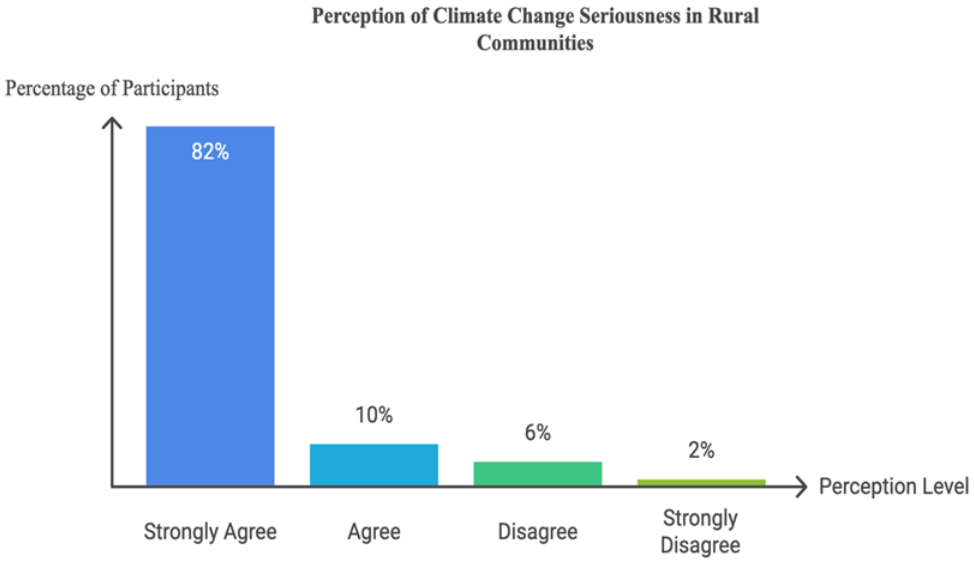

Figure 3. Exhibits the significance of climate change.

A study was organized with 350 participants to determine how significant climate change was for rural communities. The findings indicated that 287 participants (82%) strongly believed climate change to be a serious concern, whereas 35 participants (10%) believed it was a concern, and therefore, 92% of the respondents overall acknowledged climate change overall. In contrast, this issue was seen as minor by 21 respondents (6%) and 7 respondents (2%) who strongly disagreed, accounting for 28 respondents (8%) who did not consider it to be a serious problem.

This means that most of those surveyed had first-hand experience with floods, unusual rainfall, and issues with their crops. Even so, the study failed to examine the underlying causes of disagreement and did not consider whether people's opinions varied by their age, education, or work. As a result, it is important for rural local institutions to work on outreach and education to encourage the minority populations that are holding back.

4.1.3 Climate Events Experienced Locally Over the Past Five Years

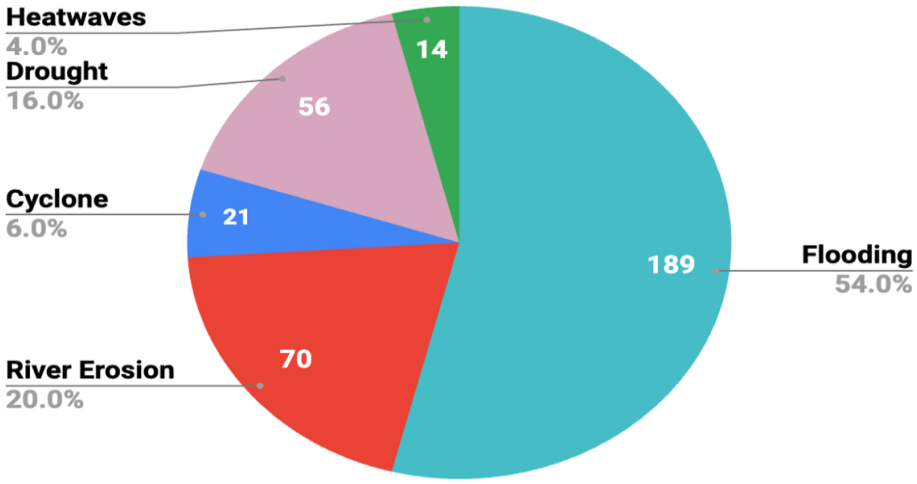

Figure 4. Shows the affected climate events in our area in the last 5 years.

The chart shows the climate events that have already influenced the rural regions in Bangladesh during the last five years with a focus on the ability of the local government institutions to reduce and adapt to the climate change. The most common example was flooding, where 189 respondents (54%) said that their regions had experienced flooding indicating that flooding it remains a dominant force as a significant environmental hazard. A total of 20% of the respondents (n=70) had experienced river erosion, indicating that the phenomenon was still a major cause of concern to riverine communities and 16% of the respondents (n=56) experienced drought, an indication of the increasing difficulty of sporadic precipitation and water scarcity. Only 6% of the respondents (n=21) had reported cyclones and 4% (n=14) had reported heatwaves, indicating that these events were either of less impact or had not focused much on rural awareness and preparedness initiatives. Compared with previous years, flooding and erosion have also remained persistent threats, whereas the reduced numbers of reported cyclones and heatwaves suggest underreporting or a recent increase in frequency. These findings indicate that the previous interventions by the local government had a loophole in that most of their interventions were based on flood management that other emerging climatic threats that were emerging were given minimal consideration. This urged a more comprehensive and inclusive adaptation approach of the rural local government institutions so that they became ready to face any type of climate risk.

4.1.4 Level of Institutional Involvement in Climate Mitigation and Adaptation

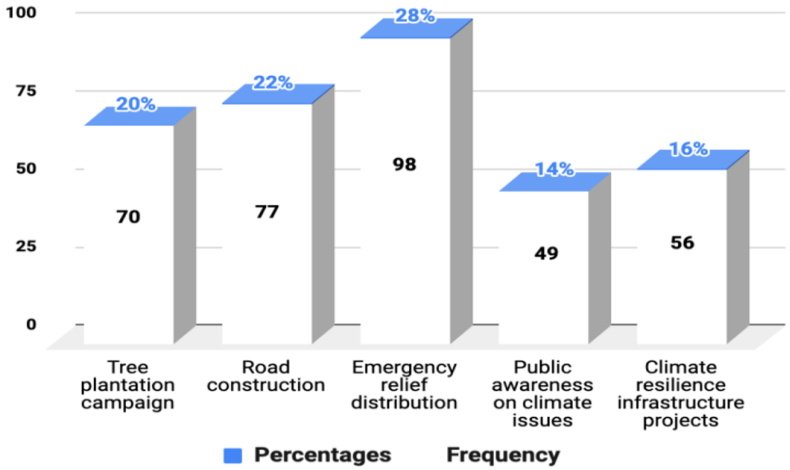

Figure 5. Demonstrate the local government institution's activities.

The chart displays the degree of engagement of rural local government institutions in various climate-related activities, with 28 percent (n=98) of respondents being very high in their involvement in the distribution of emergency relief, emerging as the most active category and illustrating the strong response capacity of the institutions in times of crisis. Twenty-two percent (n=77) reported high engagement in embankment or road construction, and 20 percent (n=70) noted high participation in tree plantation campaigns, both reflecting decent engagement in infrastructure and environmental activities. Conversely, the percentage of those who felt a high level of involvement in climate-resilient infrastructure projects was at 16 percent (n=56), indicating a failure to invest strategically in long-term resilience. Public awareness of climate issues was the least involved with only 14 percent (n=49) moderately involved, meaning that local governments had done very little regarding educating communities about climate-related risks. Compared with previous trends, this one indicated that although local institutions had been responding to emergencies and basic infrastructure in the past, they had not been doing enough proactive work such as public education and sustainable development. The gap highlights the existence of a more balanced and holistic approach to climate change mitigation and adaptation that is required at local levels in rural areas.

4.1.5 Capacity of Rural Local Governments in Responding to Climate Challenges

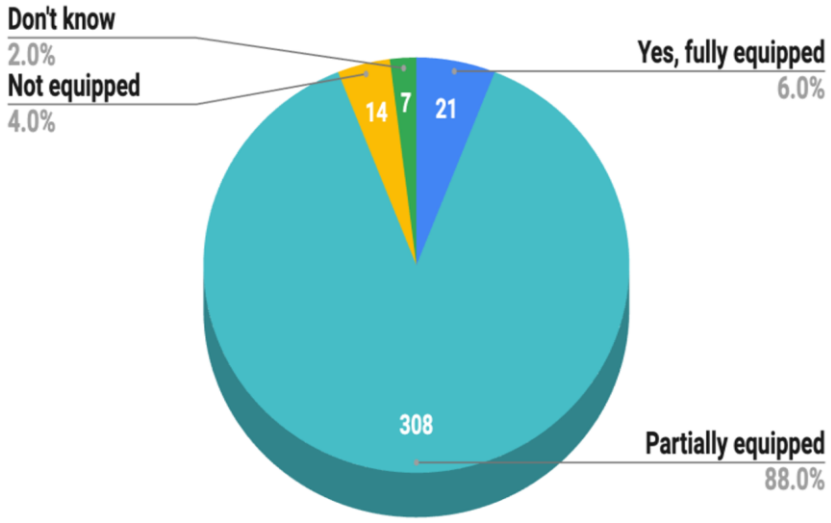

Figure 6. Display the local government have capacity to address climate challenges.

The figure demonstrates the views of the ability of local government institutions in rural areas in Bangladesh to address climate issues. Most of the respondents (88% n=308) felt that local governments were halfway prepared, meaning that although some of the underpinning systems were in place, they were not sufficient to handle climate-related challenges completely.

Very few (n=21, 6%) reported that local governments were completely prepared, which represents an extremely low level of extensive institutional preparedness. Furthermore, 4 percent (n=14) of the respondents felt that local governments were ill-equipped, indicating severe capacity problems in some areas. Interestingly, 2% (n=7) of the respondents said they did not know, which might be an indication of not being aware of or not understanding local institutional capabilities.

Compared with the historical context in which emergency response efforts were more apparent than the systematic planning, the existing results demonstrated the constant deficit in the long-term institutional preparedness. This highlighted the urgent need for on capacity development, technical training and resources to increase the position of the local government institutions in rural areas in mitigating and adapting to climate change.

4.1.6 Ranking the Top Five Climate Initiatives by Local Government

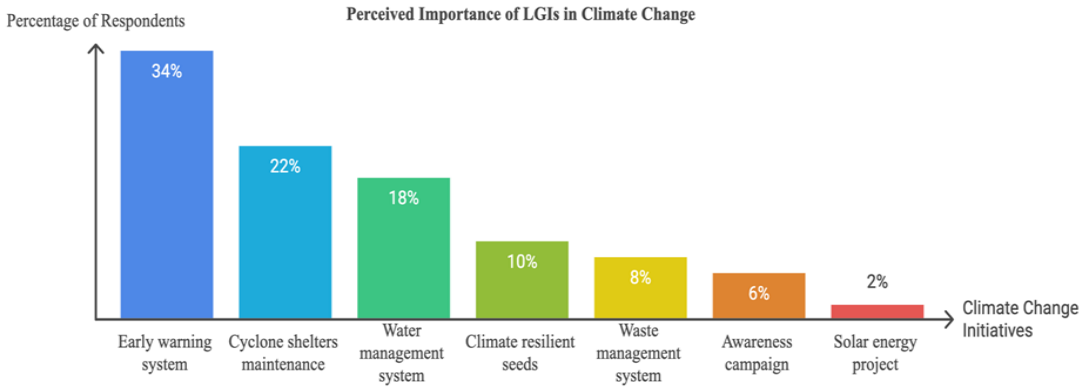

Figure 7. Highlights the top climate related programs initiatives.

The presented chart critically shows the perceived importance of the rural local government institutions (LGIs) in climate change in Bangladesh. Immediate adaptation was tremendously pronounced with the top two priorities being, "Early warning system" (34%, n=119) and "Cyclone shelters maintenance" (22%, n=77), which implied that the LGIs were perceived to be a good front line responder in disaster preparedness. LGI involvement with instant resource vulnerabilities was also observed in the case of a "water management system" (18%, n=63). However, there were essential breaks in long-term strategies. There was also a very wide disparity in the priority given to "climate-resilient seeds" (10%) and waste management systems (8%), which meant that there was little LGI participation or citizen awareness in these very important topics of sustainable adaptation and mitigation. More alarmingly, there was a clear disparity in the outreach with only 6% achieved by "the awareness campaign" which might impede community action. Of concern, was the very low score of "Solar energy project" (2%), which highlighted the existence of a large disconnect between national-level mitigation ambitions and the perceived local action. This implies that LGIs should do more than respond in the short term, advocating instead to institute proactive mitigation, raise awareness, and engage in wider climate resilience thinking to fill these perceived gaps.

4.1.7 Evaluating the effectiveness of local government climate programs

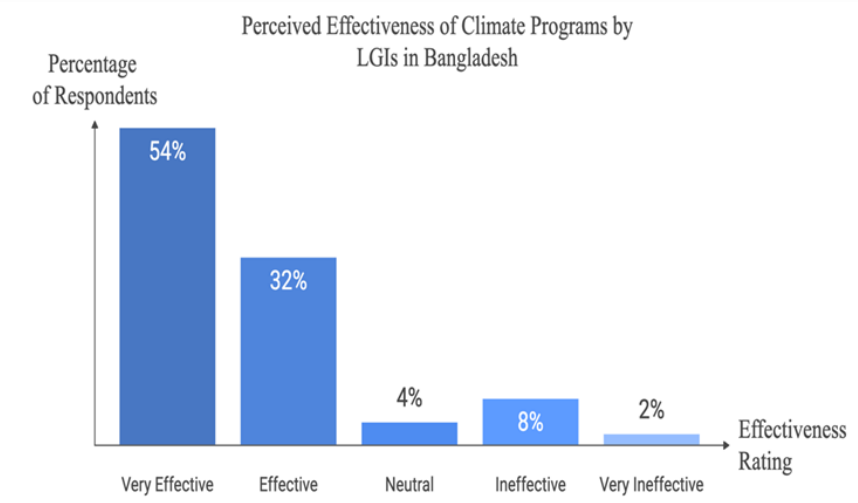

Figure 8. illustrates the effectiveness of climate programs by LGIs.

The second chart was a critical evaluation of the perceived effectiveness of the climate-related programs being executed by rural local government institutions (LGIs) in Bangladesh, which is an important part of their role in climate change mitigation and adaptation. The programs were clearly rated as "Very effective" by a very large majority (54%) of the respondents (n=189) with another 32% (n=112) deeming them as just "Effective." This cumulative 86 percent positive assessment was a strong positive indicator that, to a sizeable part of the population, the climate projects, especially those probably dealing with the direct danger of early warning systems and cyclone shelters (as already emphasized above) were doing well and were valued. This was positive feedback that suggested some success in the direct provision of these services by the LGIs. However, the results also demonstrated that there are significant gaps and areas of concern in the overall effectiveness of the LGIs. A "neutral" answer was given by 4 percent (n=14) of respondents indicating either a lack of awareness or not having been exposed enough to the programs or unable to come up with a concrete opinion on the impact of the programs. More importantly, 8% (n=28) declared the programs to be 'Ineffective', and another 2% (n=7) said that the programs were 'Very ineffective.' This aggregate 10 percent negative rating indicated certain deficiencies or program execution failures that affected a significant group of the population, meaning that there were discrepancies in LGI execution. It is important to address these documented cases of ineffectiveness so that LGIs can achieve more equal, inclusive, and meaningful climate action for all the rural communities in Bangladesh, thus playing their full role in mitigating and adapting to climate change.

4.1.8 Perceived Institutional Preparedness for Climate Change Impacts

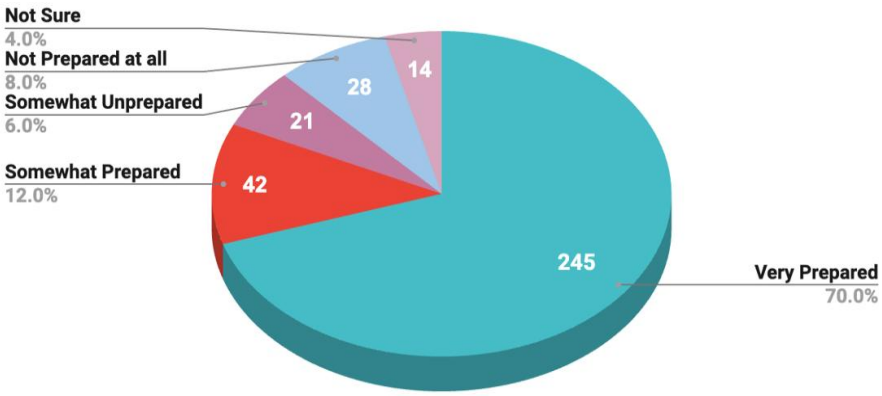

Figure 9. Shows preparedness of institutions to handle the impact of climate change.

According to the survey responses from n = 350 rural stakeholders, 70% mentioned that their institutions were very prepared, 12% said that they were somewhat prepared, 6% believed that they were somewhat unprepared, 8% believed that they were not prepared at all, and 4% were unsure. These results indicate that 82% of the participants were confident in institutional preparation, which indicates the impact of LoGIC and LoCAL on improving local planning, including climate-resilient infrastructure, as they included grant-based finance at the union level. At the same time, noticeable gaps remained: 14% of the participants believed their organizations were insufficiently prepared, blaming this on improper resource sharing, gaps in professional skills, and incomplete readiness for changes, mainly affecting areas far from urban centers. Furthermore, the 4% who said they were unsure pointed out that some universities are not completely clear about their institutions' climate actions or involve all parties. The survey did not investigate why people felt uncertain or had negative thoughts, nor did it compare answers based on the type of college, where it is located, or its financial level. To overcome these challenges, local government bodies should conduct thorough preparedness reviews, provide underdeveloped regions with suitable resources, and connect with people of all views to develop a strong and complete institution in their city.

4.1.9 Barriers to climate action at the local government level

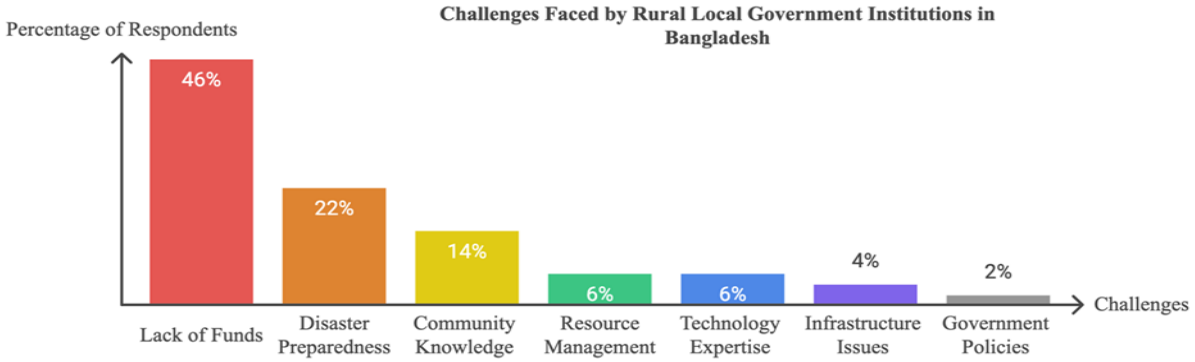

Figure 10. Demonstrates the main sources of challenges for climate initiatives.

In the study entitled "Climate Change Mitigation and Adaptation: The Role of Rural Local Government Institutions in Bangladesh," a survey of n = 350 rural stakeholders highlighted main problems faced by rural local government institutions. The main challenge reported by 161 respondents (46%) was not having enough money, and 22% (n = 77) said it was a lack of preparation for disaster. Mid-level challenges included not having enough knowledge in the community (14%), managing resources (6%), and technology lacking expertise (6%). Fewer than 10% noted that infrastructure issues (4%, n = 14) and government policies (2%, n = 7) caused problems. It is evident from the findings that the greatest problem is a lack of money and strong preparation, while governance, skills, and infrastructure problems are closely connected. Nevertheless, there were important gaps in the data: the survey did not explain the reasons behind the lack of funds and did not mention the types of problems with preparedness for disasters. It did not focus on the specific parts of the system that needed improvement or the laws that were considered problems. In addition, not having information by administrative level, location, or group of people makes it difficult to know if and how the problems faced by institutions differ across different areas. As a way to address these problems, rural local government organizations should deeply analyses the budget issues in details, prepare for disasters, increase training in skills and management, enhance important buildings, and revise their policies. They ought to make inventions that support local people and raise awareness about climate change in all rural settings.

4.1.10 Priority Initiatives for Strengthening Climate Change mitigation and adaptation

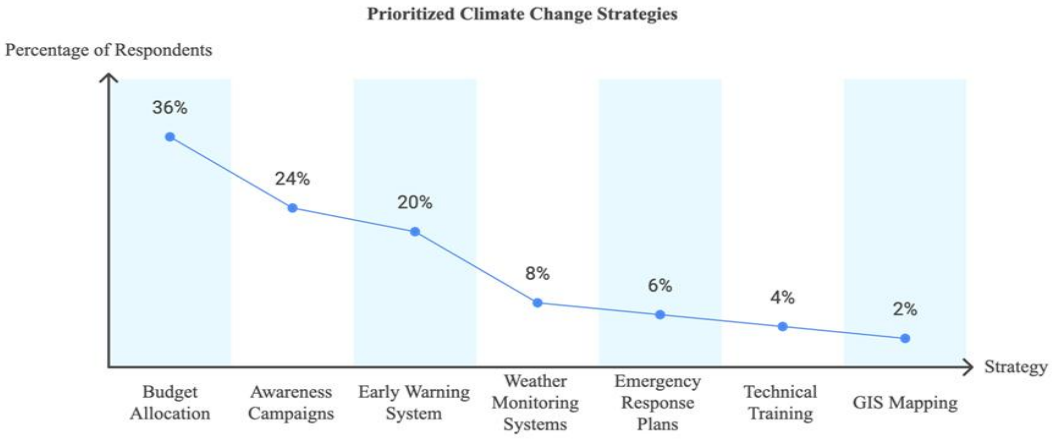

Figure 11. Depicts initiatives to enhance the climate change mitigation & adaptation.

Out of 350 responses (n=350), the data indicated a significant change compared with the previous approaches to climate change, which tended to be reactive and based on physical infrastructure. Budget allocation received top priority 126 responses (36%), compared with earlier years when funding was either inadequate or uneven, indicating that financial planning had taken center stage as opposed to earlier years. Awareness campaigns that previously received low attention were prioritized by 84 respondents (24%), meaning that more efforts will be made to reach out and educate communities. In a similar fashion, an early warning system, selected by 70 respondents (20%), became more important, as did proactive disaster preparedness in general, representing a shift to more proactive response as opposed to recovery-oriented responses seen in previous years. Nevertheless, similar to the previous strategies, the results also demonstrated that some essential aspects were still overlooked. Weather monitoring systems elicited only 28 responses (8%), and emergence response plans (21 responses, 6%) and technical training (14 responses, 4%) were also low priorities, indicating that institutional preparedness and capacity-building had not been accurately addressed. The least responsive activity was GIS mapping, with 7 responses (2%), demonstrating a continuing disparity in the utilization of data-based planning instruments. In summary, although some financial commitment and public participation had been improved, the minimal attention given to technical infrastructure and institutional capacity demonstrated that some historical shortcomings persisted in influencing the contemporary climate measures.

4.1.11 Setting Priorities for Future Climate Change Adaptation Strategies

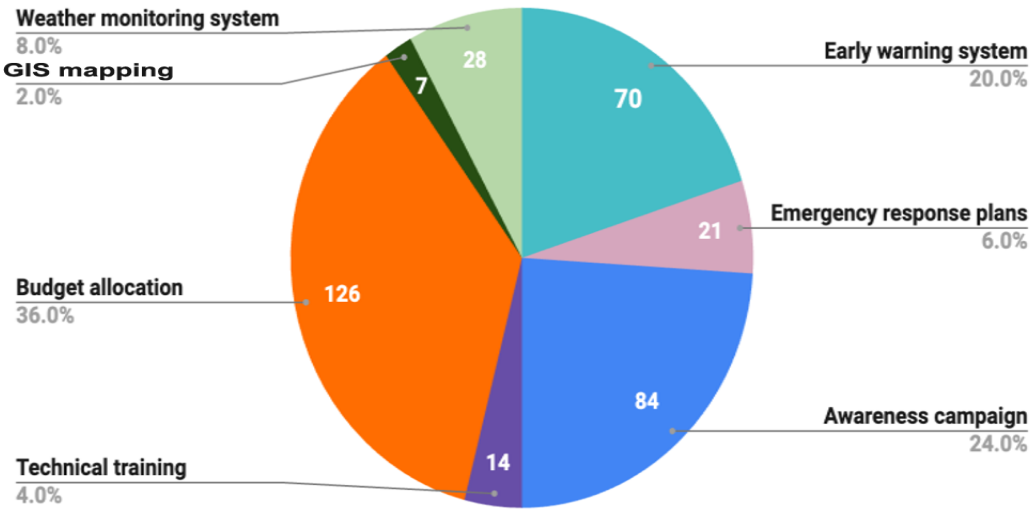

Figure 12. Represents future strategies for climate change adaptation.

The table shows the areas that should be given priority in future climate change adaptation strategies according to the responses given by the participants, which revealed both major focus areas and gaps. Biodiversity conservation was by far the most selected option, with 40% of the respondents (n=140) showing that there is a clear understanding of the need to protect ecosystems as a means of building climate resilience. Urban planning climate resilience (16%, n=56) and agricultural resilience (14%, n=49) were the next most popular, demonstrating that participants had already recognized the need to incorporate climate-related concerns into the planning of cities and achieved food security. The enhancement of the early warning system (12%, n=42) and capacity building of institutions (8%, n=28) were also noted as important but less so. The lowest level of attention was given to increasing awareness campaigns in the general population (6%, n=21) and enhancing the management of water resources (4%, n=14), indicating that community outreach and sustainable water utilization were underestimated in the adaptation planning. In general, the analysis revealed that there was much emphasis on ecological and

infrastructural approaches in the past but indicated obvious weaknesses on public engagement and water governance, which should be addressed to ensure more accommodating and holistic climate adaptation actions.

4.2 Qualitative Analysis

The results were obtained through thematic analysis, where key themes were identified from the transcription of both key informant interviews (KIIs) and in-depth Interviews (IDIs). The main topics are closely associated with the following: –

4.2.1 Understanding the current level of awareness of and preparedness for climate change among rural local government institutions in Bangladesh

Rural local government institutions that carry out grassroots climate change adaptation and resilience plans in Bangladesh. This study helps identify important gaps in knowledge, ability and resources that make climate action less effective. Using the research results, policymakers can decide better, create target training programs and improve institutional structures. It is necessary to boost these institutions to ensure both long-term protection from climate threats and sustainable progress in rural areas. The findings from the study can help bring together government bodies, NGOs and partners internationally to support local efforts in climate-smart governance.

Upazila Nirbahi Officer (UNO) stated that-

From an awareness standpoint, *"people in this upazila and local government have become much more aware of climate change. Because people are experiencing more danger from natural disasters, the results are easier to understand. We are now ready for immediate owing to our progress in readiness. Our disaster groups and early warning tools help us spread warnings about cyclones and large floods quickly. For this reason, we are trying to build a reliable level of preparation for unexpected problems. However, being prepared is not only about fast actions. It is also important to plan too, such as teaching farmers to grow new crops or developing buildings that will survive changes in climate. We have started some steps in these areas, but it is still very difficult to achieve full readiness for all our unions over a long period."*

From a preparedness standpoint, *"we have worked hard to enhance our instant reaction. Our strong early warning systems alert communities as soon as cyclones and major floods are detected. When disaster strikes, we focus on quickly delivering relief, preparing shelters, and organizing evacuation training, which helps us control damage and keep people safe. Moreover, we still need wide-ranging and long-term action in the future. We should focus on both reacting to disasters and actively working towards climate-adapted agriculture, upgrading important local infrastructure to resist flooding, and building climate-friendly houses. To improve our overall preparedness, we must use strategies that are both sustainable and serve all parts of our communities."*

From an initiative's standpoint, *"my main duty as a project implementation officer is to convert climate strategies into actions carried out by the team. Currently, several activities are underway in the rural local government institutions. As part of this, we should build climate-resistant agriculture for our farmers by supporting the use of drought-resistant crops and water-friendly techniques for irrigation. We are involved in upgrading local infrastructure, such as replacing old roads and building better culverts and embankments to prevent flooding. Setting up and running early warning systems and launching local awareness campaigns are important parts of our duties so that everybody in our rural areas is knowledgeable and prepared for disasters. All these steps are necessary to enhance our communities' ability to address climate-related problems."*

The Upazila Disaster Management Officer expressed that-

"Climate change is now understood better by rural local government institutions following a rise in natural disasters in their communities. Early warning and having teams ready to respond quickly have made it easier for countries to deal with both floods and storms as they occur. Nevertheless, disaster preparation has improved for immediate events, but more work is required to improve long-term durability with new structures, better skills and more funds. Overall, the institutions are growing in their ability and dedication to dealing with climate challenges."

The Upazila Project Implementation Officer stated that-

"Bangladeshi rural governments have become much more conscious of climate change mainly because floods, cyclones and other disasters happen there so frequently. These institutions have made sure to build early warning systems and arrange teams that can assist quickly in vulnerable communities when disasters occur. These advancements have increased emergency response for now, yet there are still issues such as shortages in funding, limited technical skills and difficulties related to working with higher authority. Despite these issues, local governments continue to support communities by investing in tough infrastructure, teaching climate-safe farming and holding public education workshops. He highlighted that more training and closer cooperation with the community will continue to support better preparedness and adaptation efforts. In general, rural LGIs are advancing in their ability to handle the challenges brought by climate change."

4.2.2 Identifying the challenges faced by rural local government institutions in implementing climate change mitigation and adaptation strategies

Identifying the difficulties rural local government institutions face when applying climate change mitigation and adaptation strategies to help strengthen governance at the local level is essential. Although these institutions are deeply affected by climate issues, they often do not obtain what they need in terms of resources, skills or policy guidance. Identifying those specific barriers such as a lack of financial support, a shortage of training or poor coordination will assist in design of better solutions that address this situation. Addressing them is necessary to increase the ability of communities to address with climate change and implement major climate goals across the country.

Local NGO representatives (Rangpur Dinajpur Rural Service Bangladesh)-

"Rural LGIs have to overcome numerous challenges regarding climate change. It is often the case that there is not enough money available for essential work such as making homes stronger or building better water drainage. The concern of limited technical skills also emerges when local people and staff do not have enough understanding of the latest adaptation techniques. Sometimes, differences in cooperation between local authorities and higher authorities cause delays. It is still a challenge to ensure that everyone in the community joins in on these ongoing actions. As a result, it is difficult to observe the changes we hope for out there in the community."

4.2.3 Propose strategies and recommendations to increase the capacity of rural local government institutions in addressing climate change issues

Rural communities in Bangladesh face considerable challenges from climate change, as constant floods, cyclones and weather shifts disrupt their lives and jobs. LGIs are responsible for frontline climate action, but most of them are challenged because of a lack of resources, expertise and support. It is vital to improve these rural organizations to help make communities more resistant and support effective local changes. The goal of this research is to investigate practical approaches and suggest specific tips to help LGIs improve their capacity. The research works to improve training, funding and community involvement so local governments can respond faster to challenges. Ultimately, greater capacity will support efforts to manage climate issues and improve rural life in exposed areas.

Upazila Nirbahi Officer (UNO) stated that-

"There are three crucial measures to fight climate change: hands-on training and skills to implement projects, not just learning through theories and it's necessary to provide them with more financial resources such as dedicated funds and guide them. These local government institutions have improved; we still need more skills at every stage to properly handle climate change properly. Officials and staff should be prepared to carry out climate-resilient projects, not just interpret policies. We also require reliable funding for climate work, featuring clear ways for LGIs to gain access and use those resources. If we had technical support for planning and writing proposal, it would be much easier for us to put our ideas into practice. To avoid delays, better cooperation between town officials and higher-level government is needed. Ensuring that local people are included

in planning and making choices means that our actions are meaningful and can endure. If we give LGIs the help they need, they will be able to do more to protect us from climate risks."

4.3 Discussion of the Study

This study detailes the importance of rural local government institutions (LGIs) in climate change mitigation and adaptation in the regard of Bangladesh. In Gaibandha District, it produced a number of significant insights that are linked to one another. The first core finding was that there is an extremely high rate of climate change awareness among local people and that the prevalence of moderate to high understanding of climate change was 80%, and it was even higher 85% of them believed that climate change is an imminent and indeed severe problem affecting their community. However, there was a notable misalignment between this level of public awareness and institutional readiness: whereas a striking 70% of the respondents confidently believed that their institutions were competent enough to respond to climate challenges, fewer than 6% of the people unreservedly believed that LGIs were well-equipped to address climate challenges in comprehensive terms. This is a vital point of attraction where policy can be made, since, although perceived confidence may be high, it might be provided that reality, which is found little real institutional strength. These were mainly identified as a lack of sufficient funding (reported by 46% of respondents), a lack of proper preparedness against disasters, a lack of easy access to specialized technical information, and poor coordination of policy among various levels of governance. Despite the praiseworthy responsivity of LGIs to emergencies described and the successful use of early warning systems, the implementation of more strategic, long-term-based measures such as the creation of climate-resilient infrastructures, the fostering of sustainable agricultural practices, and thorough public education programs is conspicuously weak.

All these interesting findings, in general, indicate that the direct experiences with and increased awareness of frequent climate events, including repeated floods and cyclones, have undoubtedly contributed to the increased awareness among people, but these findings do not necessarily imply the reinforced institutional preparedness. The illusion of readiness traditionally hides underlying problems in the system, especially related to financial independence and the presence of relevant tools to aid proper decision-making that would support climate change mitigation. Through this tangible mismatch between what people expect of LGIs and what they are actually able to deliver is the striking need to take steps in increasing institutional autonomy and vastly improving resource distribution. In addition, the lack of sound and elaborate long-term training platforms and adequate transfer of knowledge capabilities greatly reduces the capacity of LGIs to conceptualize and implement coherently thought-out adaptation plans. These conclusions are closely connected to the current academic sources, as researchers, such as Islam and Nursey-Bray (2017) and Chowdhury et al. (2022) repeatedly identified budgetary and technical limitations as the predictable barriers hampering the success of LGI. Although this analysis has slightly indicated a better institutional preparedness than other previous studies did, possibly due to improvements stimulated by recently tailored government or donor initiatives, it still definitively echoes the views of Inderberg, Eriksen, O'Brien, and Sygna (2015) and Pasquini, Cowling, and Ziervogel (2013) of continuing difficulties linked to interagency coordination, overdependence on outwards support, and the paralyzing impacts of disjointed policies.

The implications of the findings for future policymaking and research are inherently far-reaching and multidimensional. There is an urgent need to focus on providing LGIs with significantly greater higher greater financial and administrative flexibility in policy interventions to be able to manage localized climate issues with localized measures. At the same time, it is important to introduce carefully elaborated, specific capacity-building training that would enhance not only the technical expertise but also the advanced management skills of these institutions. More importantly, promoting the truly improved involvement of people in decision-making processes in climate-wise adaptation is the given way to overcome the current gap between community values and changes taken by the government to ensure that interferences are to be used in a timely and efficient manner. In the end, the most effective climate plans are those that are carefully grounded in the kind of fine-grained local assessments of

risk and the characterization of priorities by communities. Despite these contributions, a number of limitations are inherent in this study. Its narrow geographical bias on the Gaibandha District automatically prohibits the wider generalizability of the findings to the very diverse areas of Bangladesh. Furthermore, the use of a self-report survey by Microsoft enlists the possible biases of responses, where the participants may exaggerate off institutional preparedness or give socially agreeable responses that may be short of telling the truth at hand. The time limitations of the study also curtailed the possibility of presenting longitudinal evidence regarding the long-term efficacy of the LGI-led initiatives, and, unfortunately, the study failed to incorporate more sophisticated climate-related technologies, including GIS mapping or complex vulnerability examinations, to support its quantitative and qualitative findings.

Therefore, future research efforts will need to be more strategic to capture a broader mix of geographical locations, use extensive mixed methods that would ideally integrate remote sensing datasets, and cover longer periods to be most rigorous both in looking at perceptions and measurable attainments of LGIs. It is also possible that comparative studies of diverse governance systems can provide invaluable insights into how to achieve more effective and long-term local action related to climate. In addition, further investigations into the functionalities of community organizations and local guide-leaders might uncover underlying mechanisms that can unlock innovative solutions to facilitate local green and age action and advance stronger, adaptive systems that might help to avoid the forthcoming deleterious effects of climate change.

5. CHALLENGES OF THE STUDY

These research findings highlight key issues that hinder rural local government bodies in Bangladesh from using methods to fight and adapt to climate change.

Rural governments are usually supported by only small amounts of money. Activities related to climate change usually cost much and are out of the budgets of most organizations. Relying on funding from outside or the national treasury, many local governments discover that what is delivered may not be adequate and arrives after it was promised. Their restricted control over their own budgets prevents them from crafting and implementing true long-term policies on climate change (Hoppe, van den Berg, & Coenen, 2014). Failing to understand environmental science, engineering and disaster management will harm climate change adaptation and mitigation efforts. Moreover, local governments in rural Bangladesh usually find such data difficult. Such projects run into difficulties when it is difficult to hire the right experts and when opportunities for training are minimal (Pasquini et al., 2013). When rules are not properly implemented and the same job is performed in multiple areas of government, considerable waste occurs. Because local governments do not provide clear guidance, various climate efforts are disjointed and are not always effective, according to Khatun, Rahman, Ahmed, and Kabir (2021). Owing to these differences, climate policies cannot make as much difference which makes it harder to resolve problems that unite various communities. When making policies, it is important for local governments to have access to recent and clear climate data when making policies. Many rural people lack the resources to recognize and study climate change. Since there are few meteorological stations and few available data online, local governments have difficulty dealing with climate change in Bangladesh (Rahman et al., 2020). Owing to general political and government complications, rural Bangladesh has had difficulty taking any measures to address climate change. Because of these relationships, corruption and political power in running local affairs, sustainable efforts are ignored, and funds tend to be spent on quick but doomed projects (Ziervogel & Zermoglio, 2009). Since community leaders have not solved the problems of governance, people doubt that new environmental protections will occur close to them. Local government progress in rural Bangladesh can be blocked by cultural and social customs. At times, people living in rural areas are not cooperative with new methods for agriculture or changes to local infrastructure for climate change. Women usually face the problems caused by climate change and often do not play a fair role in making important decisions (Tirivangasi & Nyahunda, 2019). Rural local governments follow national policies that may not be suited to the

special needs of their community. When national-level plans do not consider communities, they might not support what can be done by communities to fight climate change (Uddin et al., 2021). Because of this, adaptation work performed locally may not be effective.

6. RECOMMENDATIONS OF THE STUDY

The governments in rural areas of Bangladesh face many challenges from climate change, as their neighborhoods are among the first to suffer. As LGIs face challenges from climate change, I have some recommendations I would like to offer. People involved in local governments can join tasks related to climate change after receiving funding for relevant training courses. Acquiring new knowledge can improve your understanding of climate science, evaluating risks and local actions to address climate change. Those participating should gain the skills to become involved in their communities and know how to use the Green Climate Fund as a current source. Eisenstadt, Olawole, and Toman (2021) recommended that rural local governments gain better skills in facing climate-related risks (Eisenstadt et al., 2021). In Bangladesh, the BCCSAP program is considered and put into practice in different development projects. As a result, any new planning effort should include droughts, floods and cyclones among the risks under consideration. According to IIED, including climate change in development planning increases the likelihood of sustainability. Importantly, more groups and individuals can use money to address climate change. Therefore, it is appropriate right for national funding for climate change to benefit rural LGIs. It is essential for local governments to receive help in building the skills needed to apply for and administer grants. In 2007, the World Bank recommended making more financial resources available to rural governments in vulnerable regions to support climate financing (Shalizi & Lecocq, 2007). Both local authorities and residents should cooperate to build adaptation policies together in their community. When those in the communities are involved in the process from start to finish, choosing which risks to prioritize, voting for important projects and working on finding answers, there could lead to much better outcomes. Most of the time, these moves are positively viewed by those trying to keep their culture and traditions present. LGIs contribute to the argument of Pelling (2010) that empowering local communities is an effective way to strengthen the resilience of places. Because disasters and cyclones regularly cause harm in rural areas, warning systems should be used in Bangladesh. Together, local administrations and meteorologists can help rural people learn about climate risks and improve early warnings. Actively preparing with your community prepares everyone in case of disaster. According to Shaw and coresearchers, in 2013, early official warnings were highly valuable for averting damage from disasters caused by climate change (Shaw, Mallick, & Islam, 2013). Owing to agroforestry and improved irrigation, people in LGIs now can depend on enough food. Food and Agriculture Organization of the United Nations (FAO) (2013) noted that showing farmers how to farm for the climate helps farm communities thrive and reduces their chances of being hit by disasters (Palombi & Sessa, 2013). LGIs are strongly supported in dealing with climate change by collaborating with various organizations. Both nationally and internationally, professional groups and NGOs are called upon by LGIs for funds, wise counsel and competencies to develop broad adaptation and mitigation plans. Combining the expertise of foreign organizations and local management has proven that climate adaptation efforts succeed better. In Bangladesh, it is necessary to update the rules that guide LGIs' actions against climate change. National rules should now permit local governments to strengthen their efforts in fighting climate change. Delina (2017) stressed the importance of having better local tools and strategies to address climate change.

7. CONCLUSION

Rural communities in Bangladesh face regular and dangerous changes due to climate change. With built-up risk and climate change, these regions want local governments to become involved. In this study, the success of helping these areas adapt to climate change strongly depends greatly on rural local government agencies. When we understand the key elements, we are better able to improve their developmental abilities. Even though rural

governments are aware of climate change, they still find it difficult to answer the problem properly, as it is shown by current assessments. A lack of resources, appropriate technology and accurate information greatly limits the work of social support groups. In addition, as local companies do not understand climate change properly, they often do not know how to respond. This investigation reveals that the country needs to handle urgent issues in race relations. These issues are caused by community disengagement, improper policy making and poor government communication. Because of many political problems and excessive bureaucracy, it is difficult for these organizations to respond quickly to climate issues. Not dealing with environmental risks may keep smaller governments from helping their communities prepare for disasters. Here, we propose bring forward several strategic ways to manage these issues. Institutional capacity increased by organizing instruction, ensuring there is funding and ensuring access to needed tools. Both individuals and institutions in a community should support adaptation planning, some adaptation projects must occur, and governments should perform vulnerability assessments. Working with non-governmental organizations, businesses and outside funders can reduce the use of resources and improve how we communicate. It is essential for governmental organizations, schools and community groups to cooperate to form policies that will remain in place for a long period of time. Officials may involve the community by asking for their ideas and motivating everyone to be responsible for climate change actions. Government decisions on rural rules should give these regions more independence.

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