FINAL TECHNICAL REPORT OF THE SAKTEE PROJECT

Dwijen Mallick , C. Emdad Haque , Sharmind Neelormi

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IDRC GRANT / SUBVENTION DU CRDI : - SCALING CLIMATE CHANGE ADAPTATION KNOWLEDGE AND TECHNOLOGIES FOR EMPOWERING WOMEN, AND TO ENHANCE SOCIAL EQUITY AND DISASTER RESILIENCE IN BANGLADESH

Final Technical Report of the SAKTEE Project


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Basic Information of the Project

Project Title: Scaling up climate change Adaptation Knowledge and Technologies for Empowering women and to Enhance social equity and disaster resilience (SAKTEE) in Bangladesh

IDRC Project: 108960
Country/Region: Bangladesh, Asia

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Duration of the Project: 3 Years (May 2019 – April 2022)

Beneficiaries of the Project:

12,090 Direct Beneficiaries: 6,750 Women – local community + 4,500 Disadvantaged household heads + 300 Women stakeholders – local and regional + 75 Women stakeholders - national + 400 Youths/Students + 5 Thesis students + 60 Policy Makers
1,606,050 Indirect Beneficiaries: 6,750 Women trained x 3 Women recruitments+1,585,800 communication strategy targets from the project

Report Type: Final Technical Report
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Foreword

The Intergovernmental Panel on Climate Change (IPCC) Sixth Assessment Report highlighted that human-caused global warming and consequential climate change are already impacting many weather and climate extremes in every region of the world. Paradoxically, vulnerable communities who have historically contributed the least to greenhouse gas emissions and the changes are being disproportionately affected (adversely); Bangladesh's coastal and wetland inhabitants, the poor and other marginalized sub-populations including women, and physically and mentally challenged people are one cohort of these victims. IPCC further cautioned that despite noticeable adaptation innovation and technological development, adaptation options that are viable now are likely to become constrained and less effective with increasing global warming.

Our knowledge of the differentiated impact of climate change-related stresses and shocks, and adaptation actions is limited and still fragmented. The International Development Research Centre (IDRC), Canada, has long recognized the critical role of meaningful action to address climate change, including Southern research that seeks local and regional solutions, along with international initiatives and agreements, to this global problem. In addition, along with IPCC, IDRC has also underscored that maladaptation can be avoided by flexible, inter- and multi-sectoral, inclusive, and transformative adaptation actions, with co-benefits to vulnerable sub-populations, multiple sectors, multi-stakeholders, and systems.

Against this backdrop and context, the *Scaling Up Climate Change Adaptation Knowledge and Technologies for Empowering Women and to Enhance Social Equity and Disaster Resilience (SAKTEE) in Bangladesh* Project was sponsored and funded by IDRC, commencing in May 2019. Implementation of the SAKTEE Project has successfully been carried out, with a focus on the extremely climate-vulnerable coastal and wetland hotspots in Bangladesh, during May 2029 – November 2022 period.

This Final Technical Report of the SAKTEE Project offers a synthesis of all activities supported by the Project, the substantive achievements, and lessons learned from the experience of research, implementation, and multi-level and multi-scale institutional partnerships. It embodies a synthesis of the empirical data analysis, action research outputs and outcomes, and reflections of the research team as well as the participants on the experience and the concerned issues. The Report further incorporates research-revealed insights into addressing the integration of gender equity and women's empowerment into climate adaptation interventions in Bangladesh.

We expect that this Final Technical Report will play a role as a guideline for future climate change adaptation actions that will aim to integrate gender equity and empower women in the Global South.

On behalf of the SAKTEE Project research team —

C. Emdad Haque
Professor, University of Manitoba
Winnipeg, Manitoba, Canada

30 April 2023

Executive Summary

The SAKTEE has been a multi-institutional, collaborative and action research project in Bangladesh for the duration of 3 years (May 2019 to April 2022), and it received a six-month no-cost extension to carry out the activities that were hampered by the global CODID19 Pandemic. Coordinated by the Bangladesh Centre for Advanced Studies (BCAS), the project was implemented by the Department of Women's Affairs (DWA) of the Government of Bangladesh, the International Centre for Climate Change and Development (ICCCAD) and the University of Manitoba (UoM), Canada. The International Development Research Centre (IDRC) of Canada supported the project with technical guidance and finance. The **general purposes** of the action research project were to scale-up appropriate, socially transformative technologies for adaptation to climate change, to enhance development planning capacity and policy sensitivity at multiple institutional levels, and to support the empowerment of women and the disadvantaged segments of the population in the climate hotspots of Bangladesh. The **specific objective**s of the project were to:

- **Explore and understand** the interrelationships of various environmental, socioeconomic, political and cultural factors and climate change that may exacerbate gendered vulnerability as well as social and gender inequity.
- **Scale-up innovative, locally tested adaptation technologies** to address worsening climate change impacts, through gender responsive and socially appropriate adaptation, particularly in water, agriculture and resilient livelihoods by promoting multi-level institutional coordination and collaboration.
- **Support empowering women**, students and poverty-stricken disadvantaged households in the climate-vulnerable regions; and
- **Engage and inform policy and decision makers** about transformative climate change adaptation technologies and the potential for integration of social and gender equity in relevant policies, strategies and programs.

Research Framework and key Components: The Project was based on a well-constructed research framework. The research framework had five key components with clear inter-linkages and possible outcomes to meet the goal and objectives. The key components and approaches, portrayed in the research framework included: i) Feminist principles of research and actions; ii) Exploratory research (for improving understanding and knowledge of gender and other intersecting social dynamics and inequality as well the effects and attribution of climate change to them); iii) Capacity building for adoption and scaling up of gender-responsive adaptation technologies; iv) Integrative and trans-disciplinary approach; and v) Co-generation of new knowledge and locally appropriate technologies for risk reduction, social transformation, and gender equality. The methods and tools for exploratory research, promotion of adaptation technologies and capacity building for empowerment and policy engagement were developed and applied in the light of feminist principles that included: reflectivity, inclusiveness, participation, gender equity and social justice.

Project Areas, Activities and Key Outcomes: The targeted communities and project beneficiaries were located in four Upazilas (sub-districts) of two districts of Bangladesh:

Satkhira (in coastal zone) and Sunamganj (in Northeaster wetland in *Haor* Basin). These two districts were identified as the most vulnerable regions in the country to the impacts of global climate change and frequent extreme climatic events such as cyclones, storm surges, and floods, with widespread poverty, social inequity, and food insecurity. The targeted sub-populations were poor women, disaster-affected and disadvantaged households, youths, students, women stakeholders and representatives of local communities, government departments (like the Department of Women's Affairs, Department of Agriculture Extension, Department of Public Health and Engineering, Department of Disaster Management, Department of Social Welfare, and Department of Environment), NGOs, universities, and private sectors at different levels. A total of 12,090 and over 1,606,000 persons were targeted to benefit directly and indirectly respectively by the project activities.

In the last three and a half years, over 50 activities were implemented under the **four key objectives** to benefit the vulnerable communities directly, local actors, and stakeholders indirectly to make long-term impacts through policy influencing and gender-responsive climate actions. The activities at local, regional, and national levels were planned and implemented under the four key objectives of the SAKTEE Project. The initial activities were implemented in 2019 without any interruption, for example, the desk review of the relevant literature and revision of methods and tools. However, with the commencement of the COVID-19 pandemic, contingency plans were prepared in 2020 and 2021 in consultation with the IDRC Program Lead and project partners. Necessary adjustments were made in the implementation plan and all the incomplete activities were carried forward to the following years during the COVID pandemic period. Upon request, the Project received a six-monthh no-cost extension initially to complete all the activities in the final year of 2022. Sincere, rapid and additional efforts were made by BCAS and the partners (ICCCAD, DWA, and the University of Manitoba) to complete all remaining activities with quality outputs and outcomes. The following table-1a shows the key activities and outcomes of the SAKTEE project in brief.

Table-1a: Key Activities and Outcomes by Key Objectives

Objectives	Activities, Outputs & Outcomes
Objective 1: Improve understanding of the factors and dynamics of differential climate change impacts	The baseline study covering 2,411 households; Exploratory research and PAR with 2,700 households and 6 village communities were conducted for improving the understanding of differentiated impacts as well as the various causes and factors of vulnerability. Nine MS and PhD theses prepared by students from public universities of Bangladesh and the University of Manitoba, Canada; Knowledge products in the forms of technical papers, policy briefs and journal articles; Besides quantitative and qualitative data analysis, the exploratory studies also used feminist research approach and capability approach for deeper understanding of the issues
Objective 2: Identify and evaluate innovative climate change adaptation knowledge and technologies in water	A national inventory on adaptation technologies was prepared and shared with actors and stakeholders at local, regional and national levels; Assessed appropriateness and effectiveness of the technologies using specific criteria; Multi-stakeholders consultations, and PAR with a feminist approach were undertaken for identification and demonstration of climate change adaptation technologies

and agricultural sectors for multi-level institutional adoption, and to empower women and poverty-stricken disadvantaged groups	(CCAT) in agriculture and water in the two climate affected zones; two rainwater harvesting in Satkhira and two flood resilient deep tube-wells were established for vulnerable communities in Sylhet; several community-based home gardens led by women were piloted in both ecosystems; the project also facilitated a number of adaptor households for drinking water and small agriculture at the community levels; all those increased adaptation knowledge and use of innovative technologies in water and agricultural sectors that are locally appropriate and socially-transformative, particularly in terms of reduction of social and gender inequities and empowerment of women
Objective 3: Build and coordinate institutional integration through enhancing local, regional and national level stakeholders' awareness and capacity	Series of capacity building trainings for the primary stakeholders-women and socially disadvantaged groups were organized: a total of 5,846 participants attended trainings on CCAT, gender-responsive adaptation and gender equality which also aimed at strengthening partnership and capacity of the actors and stakeholders on empowerment of women, gender-responsive and transformative adaptation; Capacity of about 300 women stakeholders at local, regional and national was enhanced; the youths and students of Khulna and Sylhet universities attended workshops on Women Empowerment and Gender Equity; Community radio program, local cultural events and knowledge platform have influenced thousands of community people directly and indirectly; enhanced awareness and capacity of the stakeholders to adopt locally appropriate adaptation technologies empowered the poor women, youths, and disadvantaged groups; and strengthened community resilience to climate change and disasters; enhanced institutional linkages at multiple levels and have supported scaling-up of socially-transformative adaptation knowledge, technologies
Objective 4: Facilitate discussion and coordination among relevant government sectors (particularly women affairs, environment and climate change, and disaster management) and other stakeholders that support and take up socially-transformative climate change adaptation technologies and policies	Annual and regular coordination meetings at the Department of Women Affairs (DWA) office with the project coordination committees held; stakeholders workshops at national levels, LHEs on integration of gender equity in National Disaster Management Plan and Bangladesh Delta Plan 2100 were held with government policy makers and development agencies; a national symposium on Empowerment of Women and Gender Equity held in Dhaka; and a knowledge sharing workshop with the LDC countries universities was held in Nepal; sessions were held on CCAT and findings of the exploratory studies in Global *Gobeshona* conferences; policy engagement, multi-stakeholders dialogues, LHEs, knowledge sharing and advocacy has been created space for improving the national policies and Programs with commitments to accelerate adoption of socially-accepted and transformative adaptation knowledge and technologies that will empower women and disadvantaged groups in the long run and thus increase social resilience

Under the leadership of the DWA of the Ministry of Women and Children Affairs (MoWCA) and the partners, the Project has made continuous efforts for positive engagement of the policy and decision makers for scaling up the new knowledge and innovative technologies for gender-responsive and socially transformative climate change adaptation and gender equity. The DWA Offices at the District and Upazilas (sub-district) worked closely with the project team in PAR, technology selection and demonstration, training for capacity building as well as in stakeholder engagement. All those activities and collective actions have contributed to achieving the goal and objectives of the project.

Achievements of the Results and Outcomes

The exploratory research, as part of their Masters and PhD theses, were carried out by nine students from public universities in Bangladesh and the University of Manitoba in Canada. The students explored the gender-differentiated vulnerability, capacity of women and men, adaptation needs and institutional barriers using the key principles of feminist research and capability approach. The students received much orientation on the approaches and research methods and gained practical skills for conducting field research, data collection and analysis. These efforts had not only built capacity and skills but also enhanced positive changes towards feminist approach and inter-disciplinary research focusing on climate vulnerability analysis, social resilience, empowerment of women and gender equity and transformative social change. It is expected that the research team and the students will use these approaches and expertise in their future research and knowledge generation. Several knowledge products including journal articles (on social learning, innovation, adaptation and community resilience) and technical papers for book chapters have already been published from home and abroad, and a few knowledge products are still being planned and generated.

The action research project has generated different sets of immediate and long-term outcomes. These are reinforcing each other to achieve the social goal (transformative social change), empowerment of women, and gender equity. The exploratory research and PAR with a feminist approach have enhanced deeper understanding and analytical capacity of the poor women and actors that challenged the existing socio-political and unjust institutional arrangement, social norms, and patriarchal values. In many cases, the poor and women can demand their rights and have greater access to supports and services of the government in the project villages. It is expected that the demonstration of CCAT and piloting of gender-responsive adaptations (GRA) will reduce the risks and vulnerability, promote resilient livelihoods and thus contribute to gender equity and social resilience in the long run. The project has initiated the social and institutional process, where the local actors including the CBOs and women let organizations would have to continue the process. It is a longer-term process, and the SAKTEE project has laid down the foundation by attempting changes and influencing the "thought process" so that behaviour change can take place in the coming days.

The SAKTEE project has contributed to improving our understanding of the differentiated vulnerability to climate change and related actions and the social, and institutional factors and gender drivers behind these phenomena. The exploratory research and PAR have

made a solid foundation on this by generating local evidence and varied perspectives of the poor women and vulnerable groups that are reflected in the knowledge products. These outputs were very helpful for dislodges and policy advocacy.

From the range adaptation technologies, the project has selected a number of socially appropriate and gender-responsive technologies in small agriculture, water and resilient livelihoods. Those were tested and demonstrated with the poor women, vulnerable communities, local government and actors. The adaptation best practices and technologies are: salinity and drought tolerant crops and vegetables; sunflower and maize cultivation in the coastal regions; short duration and early variety of rice and Kanda farming in the wetlands; crab fattening in the coast; duck rearing in the haor and vermin compost in both areas, where women can adopt the technologies and can take most of the benefit for the families. Regarding water, health and WASH, the Rainwater Harvesting System and Pond Sand Filters (PSF) were found women friendly and climate resilient in the coastal region while Raised Plinth Hand Tubwell (flood resilient) and piped water were demonstrated in the wetland. Since the demonstration of adaptation technologies was delayed due to the COVID-19 pandemic, the adoption of the best practices at the community level is a bit slow. However, BCAS and the local partners are monitoring the progress and are motivating the community people and women's groups for scaling up the technologies of gender-responsive climate actions.

Key Learning and Recommendations

The SAKTEE project endeavored to maintain scientific rigor in multidisciplinary and participatory research for knowledge generation, innovation in approach and capacity building of the students, youths and women stakeholders. The approach and principles of IDRC of gender and climate research have immensely influenced the SAKTEE research team in designing the tools and methods for field research. Those were also used in the participatory assessment of adaptation technology identification with women and vulnerable communities in both the coastal zone and *haor* (wetland) basin. The new learning has built the capacity of the individual researchers as well as enhanced institutional capacity for taking into consideration of diverse issues (climate change, socio-economic conditions, governance and gender drivers) and their intersectionality in the society.

Our planet has already experienced the rise of 1.2 degrees Celsius of the global temperature in 2020 (IPCC, AR-6, 2022) with devastating impacts across the globe. The vulnerability of the poor, women and socially disadvantaged groups in South Asia and Bangladesh is increasing. Hence regional, local and gender-responsive practical actions are to be undertaken for the most underserved and vulnerable groups. Access to resources, services and livelihood skills are to be enhanced for locally-led climate actions and GRA. The NGOs and CBOs may follow right based approach (RBA) for adaptation, DRR and climate/social justice. It is strongly suggested that women's concerns (differentiated vulnerability and growing inequity, GRA and social/gender justice) are to

be raised in different forums with government and actors for urgent climate and gender actions for resilience and climate justice.

Youth engagement has been crucially important for addressing climate change and gendered vulnerability with locally led climate actions. They can work as active change agents in society and can influence policy and influence with their forcefulness and bold steps. The learning of the students and young researchers, facilitated by the SAKTEE Project, IDRC and Gender@Work, will have long-term impacts on their professional development and conducting applied research on complex issues like the environment, climate change, and gender issues. The personal and institutional capacity and mutual learning achieved, through *Gobeshona* conferences and Learning Hub Events (LHEs), will support upholding the feminist approach and gender lens for integration of GRA and gender equity in relevant policies, future projects and programs.

Key messages of SAKTEE project are: localization of gender-responsive adaptation and DRR plans (with adequate resources, skills, and institutional arrangement) are urgently needed in Bangladesh; the adaptation technologies that are simple, low-cost, available in local markets are more acceptable to the poor and women than other types of technologies; application and effectiveness of the technologies largely depend on the knowledge, skills and capacity of the users. Hence, the capability and gender action learning (GAL) approaches with participatory and feminist research can build the necessary synergy among the hardware, software, org-ware (institutional linkages), and multiple stakeholders for effective collaboration. The learning hub events (LHEs), being the process-led actions and advocacy, require a longer time duration for generating expected outcomes in terms of influencing policy, strategies, and practices on the ground.

Further participatory and multi-disciplinary research and collective actions are to be initiated for the generation of evidence with perspectives and insights of the people and actors, effective policy engagement and advocacy towards the right policy (translating the good policy to actions), localization of plans and actions for the poor, women and socially disadvantaged communities in the rapidly changing climate that is affecting society, economy and ecosystems severely. The IDRC may support the research consortium in the new and emerging areas of research and development challenge and the collective journey towards gender equality and social justice. Hence, BCAS, ICCCAD, the University of Manitoba, and the partners are committed to strengthening the partnership with actors and stakeholders for future collaboration on climate change adaptation, resilient livelihoods, inclusive social development, and gender equality.

List of Abbreviations

AWD- Alternative Wetting and Drying
BARI- Bangladesh Agriculture Research Institute
BCAS- Bangladesh Centre for Advanced Studies
BccGAP- Bangladesh Climate Change Gender Action Plan
BINA- Bangladesh Institute of Nuclear Agriculture
BRRI- Bangladesh Rice Research Institute
CBO- Community Based Organization
CCA- Climate Change Adaptation
CCAT- Climate Change Adaptation Technology
DAE- Department of Agricultural Extension
DDM- Department of Disaster Management
DoE- Department of Environment
DRR- Disaster Risk Reduction
DPHE- Department of Public Health and Engineering
DRR- Disaster Risk Reduction
DWA- Department of Women Affairs
FGD- Focus Group Discussion
GOB- Government of Bangladesh
GRA- Gender Responsive Adaptation
ICCCAD- International Centre for Climate Change Adaptation and Development
IDRC- International Development Research Centre
IGA- Income Generating Activities
LLA- Locally led Adaptation
KII- Key Informant Interview
LGI – Local Government Institute
LGRD- Local Government and Rural Development
LHE- Learning Hub Event
MoDMR- Ministry of Disaster Management and Relief
MoEFCC- Ministry of Environment, Forest and Climate Change
MoP- Mititry of Planning
MoWCA- Ministry of Women and Child Affairs
NGO- Non-Government Organization
NDMP- National Disaster Management Plan
NRP- National Resilence Program
PSF-Pond Sand Filter
PAR – Participatory Action Research
TNA- Technology Needs Assessment
ToC- Theory of Change
ToT- Training of Trainers
PI- Principal Investigator
RWH- Rain Water Harvesting
UM- University of Manitoba
UP- Union Parishad

1. Introduction

1.1 Background with Research Problems

The SAKTEE is a multi-institutional, collaborative, and action research project in Bangladesh for the duration of 3 years (May 2019 to April 2022). Coordinated by the Bangladesh Centre for Advanced Studies (BCAS), the project has been implemented by the Department of Women's Affairs (DWA) of the Government of Bangladesh, the International Centre for Climate Change and Development (ICCCAD) and the University of Manitoba (UoM), Canada. The International Development Research Centre (IDRC) of Canada supported the project as well as provided with technical guidance and finance. The project was intended to improve understanding of the dynamics of the complex set of factors that aggravate differentiated climate change and disaster impacts and vulnerability in Bangladesh (with updated information, evidence, and local perspectives) as well as identify climate change adaptation knowledge and technologies (CCAT) for poor women and most vulnerable sections in the society. The project also aims to fill-in identified knowledge gaps in the areas of gender-responsive adaptation to climate change and empowerment of women for enhancing social resilience and gender equity. Besides the climate change impacts and vulnerability nexus, there are notable knowledge gaps in relation to the gender-differentiated climate change impacts, gender-responsive climate adaptation options, social structure, and power relations of the vulnerable groups. The project undertook knowledge, technologies, and capacity building as key the means for empowerment of women and disadvantaged groups, building social resilience to climate change and its associated disasters, and enhancing gender equality.

Research Problems and Knowledge Gap Analysis

The pre-project literature review and consultation meetings asserted that devastating climate change impacts were the increasing marginalization of the women and the poverty-stricken disadvantaged groups in the major climate hotspots in Bangladesh. The impacts of rapid climate change are also affecting the livelihoods of the common people and national economy with huge development challenges. Further, the project development team of BCAS, ICCCAD and University of Manitoba, Canada conducted an in-depth knowledge gap analysis in relation to gender differentiated climate change impacts, needs for gender responsive adaptation actions and their linkages with social justice and gender equity. The critical review of literature and key documents identified significant gaps in the following key areas:

a) A slow uptake and scaling of adaptation knowledge and technology
b) Lack of inter-sectoral coordination and integration
c) Inadequate research on community participation, and gender and social implications of climate adaptation measures
d) Disparate considerations of climate change and societal issues; and
e) Adaptation innovations not systematically promoted to ensure sustainability.

The Technology Needs Assessment (TNA) by the Government of Bangladesh (GoB, 2012) confirmed that a multitude of adaptation technology options are being tested in Bangladesh, however, most international best practices are still unknown to the stakeholders in Bangladesh, and thus remained untested.

Addressing the gaps: i) research on learning from past studies, and best practices in disaster and climate resilience worldwide;
ii) research on learning from past studies, best practices in disaster and climate resilience in Bangladesh;
iii) investigate ways to promote best practices among the stakeholders for testing, adoption, and scaling pro-poor and gender-responsive adaptation in water and agriculture

In this backdrop, the SAKTEE project intended to:

i) explore and understand the interrelationships of various environmental, socioeconomic, political and cultural factors and climate change that may exacerbate social and gender inequity – which is one of the main prevailing knowledge gaps (Exploratory research component);
ii) scale up innovative, locally-tested adaptation technologies to address worsening climate change impacts, particularly on water and agriculture, through promoting "best practices" in disaster and climate resilience and multi-level institutional coordination and integration (Capacity building component);
iii) support empowering women, students, and poverty-stricken disadvantaged households in the climate-vulnerable regions (Participatory Action Research component); and
iv) engage and inform policy and decision-makers about transformative climate change adaptation technologies and the potential for their integration with social and gender equity programs (Policy-Institute-Practice Integration component).

The issues are multidimensional and inter-connected that required an inter-disciplinary and trans-disciplinary research approach for identifying and filling in the knowledge gaps as well as finding effective adaptation solutions in water and agriculture (which give the primary basis of livelihoods of the poor and disadvantaged groups) and policy recommendations. The desk-based reviews and consultations have identified the following research and knowledge gaps: a) a slow uptake and scaling of climate change adaptation knowledge and technologies; b) there is a lack of inter-sectoral coordination and integration; c) inadequate research exists on community participation, and gender and social implications of climate adaptation measures; d) disparate considerations of climate change and societal issues are given; and e) adaptation innovations have not been systematically promoted to ensure sustainability.

1.2 General Purpose and Objectives

Considering the vital gaps in research and knowledge, adaptation technologies and practices in Bangladesh, the SAKTEE Project set **a general purpose** of the research, which were to scale-up appropriate, socially transformative technologies for adaptation to climate change, to enhance development planning capacity and policy sensitivity at multiple institutional levels (local, regional, national and international), and to support empowerment of women and the disadvantaged segments of population in Bangladesh.

The **specific objective**s of the project were as follows:

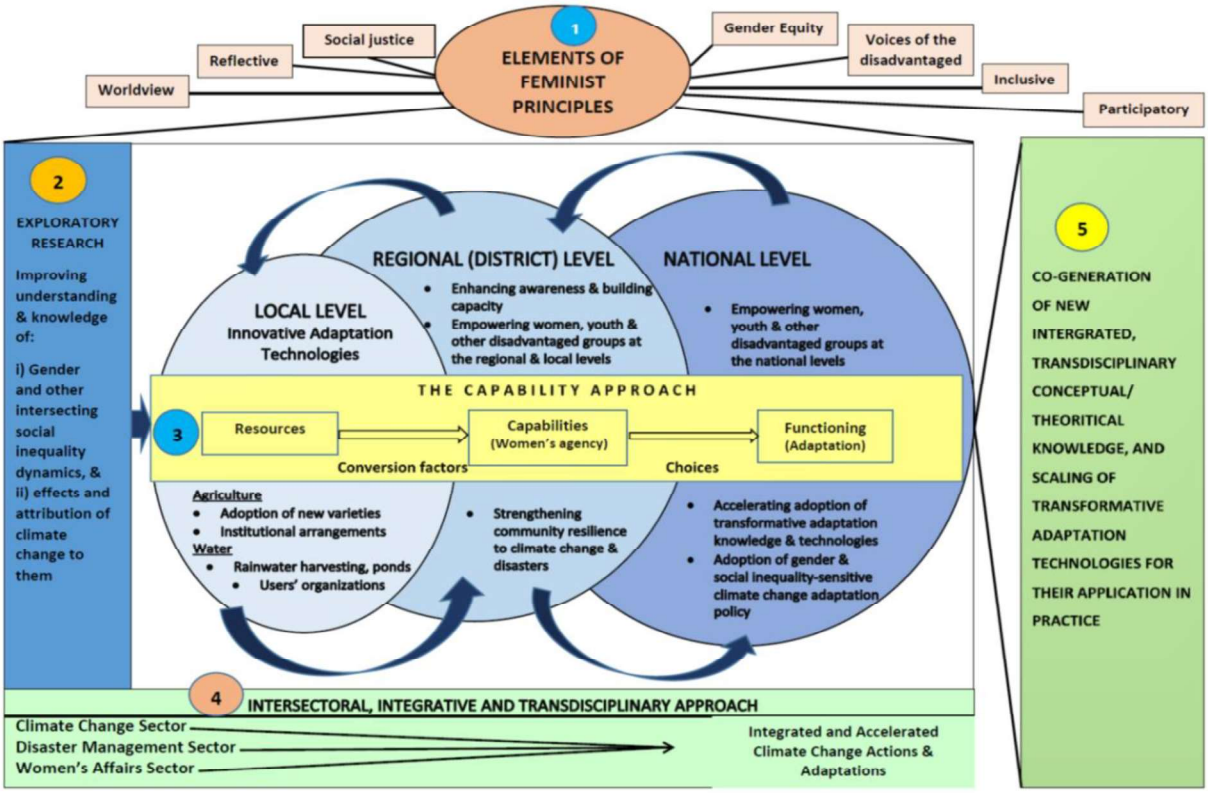
- **Explore and understand** the interrelationships of various environmental, socioeconomic, political and cultural factors and climate change that may exacerbate social and gender inequity;
- **Scale-up innovative, locally tested adaptation technologies** to address worsening climate change impacts, particularly on water and agriculture, through promoting multi-level institutional coordination and integration;
- **Support empowering women**, students and poverty-stricken disadvantaged households in the climate-vulnerable regions; and
- **Engage and inform policy and decision makers** about transformative climate change adaptation technologies and the potential for their integration with social and gender equity programs.

The focus of the SAKTEE Project was to understand deeply the effects of climate change on women and impoverished populations in two of the most climate-vulnerable regions i.e., Southwest coastal region and Northeast *Haor* (wetland) basin in Bangladesh. The project had a focus consistently on the empowerment of women, youth, students and disadvantaged families through enhancing their knowledge, building more adaptive capacity, and increasing income-generation activities and skills for climate resilient-alternative livelihoods of the poor and socially disadvantaged groups. In doing so, feminist research and participatory action research approaches were applied to all components of the project. The project completed many of the planned activities in year-1 and year-2 (during May 2019 to April 2021). The action research implementation was delayed by the Covid 19 pandemic with the lockdown of the entire country in 2020-21. The action research components on adaptation technology selection and demonstration of technologies, specifically in water and agriculture; completion of exploratory research with knowledge products by the university students; capacity building of the poor women, disadvantaged groups, youths, and students and women stakeholders; and the policy engagement and linkages among the actors and stakeholders -- the key areas of interventions – were therefore implemented in the final year of the SAKTEE project (May 2021 to October 2022 with a six month of no-cost extension of the project). Please see the planned activities in Appendix-1.

1.3 Approach and Methodology

The Project was based on a well-constructed research framework and a Theory of Change. The research framework had five key components with clear interlinkages that demonstrated possible outcomes to meet the goal and objectives. The key components and approaches, portrayed in the research framework were: i) Feminist principles of research and actions; ii) exploratory research (for improving understanding and knowledge of gender and other intersecting social dynamics and inequality as well the effects and attribution of climate change to them); iii) capacity building for adoption and scaling up of gender-responsive adaptation technologies; iv) integrative and trans-disciplinary approach; and v) co-generation of new knowledge and locally appropriate technologies for risk reduction, social transformation, and gender equality. The key components and their inter-relations are shown in the conceptual and research framework. Please see the research framework of SAKTEE in the following diagram-1.

Diagram-1: Conceptual and Research Framework of SAKTEE



The **participatory research and feminist principles** were placed in the centre of the research framework. The feminist research approach (seeing the problems with the eyes of women with subjective relation) guided the entire participatory research and local actions relating to social accountability and reflexivity, which suggested to apply the six critical elements i.e., i) worldview, ii) reflective, iii) social justice, iv) gender equity, v)

voices of the disadvantaged, inclusiveness, and vi) participatory. The aspects of feminist theories, such as, women's position in society and family in terms of resource ownership and allocation, gender dominance and hegemony, gender norms, and role of patriarchy were investigated throughout the **exploratory research activities.** Further, through the Participatory Action Research (PAR) process, the project engaged vulnerable women, poverty-stricken disadvantaged household members, and youth/students from local and sub-national communities, along with researchers, policy and decision-makers and stakeholders in data and information collection and analysis to harness the varied perspectives, experiential knowledge and insights of the community and actors.

The **capability approach** was applied in the SAKTEE project to assess the ways of enhancing women's capacity for meaningful participation through exercising agency and widening the agency of women and actors at different levels. The PAR attempted to integrate the voices and lived experiences of women and disadvantaged groups in adaptation and disaster risk reduction. The process overall aimed to empower poor women and disadvantaged groups through the acceptance and adoption of transformative adaptation technologies. The SAKTEE project also undertook an **inter-sectoral and trans-disciplinary approach** to relevant real-world, research, consultation, and policy advocacy activities.

By facilitating 'outside the box' thinking, answering the issues regarding challenges of integration and coordination among climate change, disaster management and women's affairs sectors of the government at all levels, inputs were sought from with the local, regional (sub-national), and national communities, women stakeholders and actors. The **co-generation of new knowledge and transformative technologies** was envisioned as core outcomes of the SAKTEE Project. The co-generation of new integrated, trans-disciplinary knowledge (mainly through exploratory studies) and scaling of gender and social inequality sensitive and transformative adaptation technologies mostly took place through participatory research and effective policy influencing and stakeholder engagement.

In the final year of the project, several policy dialogues, Learning Hub Events (LHE) at the Planning Commission of the Government of Bangladesh (GoB) with active participation of the policy makers (from the Ministry of Environment, Forest and Climate Change; Ministry of Women Affairs and Children; and Ministries of Disaster Management, Agriculture, Food, Water, Health, and Rural Development) and development partners were organized to sensitize and influence relevant policies and actions towards gender-responsive climate actions, empowerment of women and socially disadvantaged groups and enhancing gender equality. It is assumed that the activities with vulnerable communities, women actors, local government institutions (LGI), policy makers and stakeholders at different levels have significantly contributed to **intersectional, integrative and trans-disciplinary** problem areas of the country, particularly relating to climate change, and women and disadvantaged community empowerment issues.

1.4 Project Areas, Communities and the expected Outcomes

The targeted communities and project beneficiaries were located in 4 Upazilas (sub-districts) of 2 districts of Bangladesh: Satkhira (in the coastal zone) and Sunamganj (in Northeaster wetland in *Haor* Basin). These two districts were identified as the most vulnerable regions in the country to the impacts of climate change and frequent extreme environmental events such as cyclones, storm surges, and floods, with widespread poverty, social inequity and food insecurity. The targeted sub-populations were poor women, disaster-affected and disadvantaged households, youths, students, women stakeholders and representatives of local communities, government departments (like the Department of Women's Affairs, Department of Agriculture Extension, Department of Public Health and Engineering, Department of Disaster Management, Department of Social Welfare, and Department of Environment), NGOs, universities and private sectors at different levels. A total of 12,090 and 1,606,050 persons were targeted to be the direct and indirect beneficiaries of the project activities respectively.

The research project undertook **multiple climate-gender and equity lenses** for a deeper understanding of the impacts and vulnerability, social structure, institutions, and governance as well as determining and scaling up the locally appropriate and women-focused adaptation technologies in water and agriculture sectors, where poor and women have a greater stake in relation to their livelihoods and wellbeing. The inter and multi-disciplinary research was built on the three interactive processes and approaches: i) Inter-sectional, Transdisciplinary, and Integrative Approach; ii) Participatory and Feminist Research Approach; and iii) Capacity Building Approach. An overarching feminist methodological approach has guided the research, and this ultimately supported empowerment of women, girls and youths, and socio-economically disadvantaged people in transforming dominant social relations of power, which is unequal and patriarchal in nature in Bangladesh. The feminist principles of social transformation through qualitative changes in policy, institutions, and practices, participation of women as change agents and decision-makers, social accountability, and reflexivity were followed and facilitated throughout the participatory research and stakeholder consultations at the local and regional levels.

The various activities (research, co-generation of knowledge and knowledge management, training and capacity building, identification and demonstration socially appropriate and gender-responsive adaptation technologies, and policy engagement for up-scaling CCAT in agriculture and WASH) in the last three and a half years have **contributed to the empowerment of women and the poor men, youths and vulnerable communities** in the two climate affected zones. Technology identification, innovation, demonstration as well as knowledge and skill enhancement have built the adaptive capacity of the poor and women for reducing risk and vulnerability to climate change impacts as well as the effects of climate change-induced environmental extreme events. The activities for capacity development and linkages among the local actors and women stakeholders have created spaces for policy engagement and advocacy towards scaling-up of the locally appropriate, socially transformative and gender-responsive

adaptation technologies in the two climate affected zones of northeastern and southwestern Bangladesh.

1.5 Contingency Plans and Adjustments during the COVID19 Pandemic

In the year-2 of the SAKTEE Project (in early 2020), Bangladesh along with all other countries of the world confronted an unprecedented COVID19 pandemic. The health risks and associated restrictions on movement compelled BCAS and partnering institutions to work from home, do more desk-based work and learn new approaches of online meetings. The rapid spread of the COVID-19 virus in Bangladesh since March 2020 hampered the planned activities in the field, including participatory research, community consultations, and training for the primary stakeholders. During the lockdown situation, BCAS office remained closed and staff began to work from home. Moreover, government offices were shut down and it was difficult to communicate and coordinate with them. In this context, the project team prepared a contingency plan for SAKTEE to shift some of the activities to Year-3.

The contingency plan was shared with IDRC Program Lead. As per the revised plan, the project team and partners carried out field research, technology assessment, and capacity building of actors and stakeholders in July 2020, when COVID infection was low in Bangladesh. The field level activities continued till the end of March 2021, but again Bangladesh encountered the 2nd wave of COVID from mid March 2021. The government imposed restrictions and a countrywide lockdown from early May 2021 onward. The project staff and partners started working from home again. However, the Project activities continued to organize regular online meetings and implemented activities of year-2 where possible by virtual means. For teamwork, the SAKTEE Project colleagues met in Project Office face-to-face when the situation permitted. The duties and responsibilities were distributed and followed up properly by the team leader and Co-PI. Thus, the project activities were carried out except the field-level activities in the last quarter of Year-2. The partners also reported their progress and problems and attempted to find doable solutions during the COVID-19 pandemic. From September 2021, the SAKTEE project invested a huge time and effort with a renewed commitment to complete the activities in the field and with all stakeholders at different levels. The students of the University of Manitoba, Canada traveled to Bangladesh in early 2022 and completed their field research under exploratory studies, data analysis, and reporting.

2. Activities and Outputs by Key Objective

Over 50 activities were implemented under the **four key objectives and outcomes** to benefit the vulnerable communities directly and the other actors and stakeholders indirectly to make long-term impacts through policy influencing and gender-responsive climate actions. Under the leadership of the Ministry of Women and Children's Affairs (MoWCA) and the Department of Women Affairs (DWA), which is under MoWCA and the partners, the Project has made continuous efforts for positive engagement of the policy and decision makers for scaling up the new knowledge about gender responsive and socially transformative climate change adaptation technologies; these were carried out through planning and programming at the national, regional and local levels. The Director General (DG) of the DWA was very proactive and supportive in designing and implementing the activities at the national, regional and local levels. The DWA Offices at the District and Upazilas (sub-district) worked closely with the project team in PAR, technology selection and demonstration, training, and capacity building as well as in stakeholder engagement.

The activities at local, regional, and national levels were planned and implemented under the four key objectives of the SAKTEE Project. The initial activities were implemented in 2019 without any interruption, for example, the desk review of the relevant literature. However, with the commencement of the Covid 19 pandemic, contingency plans were prepared in 2020 and 2021 in consultation with the IDRC Program Lead and project partners. Necessary adjustments were made in the implementation plan and all the incomplete activities were carried forward to the following years during the COVID pandemic period. Upon request, the Project received a six-month no-cost extension initially to complete all the activities in the final year of 2022. Sincere, rapid, and additional efforts were made by BCAS and the partners (ICCCAD, DWA, and the University of Manitoba) to complete all remaining activities with high-quality outputs and outcomes.

The baseline study, PAR, and exploratory research were conducted for improving the understanding of differentiated impacts as well as the various causes and factors of vulnerability. The multi-stakeholders' consultations and PAR with a feminist approach were undertaken for the identification and demonstration of climate change adaptation technologies (CCAT) in agriculture and water in the two climate affected zones. A series of capacity-building training sessions with community people, poor women, and local actors to enhance awareness, promote advocacy on CCAT, and adaptation and gender equality were implemented. These were aimed at strengthening the partnership and capacity of the actors and stakeholders on empowerment of women, gender-responsive and transformative adaptation. Several activities including arranging sessions in the *Gobeshona* Global Conference on Adaptation, regional and national workshops, coordination meetings with governmental agencies, a symposium on climate change and gender equality, Learning Hub Events (LHE) on the integration of gender responsive adaptation in relevant policies and strategies with the government ministries and departments were organized. Further, several knowledge sharing events were also organized for creating space, influencing policies and engagement of policy makers and actors in the above stated areas.

2.1 **Improved understanding of the dynamics of various key factors that aggravate differentiated climate change impacts and vulnerability**

Many of the planned activities under Objective-1 were conducted in year-1 and year-2. The project launching workshop, strengthening partnership with government and actors, and the baseline survey with quantitative and qualitative tools were completed before the COVID pandemic in early 2020. Exploratory studies were planned in 2020, but the students could not conduct field research in 2020 and 2021 due to the lockdown of the daily activities in the country. The field plan of exploratory research was therefore shifted to 2022. As a result, the exploratory studies and reporting by the students of the University of Manitoba and Jahangirnagar University were completed in 2022.

2.1.1 Determining the Baseline Situation

One of the key activities of the SAKTEE Project was to conduct a baseline study. The main objective of the **baseline study** was to improve our understanding and knowledge of gendered vulnerability and the intersecting social equity dynamics that had also been affected by climate change. Besides, the baseline study aimed to create a pre-project baseline database of the targeted women and community people focusing on their socio-economic conditions, access to information and services, perception about climate change, current adaptive capacity and adaptation technologies, gender role within different groups and subgroups in water, sanitation and agriculture sectors in the face of growing impacts of climate change. The baseline study has adopted a participatory and interactive approach by combining both quantitative and qualitative methods and tools to capture the evidence, varied perspectives, and experiential knowledge of women, stakeholders and community people. The study followed the standard methods of data collection, processing and analysis by using structured, semi-structured questionnaires and participatory assessment tools such as Focus Group Discussions (FGD) and Key Informant Interviews (KII). The study triangulated data and information from different sources (primary and secondary) as well as integrated quantitative data with qualitative information analysis and presentation of findings. The baseline and need assessment study selected a number of villages from Satkhira and Sunamganj districts for undertaking follow-up actions with the poor women, socially disadvantaged and disaster affected community and relevant stakeholders. The project has undertaken capacity building, enhancing awareness and co-generation of knowledge through PAR, technology selection and demonstration, resilient livelihood promotion and linkages with LGIs and local women stakeholder in the villages, where baseline study was conducted.

Box-1: A Brief on the Baseline Study

The baseline study was conducted in early 2020. The study aimed at improving the understanding the inter-relationship of various environmental, socioeconomic, political, and cultural factors and climate change that may exacerbate social and gender inequity, which is one of the main prevailing knowledge gaps in Bangladesh. The study also intended to create a pre-project baseline database of the targeted women and community people focusing on their socio-economic conditions, access to information and services, perception of climate change and current adaptive capacity. The baseline study has adopted a

participatory, multi-disciplinary and interactive approach by combining both quantitative and qualitative methods and tools to capture the evidence, different perspectives and experiential knowledge of women, stakeholders and community people. The study followed standard methods of data collection, processing and analysis by using structured, semi-structured questionnaires and participatory assessment tools such as FGDs and KIIs. The baseline study and need assessment was conducted in 24 villages from four Upazilas in Satkhira and Sunamganj districts. A total of 2411 households were selected for the questionnaire survey through a multi-stage and random sampling method. It has been found that the poor women and socially marginalized groups were the worst victims of the social drivers and climate stresses in the study villages. Three major categories of households were taken for the baseline survey based on Socio-economic status (SES) groups (i.e., poor, middle income and rich families), women headed households and disadvantaged households.

The socio-economic conditions of the surveyed households *were extremely impoverished. They suffered from lack of productive employment and regular income, whereas climate change impacts were affecting their livelihoods, food security, drinking water, health and well-being. The average household income was very low: i.e., BDT 12,894 monthly. In many cases, they could not maintain their family expenditure and hence, 55% of them had to take loans from different sources in the last year for maintaining their livelihoods.*

The climate disaster matrix differs in the two areas: *the coastal region is affected mainly by cyclones, tidal surges, high tides, water logging, and salinity while the haor basin is mainly affected by flash floods, erosion, heavy rainfall and change in seasons. All the livelihoods areas, human health and infrastructures are affected by the climate change disasters. As per the community responses, agriculture, home gardening, agri-labor and wage earnings are severely impacted by climate change variability and extremes. Sources of drinking water and sanitation facilities are affected by climate disasters in Satkhira and Sunamganj.*

The use of technologies in small agriculture and water: *The survey data have suggested that agricultural practices were shrinking in the two sites. Only 35% of the surveyed population are participating in small agriculture practices including homestead gardening. Agricultural practices have fallen in Satkhira drastically in recent years. Only 20% of them are engaged in crop agriculture, because of salinity in soil and water. Although agricultural practices are falling, but poor women and disadvantaged groups use various traditional and modern agricultural technologies as inputs (like HYV seeds of rice and vegetables, fertilizers, pesticides etc.) as well as technologies in irrigation and water management. The survey reveals that the majority of the poor farmers (87%) do not get support from the government to introduce climate adaptation technologies in agriculture. The available drinking water technologies in two sites are: rainwater harvesting systems- RWHS (widely used in Satkhira); shallow tube well and deep tube well, piped water supply, desalination plant, and pond sand filter (PSF). In Satkhira, 81% use RWHS while the majority of the people (85%) in Sunamganj use shallow tubewells for collecting drinking water: 70% of them use shared tube wells. Both the RWHS and shallow tube wells are affected by climate disasters like cyclones and floods. They would need more climate resilient and sustainable water supply systems and sanitation facilities.*

Many NGOs, CBOs and government departments like the Department of Women Affairs (DWA) and Department of Social Welfare (DSS) are working on the empowerment of women and disadvantaged groups in the localities. The communities have suggested a few activities for the empowerment of women, which included: employment and income generation, training for livelihoods diversification with small trade, business, handicraft, and entrepreneurship; access to financial resources and access to agricultural inputs, knowledge and adaptation technologies by the poor women and disadvantaged groups. The baseline study was one of the important and initial steps of the project. The data and

perspectives gathered through baseline contributed to all the interrelated activities and outcomes of the project.

2.1.2 Conducting Exploratory Studies

One of the milestones of the SAKTEE Project was to conduct **exploratory studies** in both the coastal communities in Satkhira district in the southwestern region and in the wetland areas in Sunamganj district in northeastern region of the country. The University of Manitoba (Canadian institute) and the ICCCAD undertook the lead in conducting the exploratory research. The activities associated with exploratory studies were: a) selection of students and topics of the studies in alignment with the project goal and objectives; b) using a feminist approach to research, developing methodologies and tools for data collection and analysis; and c) train students to provide the required orientation to the students and field researchers.

Besides social survey, the exploratory research component applied a feminist approach with several participatory research tools for engaging women and community people in disaster-prone villages, socially disadvantaged groups, and women and girls to reflect their experiential knowledge, insights and perspectives. A total of nine students from the UM and public universities in Bangladesh conducted the exploratory studies in alignment with the project focus and outcomes. In Table 1, the thematic areas covered by the project students from both Bangladeshi and Canadian universities are shown. The summary reports of these student research studies are included in Annex-2.

Table-1: Titles and thematic areas of the studies with names of students and their institutional affiliation

Titles of the Theses	Names of the Students
Analyzing differentiated Climate Change Impacts on Women in the Wetland Area: A Case Study on Sunamganj District- MS Thesis	**Md. Kazi. Rokonuzzaman**, Department of Disaster Resilience and Engineering at the Patuakhali Science and Technology University
Understanding the differential climate change impacts among impoverished and disadvantaged households in coastal Bangladesh: A case study on Satkhira district- MS Thesis	**Ms. AsmaUl Husna**, a Masters Student of the Urban and Rural Planning Discipline, Khulna University
Climate change impacts, responses and adaptation technologies in small-scale agriculture in coastal areas of Bangladesh: Gender Dimensions and Women's Perspectives- MS Thesis	**Ms Alvira Farheen Ria,** Natural Resources Institute, University of Manitoba, Canada
Climate Change and Its Impact on Women Vulnerabilities and Adaptation Technologies in The Coastal Region of Bangladesh: Shaymnagar- MSThesis	**Ms Dolon Champa Dutta**, Department of Economics, Jahangirnagar University
Differentiated Impacts of Climate Change and Agricultural Adaptation Technologies on Social Equity in Bangladesh: A Case of the Sunamganj Communities- PhD Thesis	**Md. Abul Kalam Azad**, Natural Resources Institute, University of Manitoba, Canada

Climate Change and Its Impact on Agricultural Vulnerabilities and Adaptation Technologies in the Flood Prone areas of Bangladesh: Dowarabazar – MS Thesis	**Refat Hasan**, Department of Economics, Jahangirnagar University
Gender Differentiated Vulnerability and Adaptation of Climate Change in North-western District Sunamganj	**Woakimul Islam Shakil**, Department of Economics, Jahangirnagar University
Adaptation to water use through adoption of technology in Satkhira communities in Bangladesh- MS Thesis	**M. Kamruzzaman Shehab**, Natural Resources Institute, University of Manitoba, Canada
The role of innovation and adaptation technologies in reducing climate-induced disaster impacts and enhancing resilience in Satkhira communities of Bangladesh- MS Thesis	**Sabbir Ahmed Khan**, Natural Resources Institute, University of Manitoba, Canada

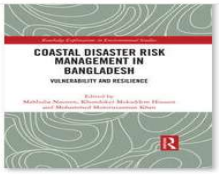
2.1.3 Key Knowledge Products

The students and the supervisors have been working on preparing manuscripts for journal articles to fulfill the objectives of the SAKTEE project. In collaboration with and leveraging resources from a Social Science and Humanities Research Council (SSHRC) grant to Dr. C. Emdad Haque with the IDRC-SAKTEE Project Exploratory Study Component, the University of Manitoba team and the graduate students of the SAKTEE Project have already produced two journal articles in 2022. The following two articles have already been published in peer-reviewed international OPEN-ACCESS journals:

i) Social learning, innovative adaptation and community resilience to disaster: the case of flash floods in Bangladesh" (authors: Haque, C.E., Azad, M.A.K. and Choudhury, M.). It was published in January 2022: Issue of *Disaster Prevention and Management: An International Journal* (DOI 10.1108/DPM-12-2020-0373); and

ii) Social learning-based disaster resilience: Collective action in flash flood-prone Sunamganj communities in Bangladesh", Published in *Environmental Hazards* journal, September 2021 (http://doi.org/10.1080/17477891.2021.1976096).

A technical paper titled "Empowering Women to Enhance Social Equity and Disaster Resilience in Coastal Bangladesh through Climate Change Adaptation Knowledge and Technologies (CCAT)" by Prof. Mahbuba Nasreen, Dr. Dwijen Mallick and Prof. Sharmind Neelormi has been already published in Routledge book in 2023. The paper has been accepted by the ROUTLEDGE Publisher as a chapter in a forthcoming book. Our colleagues at the ICCCAD have also been working on preparing manuscripts for a peer-reviewed Open Access journal article on Gender and Social Equity Analysis of Disaster and Climate Change Differentiated Impacts.



Empowering Women to Enhance Social Equity and Disaster Resilience in Coastal Bangladesh through Climate Change Adaptation Knowledge and Technologies

By Mahbuba Nasreen, Dwijen Mallick, Sharmind Neelormi

Book Coastal Disaster Risk Management in Bangladesh

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Pages	39

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ABSTRACT

This chapter focuses on the findings of a research project "Scaling climate change adaptation knowledge and technologies for empowering women, and to the enhance social equity and disaster resilience in Bangladesh" (SAKTEE). The adoption of socially transformative adaptation technologies may support pursuing the goals of accelerating climate action and reducing gender vulnerability for the achieving social inequity and empowering women and disadvantaged, impoverished people. Agriculture is one of the major livelihoods in the coastal Bangladesh and future change climate is likely to affect the agricultural activities. One of the key objectives of SAKTEE is to identify, evaluate and demonstrate innovative climate change adaptation knowledge and technologies in water and agricultural sectors for multi-level institutional adoption as well as to empower women and poverty-stricken disadvantaged groups in the project districts. Agriculture and aquaculture are the principal livelihood options in coastal Bangladesh.

2.2 Identification of innovative adaptation knowledge and technologies

The aim of the outcome was to identify innovative and resilient technologies to address the worsening impacts of climate change and to reduce risk and vulnerability of the poor and women. The key activities included: a) preparing a national inventory on adaptation technologies in water and agriculture; b) identification of stakeholders on adaptation technologies; c) organize district and Upazila levels stakeholder consultations on CCAT for screening and evaluation of adaptation technologies by stakeholders; d) development of a framework and methodology for participatory assessment of CCAT for identifying the best practices in adaptation technologies; e) demonstration of suitable CCAT in water and agriculture at selected villages in two districts. Through desk review, PAR, and consultation with climate change experts and multiple stakeholders, the Project stakeholders and researchers have identified the CCAT and best practices in water and agriculture for the two climate-affected zones. An adaptation technology inventory was prepared and shared with the key stakeholders and relevant government agencies at the local, regional, and national levels for scaling up the pro-poor, gender-responsive and socially appropriate technologies.

2.2.1 Inventory of Adaptation Technologies for Gender Equity and Social Resilience

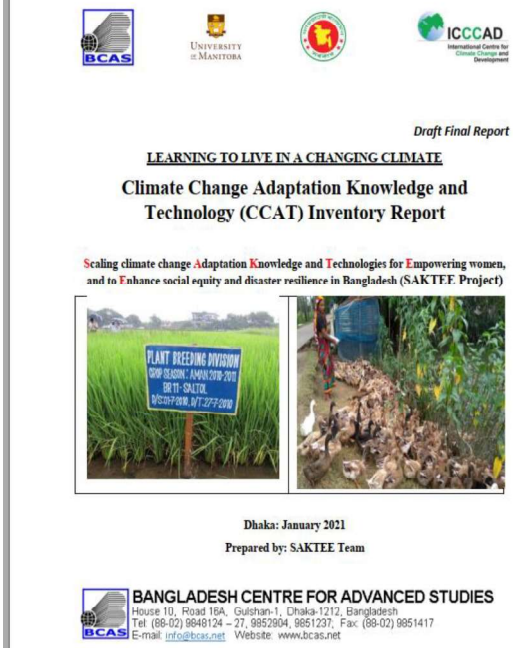
One of the key objectives of the SAKTEE project was to identify, evaluate and demonstrate innovative climate change adaptation knowledge and technologies (CCAT) in water and agricultural sectors for multi-level institutional adoption as well as to empower women and poverty-stricken disadvantaged groups in the selected two districts. A series of community consultations on appropriateness of the selected CCAT were conducted in the local and regional levels for prioritization of adaptation technologies in water and agriculture considering the climate change impacts in the coastal villages and wetlands. As part of technology selection, Participatory Action Research (PAR) with the poor women, socially impoverished and disadvantaged groups were conducted for final selection and

demonstrations of the adaptation technologies in the two districts. The PAR in Satkhira was conducted in year-2 while PAR in Sunamganj was conducted in year-3 due to COVID Pandemic. The FGDs and community consultations were held at the village in Dowarabazar and Jamalganj Upazilas in Sunamganj district. The community people in Jagatsree village have identified Deep Tube well on high raised platform as the number one drinking water technology followed by Shallow Tube well on high raised platform and Rain Water Harvesting.

The community consultations have identified a range of technologies in small agriculture and water in the face of growing impacts of climate change. The commonly used agricultural technologies and inputs are: compost and animal manure, chemical fertilizers, multi-crops and crop rotation, integrated (paddy, fish and vegetables growing), integrated pest management (IPM), drip irrigation and treadle pump. The farmers are also aware of adaptation technologies in agriculture, although the poor farmers and women cannot afford these new practices and technologies in agri-culture and home gardening. The promising CCATs are salinity tolerant and flood resilient crop varieties; short and high yielding varieties; low water consuming crops (like maize and sunflower in the coastal region); alternative wetting and drying (AWD) and vermicompost. Most of the conventional agricultural technologies and appliances are used by men. However, few technologies are also used by women, which are: reaper machine and spray machine in Satkhira while solar pump and deep tube well for irrigation in Sunamganj.

Four stakeholder consultation workshops on CCAT in water and small agriculture were held in the selected Upazilas to share and validate the selected technologies in years 2-3. The participants from relevant government departments including DAE, DPHE, DWA, DSS, LGED, BWDB etc., representatives of NGOs and women-led organizations attended the regional workshops of SAKTEE project. They have provided their views and experiential knowledge on the appropriateness of the selected adaptation technologies. They have also suggested a set of tested technologies and suggested innovation for the implementation of pro-poor and women-friendly adaptation technologies in the two climate hotspots. Finally, a national stakeholder consultation workshop on the CCAT was held in Dhaka in December 2022.

The national stakeholders' workshop was held on 06 December 2022 at Hotel Golden Tulip, Banani, Dhaka. The aim of the workshop was to share the key findings of the technology inventory and participatory research on CCAT as well as get the views of the national actors and stakeholders on how to disseminate and scale up appropriate adaptation technologies in the two most climate-impacted regions. The representatives from relevant government departments, development partners, and women stakeholders attended the workshop. Ms. Parvin Sultana, the Director General of the DWA attended the stakeholders' workshops as the Chief Guest and made a commitment to upscale the selected technologies to reduce the risk and vulnerability of the poor and women as well as support resilient livelihood in the climate-affected regions.



Draft Final Report

LEARNING TO LIVE IN A CHANGING CLIMATE

Climate Change Adaptation Knowledge and Technology (CCAT) Inventory Report

Scaling climate change Adaptation Knowledge and Technologies for Empowering women, and to Enhance social equity and disaster resilience in Bangladesh (SAKTEE Project)

Dhaka: January 2021

Prepared by: SAKTEE Team

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Ms Parvin Sultana, the Director General of the DWA was giving her Inaugural Speech online at the National Stakeholder's Consultation on Adaptation Technologies and Gender Equity on 6 December 2022: Photo- BCAS

2.2.2 Identification and Demonstration of Adaptation Technologies & Best Practices

The technology inventory and stakeholders consultations have prioritized a number of technologies for two climate change-affected zones. The following table-2 shows the most promising CCAT in two ecosystems in agriculture, water, and livelihoods.

Table-2: Technology Matrix based on literature Review and Consultations

Regions/ CCAT by Sector	Regions	
	Satkhira	**Sunamganj**
Agriculture	Salinity tolerant paddy and vegetable growing: BRRI dhan-40,41,47 and for T. Aman - BR-22 and BR-23, Bina Shail Potato- BARI A10 and 22, Maize and Sunflower; Crab fattening led by poor women	Kanda Farming for winter crops Duck rearing led by women Short duration variety BRRI dhan 28; and Vermin compost
Water & Sanitation	Rain Water Harvesting & Pond Sand Filter (PSF) for drinking water; Piped water supply Step Toilet'- a form of sanitary toilet initiated by *Uttaran*,	Duel Platform Tube Well; Piped water supply; Flood Resilient raised plinth hand tube wells; Community latrine

	constructed in a way to prevent flood water from entering the pit	
Livelihoods	Integrated fish farming, crab fattening, and vegetable growing; small trade and business led by women; goat and cattle rearing	Fish cultivation in fellow pond and small-scale water body Bamboo and cane-made fishing instruments and handicrafts; small business led by women

Note: *The adaptation technologies in three broad categories have been identified from a long list of the technology inventory report based on Multi-criteria Analysis: Climate resiliency, pro-poor and women-friendly, low cost, and available in the market/region*

The stakeholders' consultation emphasized that the successful application of the CCAT largely depends on social conditions (affordability, awareness, skill, and capacity to use the required technologies and motivation of the poor and women) and the availability of the technologies in the localities. Hence, the local government, NGOs, private sector and market systems, and the actors should support the poor, women, and socially disadvantaged communities for use of appropriate technologies in agriculture, water, sanitation, health, and livelihoods that are climate resilient, low cost (considering the affordability of the poor) and available in the locality and women-friendly. Initiatives have been taken for linkages of the community with local government and actors in this regard. The project has demonstrated the best practices and women-friendly adaptation technologies in water and small-scale agriculture that are proven and have potential for benefiting vulnerable women and disadvantaged groups in the project areas. The following Table-3 shows a list of adaptation technologies piloted and demonstrated in the two ecosystems. The project has also encouraged and facilitated a number of beneficiaries households who received training to adopt the piloted technologies in small agriculture, drinking water, and WASH.

Table-3: List of demonstrated Adaptation Technologies in two Climate Hotspots

Types of CCAT *	Regions	
	Satkhira	Sunamganj
Adaptation Technologies in Water	Two Rainwater harvesting systems in Kaliganj and Shyamnagar	Two Deep Tube-wells on high raised platforms (flood resilient) in Jamalganj and Dwarabazar
Adaptation Technologies in Small agriculture	Six Home based integrated vegetable farms with salinity tolerant and drought tolerant varieties (led by poor women of the villages)	Four Community based vegetable gardening (led by Poor Women) on the river banks with winter and summer crops

*Examples are given bellow:

 A Deep Tubewell was installed by the project in a flood affected village in Jamalganj, Sumanganj	 Home Gardening led by Poor Women in Kaliganj, Satkhira

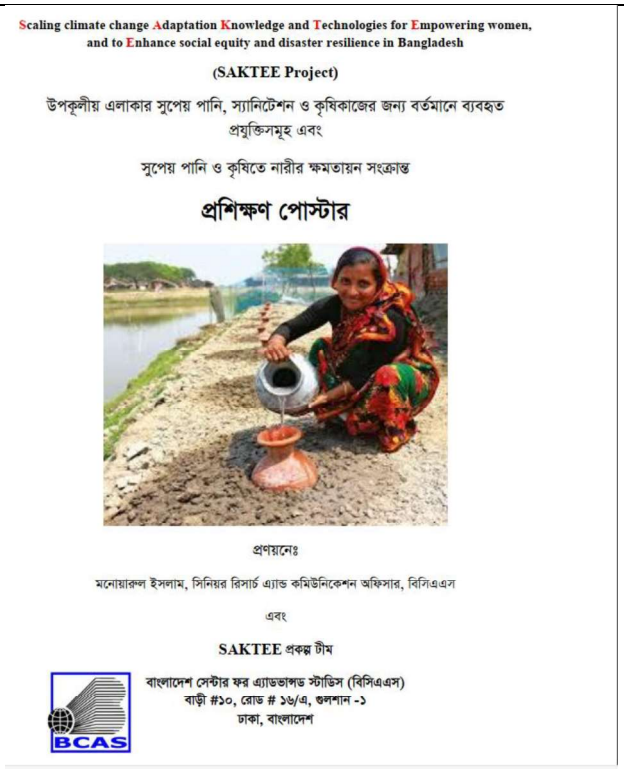
2.3 Enhanced awareness and capacity of the poor women and stakeholders to adopt locally appropriate adaptation technologies

The activities that focused on enhanced awareness and capacity building included:

- Conducting training needs assessment and development of training modules on CCAT and climate resilient livelihoods;
- Organizing series of training workshops on adaptation technologies (focusing on water and agriculture sectors) for poor women and socially disadvantaged groups in two selected districts;
- Organizing series of trainings on climate resilient livelihoods and income-generating activities for the poor women and socio-economically disadvantaged groups;
- Forming a Knowledge Management Platform on climate change, and gender and social inequity;
- Use of electronic media: Webpage/regional radios/local cultural programs for knowledge dissemination;
- Organizing training workshops on adaptation technologies among local women stakeholders in Satkhira and Sunamganj districts as well as among the youths and university students; and
- Organizing national stakeholders consultations and policy forums on Gender Responsive Adaptation and CCAT for empowerment of women and disadvantaged groups.

Two sets of training modules on Gender Responsive Adaptation Technologies in Water and Agriculture, and Climate Resilient Livelihood Options and IGA in two ecosystems (coastal and wetland) were prepared. The CCAT Module focused on the impacts of climate change on agriculture and water (sources, quality and availability of water for drinking); promising adaptation practices and technologies in small agriculture, home garden and WASH; roles and responsibilities of the actors and stakeholders to develop and disseminate the CCAT in small agriculture, water, sanitation and health risk management.

The Module on Resilient Livelihood focused on climate resilient livelihood options in both ecosystems; these included on-farm activities in agriculture, fisheries, crab fattening, poultry and cattle raising, the natural resource-based livelihood climate resilient-livelihood options in non-farm activities, such as small trade and business led by women, handicraft, mobile phone servicing, local service providing in poultry and cattle raising, and nursery of sapling.


Scaling climate change Adaptation Knowledge and Technologies for Empowering women, and to Enhance social equity and disaster resilience in Bangladesh

(SAKTEE Project)

উপকূলীয় এলাকার সুপেয় পানি, স্যানিটেশন ও কৃষিকাজের জন্য বর্তমানে ব্যবহৃত প্রযুক্তিসমূহ এবং

সুপেয় পানি ও কৃষিতে নারীর ক্ষমতায়ন সংক্রান্ত

প্রশিক্ষণ পোস্টার

প্রণয়নেঃ

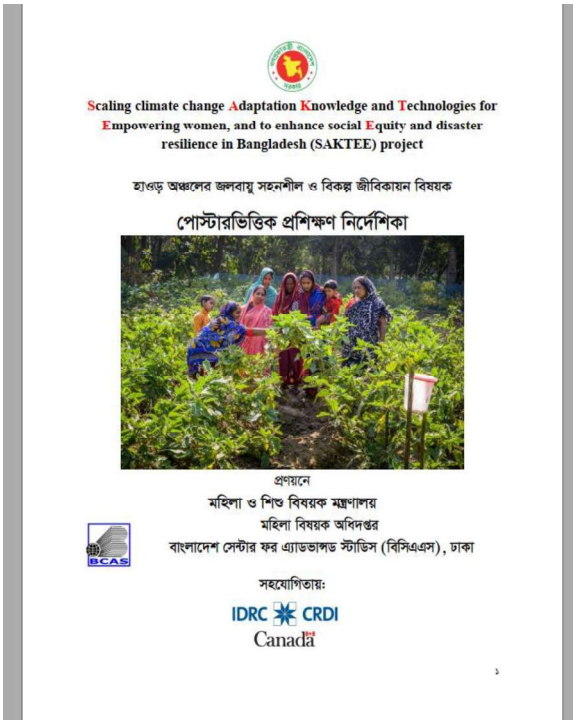
মনোয়ারুল ইসলাম, সিনিয়র রিসার্চ এ্যান্ড কমিউনিকেশন অফিসার, বিসিএএস

এবং

SAKTEE প্রকল্প টীম

বাংলাদেশ সেন্টার ফর এ্যাডভান্সড স্টাডিস (বিসিএএস)
বাড়ী #১০, রোড # ১৬/এ, গুলশান -১
ঢাকা, বাংলাদেশ

Image of the Module on CCAT for Empowerment of Women and Disaster affected Communities


Scaling climate change Adaptation Knowledge and Technologies for Empowering women, and to enhance social Equity and disaster resilience in Bangladesh (SAKTEE) project

হাওড় অঞ্চলের জলবায়ু সহনশীল ও বিকল্প জীবিকায়ন বিষয়ক

পোস্টারভিত্তিক প্রশিক্ষণ নির্দেশিকা

প্রণয়নে

মহিলা ও শিশু বিষয়ক মন্ত্রণালয়
মহিলা বিষয়ক অধিদপ্তর
বাংলাদেশ সেন্টার ফর এ্যাডভান্সড স্টাডিস (বিসিএএস), ঢাকা

সহযোগিতায়:

IDRC CRDI
Canada

Image of the Module on Resilient Livelihood for the poor Women and Socially disadvantaged Communities

Process and Outcomes of the Hands-on Training

The training modules were developed on locally appropriate adaptation technologies in small agriculture, drinking water, sanitation, and resilient livelihoods considering the local climate contexts, socio-economic conditions, and gender drivers. The training needs and technology needs were assessed through the baseline study and PAR with the vulnerable

communities. The modules focused on four broad themes: impacts of climate change in the two ecosystems with recent facts, images and scenarios; appropriate adaptation options & technologies in agriculture and WASH; resilient livelihoods options in on-farm and off-farms and empowerment of women and poor for enhancing social resilience and gender equity. The modules on CCAT and resilient livelihoods aimed at enhancing awareness among poor women and men about the suitable adaptation technologies developed by government and NGOs with examples and photos as well as how to apply those in small agriculture, crop cultivation, home gardening, fisheries, livestock & WASH; and who develop and disseminate the technologies and how the poor can access those?

Three-day training workshops for the trainers were held at BCAS in Dhaka. Trainers were appointed from the local partner's NGOs, who organized 216 training sessions in the project villages in four Upazilas in the two districts. Training sessions at the community level were organized in open places (under the sheds or large trees), or in the campus of primary schools and community places that are available in the villages. Large posters were displayed to make the discussion and reflection interactive. The trainers and community spent 3-4 hours in each training session. The training sessions on CCAT and Resilient livelihoods were organized separately. The participation in the hands-on training and capacity-building initiatives was selected from the list of the Union Parishads (lowest level administrative unit in Bangladesh) and the beneficiary groups of the local DWA offices. The beneficiaries for the piloting and demonstrations of best practices were also selected from the trainees with support from the women members of the Union Parishads. They were again motivated and encouraged to share their experience and learning with neighboring villagers for scaling up the innovative CCAT in the locality.

2.3.1 Capacity Building Training for the Primary Stakeholders

The Project has contributed significantly to raising awareness and to building capacity in Year-2 and year-3. Based on the training needs assessed through the baseline study and stakeholders consultation on CCAT and climate-resilient livelihoods, a total of four sets of training modules on CCAT in coastal and wetland areas as well as resilient livelihoods in two ecosystems were developed. A series of training sessions (108 sessions in Satkhira and 108 sessions in Sunamganj, totaling 216) were organized on adaptation technologies (focusing on water and agriculture sectors) to build awareness and capacity of the poor women, men, and socially disadvantaged groups. Each training session included 25-30 participants: poor women and members of the socially disadvantaged and disaster-affected families. Most of them were selected from the list of the Social Safety Net program of the local government, by the Union Parishads and DWA, and the Upazila office. Please see the details in Table 4.

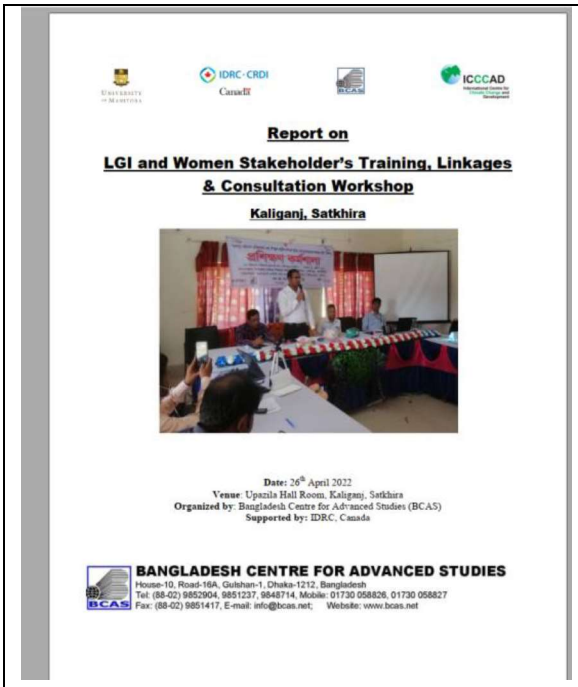
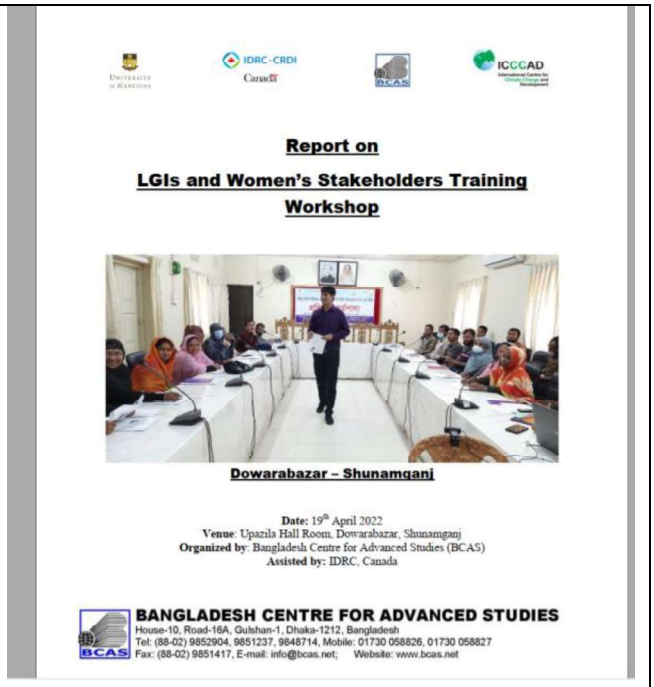
Table-4: Number of Participants those who received training in two Districts

	CCAT	IGA		IGA Total	Grand Total
District	Female	Female	Male		
Satkhira	2,133	893	169	1,062	3,195
Sunamgonj	1,765	603	283	886	2,651
Grand Total	3,898	1,496	452	1,948	5,846

The training sessions on CCAT highlighted on climate change trends and disasters in the localities, impacts of climate change on lives, livelihoods and resource base of the poor, with a special focus on small agriculture, drinking water and sanitation, where the women have high stakes. The poster and picture-based training sessions on CCAT demonstrated the pro-poor and women-friendly adaptation technologies in agriculture and WASH; explained – how poor women and their families can access adaptation technologies and resources from the local government, NGOs and actors who generate and transfer technologies to people and communities. The training sessions on climate-resilient livelihoods focused on income-generating activities and livelihood diversifications for poor women and socio-economically disadvantaged groups.

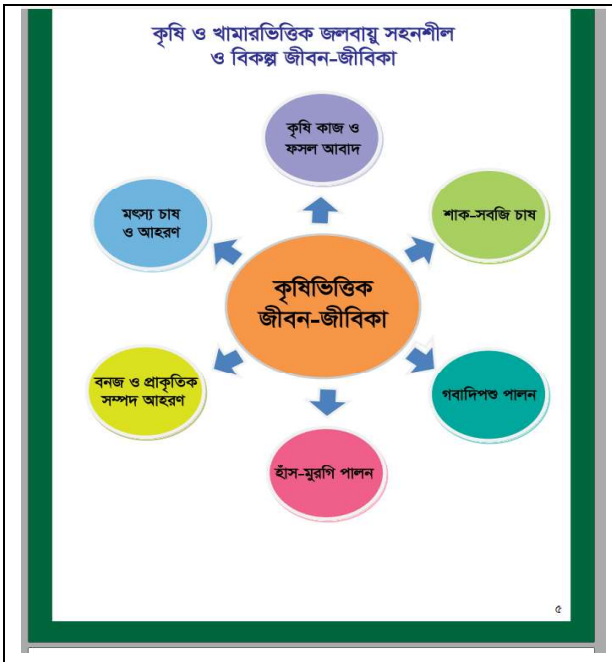
2.3.2 Capacity Building Training for LGIs and Women Stakeholders

A series of capacity-building training sessions with the LGIs and Women Stakeholders were organized for scaling up the CCAT and promoting resilient livelihoods in the climate-affected zones. The four batches of training in Kaliganj and Shyamnagar Upazilas in Satkhira district and Jamalganj and Dwarabazar Upazilas in Sunamganj district have graduated from the SAKTEE Project training activities. Please see the Capacity Building Training for the Women Stakeholders, held in Dwarabazar, Sunamganj in Appendix-3.

	
Report on the Training for Women Stakeholders and LGIs on Scaling CCAT and Empowerment in Kaliganj, Satkhira	Report on the Training and linkages with LGIs and Women Stakeholders on Scaling up CCAT in Sunamganj

2.3.3 Communication Strategy for Awareness on Gender Responsive Adaptation & Equity

The SAKTEE Project has developed a communication strategy to disseminate the awareness-raising materials and knowledge products among the actors and stakeholders. The target populations were the sectoral actors and the women stakeholders of the two selected climate change-affected districts. The popular communication materials of the project included: posters, leaflets, factsheets, community radio and video documentaries on impacts, vulnerabilities, adaptation options, technologies, and the collective initiatives on risk reduction and empowerment of women, girls, and marginalized communities.



Poster on Farm-based Adaptation Options

Poster on Off-farm Adaptation Options

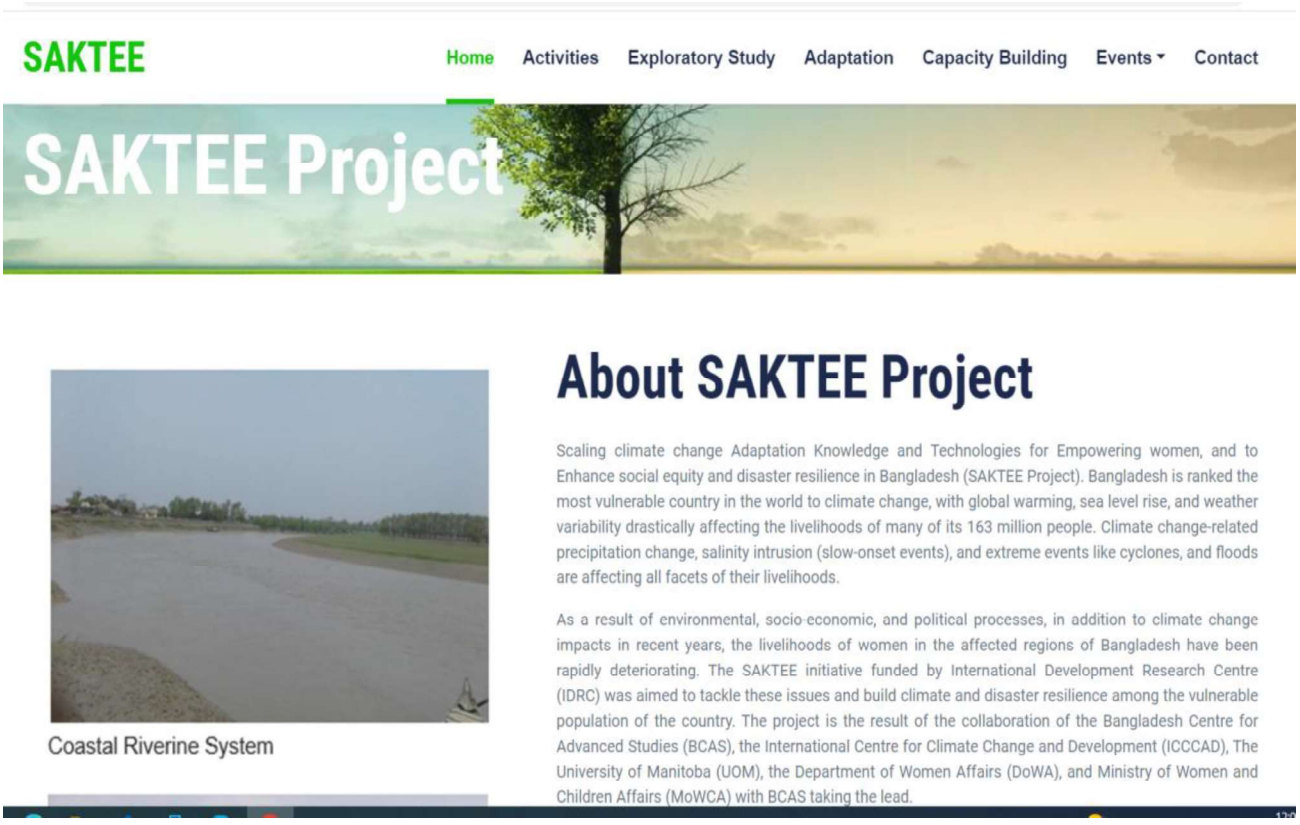
The SAKTEE Project prepared six episodes on the project and its activities for a Community Radio called *NALTA Radio* in Satkhira. The aims of the community radio program were to raise awareness about climate change impacts, risks and build the capacity of the poor, women and youths for prompt disaster responses and effective local adaptation to climate change. One episode each (in 30 minutes) was aired on Friday in six weeks through the Magazine Program of the community radio that covered 3-4 coastal districts. Experiential knowledge and stories of the women and vulnerable communities were captured through PRA on risks and vulnerability, disaster preparedness, and the capacity of the women and community to tackle disaster's impacts and those were shared through the radio program. *Bindu Nari Unnyan Sangtha,* a local partner provided technical and research support to the NALTA Radio to prepare the episodes. The views and speeches of the local DWA, DPHE and DAE officials, DRR professionals, and leaders of the right-based organizations were also aired through the community radio program from July to September 2022. The following six episodes were aired that got much attention from the poor, women, youths, and community people:

Episode-1: Climate Change Impacts in the Coastal Region and the growing Needs for Adaptation and DRR
Episode-2: Impacts of Climate Change on Women, Children and PWD and Urgent Response
Episode-3: Gender Responsive and Pro-poor Adaptation and DRR
Episode-4: Climate Resilient Livelihoods in the Coastal Region
Episode-5: Adaptation Technologies in Water and Small Agriculture in the Coastal Region; and

Episode-6: Role of LGIs and How do the Poor and Women can access resources and supports for adaptation and DRR.

Due to the absence of a community radio in Sunamganj, a short film was prepared and screened in the community places in several villages of two Upazilas in the district from October to November 2022. The short film focused on the flood impacts, adaptation technologies and community resilience in Sunamganj. The film was shown to the villagers involving women, children and youths through “para-based” (local social wards) cultural events. Simple messages on flood impacts and disaster preparedness were given and doable CCA & DRR solutions were shared with evidence and lots of fun. The film shows drew the attention of several thousand people directly and indirectly in the flood-affected region.

A knowledge platform has been created. Several meetings of the knowledge platform/network were held at BCAS and ICCCAD. The last meeting of the platform was held at the Tulip Hotel, Dhaka in early December 2022. The meeting discussed key knowledge products and sharing the learning of the projects across actors and stakeholders through meetings and advocacy. The project has developed a SAKTEE Project webpage. The project outputs and relevant documents have been posted on the online knowledge platform and webpage of the SAKTEE project at www.bcas.net.



2.3.4 Youth Engagement through Policy Dialogues with University Students

The SAKTEE project attached the highest value to engage the youths to improve their understanding of the climate change problems, gendered vulnerability, and responses. Several policy dialogues with youths (i.e., male and female students) have been organized by the Project personnel in Dhaka as well as at the regional universities. A recent youth engagement was organized in Dhaka through a day-long Symposium on the Empowerment of Women for Gender Equality and Social Resilience. The presentation and proceeding of the symposium are attached in Appendices-4 & 5 respectively.

A Brief on the Symposium on Empowerment of Women for Gender Equity and Social Resilience

Concept Note on
Symposium on Empowering women and Enhancing Equity in Bangladesh'2022
26th October – 27th October, 2022
Venue: Hotel Bengal Blueberry
Banquet Hall

'Scaling Climate Change Adaptation Knowledge and Technologies for Empowering Women, and to enhance Social Equity and Disaster Resilience in Bangladesh (SAKTEE)' was initiated by Bangladesh Centre for Advanced Studies (BCAS) in collaboration with the International Centre for Climate Change and Development (ICCCAD), Department of Women Affairs (DWA), Ministry of Women and Children Affairs (MoWCA), Government of the People's Republic of Bangladesh and The University of Manitoba (UM) funded by 'International Development Research Centre (IDRC)'.

International Centre for Climate Change and Development (ICCCAD) is playing active role in capacity building component of SAKTEE project. The project aims to support stakeholders and participants to deliver, use and act on the research. The project aims to build and coordinate institutional integration through enhancing local (Union and Sub district), regional (District) and national level stakeholders 'awareness and capacity to: (a) adopt and scale locally appropriate adaptation technologies; (b) empower women, youth/students, and the poor; and, (c) strengthen community resilience to climate change and natural disasters.

Under this project several capacity building and awareness building program were initiated in the last couple of years and the events will be ended with the symposium on Empowering Women and Enhancing Social Equity in Bangladesh. Also, A policy institutional dialogue on adoption of Adaptation technology and reduction of gender and social inequalities including relevant government departments will be held under this symposium.

The symposium will include:

- Dialogue on Adaptation Strategies towards reduction of gender and social inequities
- Social Inequities and Climate Action
- Women in Locally Led Adaptation
- Inclusion on Disadvantaged group (People with Disabilities)
- Reflection from SAKTEE
- Feminist lens in Disaster Management in Bangladesh
- Reflection and Knowledge sharing from Youth women group

Expected Outcomes

The in-person knowledge dissemination will create an enabling environment and common ground of understanding among people working on empowering women and enhancing social equity including people from relevant sectors . A networking ground will be created for further collaboration.

The exchanges among women stakeholders (government, NGOs and academic institutes) occurred through a series of workshops, seminars and policy dialogues on gender equity, climate change and technologies. The ICCCAD organized two workshops for university students titled, a Training workshop on Gender and Social Equity in Climate Change Adaptation and Women Friendly Adaptation Technology in two selected Districts. They organized a workshop in Khulna on 22 February 2021. Around 20 students participated in the workshop. The other workshop was organized in Sylhet on 7 March 2021. The total number of participants was 18. Among the participants, 50% were females. The training sessions were facilitated by the senior professionals of ICCCAD with support from the regional universities in Khulna and Satkhira. The reports are attached in Appendix-6.

2.4 Policy engagement and enhancing linkages with multiple stakeholders

The necessary platforms were created by the SAKTEE Project for the policymakers and stakeholders to engage and discuss climate change and gender equity issues and for accelerating the adoption of socially-accepted and transformative adaptation knowledge and technologies to empower women and disadvantaged groups. Besides several coordination meetings at the DWA with the key government agencies (such as the DDM, DAE, DPHE, DSW, and LGRD), the project also organized two Learning Hub Events (LHE) at the Planning Commission, a Dialogue Forum with Least Developed Countries Universities Consortium on Climate Change (LUCCC) on Climate Change and Gender Equity in Kathmandu, Nepal and a national stakeholders workshop on Adaptation Technology and Gender Equity on 6 December, 2022.

The SAKTEE Project arranged a final project workshop in Dhaka in December 2022 to share the key findings. It was attended by national policymakers, government officials from the Department of Women Affairs (DWA), Bangladesh Climate Change Trust (BCCT), the Department of Agriculture (DAE), the Department of Public Health and Engineering (DPHE), Local Government and Rural Department (LGRD), Local Government and Engineering Department (LGED), Department of Social Welfare (DSW), Department of Fisheries (DoF), Department of Forest (BFD) and Department of Environment (DoE). Over 60 participants including government officials, development professionals and representatives of right-based organizations attended the workshop. The participants appreciated the project approach, outcomes and knowledge products and expressed their commitments to promoting gender-responsive climate actions, empowerment of poor and women towards gender equality and social justice. The leading national dailies published news on the SAKTEE Project event on the following day. Please see the news on the following page.

The news of the National Stakeholder Workshop was published in the Prothom Alo – a national daily

রাজধানী

কর্মশালায় বক্তারা: জলবায়ু পরিবর্তনজনিত দুর্যোগে ভুগছে প্রান্তিক মানুষ

নিজস্ব প্রতিবেদক
ঢাকা
প্রকাশ: ০৬ ডিসেম্বর ২০২২, ১৯: ৩১

'জলবায়ু পরিবর্তনে জেন্ডার সমতার জন্য প্রযুক্তির অভিযোজন' শীর্ষক কর্মশালার অতিথিরাছবি: সংগৃহীত

জলবায়ু পরিবর্তনজনিত দুর্যোগে স্থানীয় জনগোষ্ঠী, বিশেষ করে দরিদ্র, প্রান্তিক ও সুবিধাবঞ্চিত জনগোষ্ঠীর নারী ও পুরুষ মারাত্মকভাবে ক্ষতিগ্রস্ত হচ্ছেন। আর্থসামাজিক শ্রেণিবৈষম্যের কারণেও নারী ও প্রান্তিক জনগোষ্ঠীর দুর্যোগ-দুর্ভোগ অন্যদের তুলনায় বেশি।

রাজধানীতে 'জলবায়ু পরিবর্তনে জেন্ডার সমতার জন্য প্রযুক্তির অভিযোজন' সংক্রান্ত এক কর্মশালায় এসব কথা বলেন বক্তারা। আজ মঙ্গলবার রাজধানীর এক হোটেলে এ কর্মশালা হয়। বাংলাদেশ সেন্টর ফর অ্যাডভান্সড স্টাডিজ (বিসিএএস), মহিলাবিষয়ক অধিদপ্তর এবং ইন্টারন্যাশনাল সেন্টর ফর ক্লাইমেট চেঞ্জ অ্যান্ড ডেভেলপমেন্ট (ইক্যাড) এ কর্মশালার আয়োজন করে।

কর্মশালায় মহিলাবিষয়ক অধিদপ্তরের মহাপরিচালক ফরিদা পারভীন বলেন, নারীর দুর্যোগ মোকাবিলার সক্ষমতা বৃদ্ধির জন্য সরকারের একাধিক উদ্যোগ রয়েছে। মহিলাবিষয়ক অধিদপ্তরের অধীন ন্যাশনাল রেজিলিয়েন্স প্রোগ্রামের (এনআরপি) নানা কর্মসূচি বাস্তবায়িত হচ্ছে। যার মাধ্যমে নারীরা দুর্যোগ মোকাবিলার সক্ষমতা ও অভিযোজন প্রযুক্তি সম্পর্কে জানতে এবং দক্ষতা অর্জন করতে পারছেন। এ প্রকল্পের অর্জন ও সুফল যাতে দীর্ঘস্থায়ী হয়, সে জন্য আরও গণমুখী গবেষণা হওয়া প্রয়োজন।

The workshop presentations and discussion highlighted the growing adverse impacts of climate-related disasters on the poor, women, and socially disadvantaged communities in coastal Bangladesh and the Haor basin (perennial wetlands) in the northeastern region. How the climate stimuli and disasters are affecting women and men differently and increasing social inequity etc., were presented with evidence to the policymakers and development practitioners. The gender-responsive adaptation options and locally

appropriate adaptation technologies were presented for scaling up through the support of government and development agencies that are urgently needed for reducing risk and vulnerability as well as enhancing social resilience and gender equity. It was strongly felt that the simple, locally available, and women-friendly adaptation technologies are more acceptable to the community people for risk reduction and resilient livelihoods. Hence, there is a greater need for further development and dissemination of climate-resilient, pro-poor and women-friendly technologies in the localities. Further, capacity building and skill development training are required for optimal uses and replication of the tested adaptation technologies in water, small agriculture, and livelihoods.

2.4.1 Learning Hub Events (LHE) for Policy Advocacy and Stakeholder Engagement

The SAKTEE Project organized two important LHEs at the Planning Commission of the Government of Bangladesh in 2022. The main aims of the LHEs were to share the approach and key findings of the project to influence policy and actions of the GoB for scaling up the CCAT for the empowerment of women, gender equality and social resilience. Learning hub events were mostly organized to have a thorough discussion on particular topics and to further come up with ideas for research and actions. The presentations were followed by long discussions, comments, and sharing ideas on Pro-poor and women-friendly climate actions and DRR for empowerment and gender equality. The LHES were organized under the umbrella of science-policy-dialogue of the ICCCAD and BCAS. Largely participated by mid-level to high government officials and development professionals, the LHEs focused on the Integration of Gender Equity in the National Disaster Management Policy and Plan as well as the Integration of Gender Responsive Adaptation in the Bangladesh Delta Plan 2100. Chaired by Mr. PR Chakraborty, Head of the GED, Planning Commission of the Ministry of Planning, it was addressed by the Director of the Department of Disaster Management (DDM) and the representatives from relevant government officials. Presentations were made by the team members of SAKTEE project while Prof. Emdad Haque of the University of Manitoba elaborated the research framework and methods of the project that were well received by the participants. Please see details in the proceedings of the LHEs attached in Appendix-7.

The First LHE held at the Planning Commission, Dhaka on 23 June 2022 on Integration of Gender Equity in National Disaster Management Policy and Plan of Bangladesh

The key activities under Outcome-4 began in year-2, which focused on the empowerment of women, girls and disadvantaged groups through stakeholders and policy engagement. The key activities included: a) the formation of a National Coordination Committee of the SAKTEE Project and organizing meetings with the government agencies for policy engagement; b) organizing a policy engagement session at International *Gobeshona* (a knowledge platform on CCA Research) Conference 2020 in Dhaka; c) organize a Joint policy dialogue forum for the National Plan for "Disaster Management Plan" 2016-2020; d) organize a Joint policy dialogue forum for Bangladesh

Mr. PR Chakraborty of the Ministry of Planning was speaking in the concluding session of the LHE

Delta Plan 2100 (with Planning Commission of the GoB); and e) conducting of Gender and Social Equity Analysis on disaster and climate change-induced differentiated impacts and responses. These were organized successfully with the effective participation of government policymakers, planners, and representatives from the development agencies.

As part of the knowledge platform, the SAKTEE Project organized two important sessions in the *Gobeshona* Global Conference held in 2021. The SAKTEE team (comprising of ICCCAD, BCAS and the University of Manitoba) hosted a session on "Adaptation Technologies, Gender Equity and Social Inclusion" at the *Gobeshona* Global Conference on 21 January 2021. The ICCCAD team successfully supported BCAS, and the University of Manitoba in organizing a session on the findings of the SAKTEE Project.

The session on Adaptation Technologies, Gender Equity, and Social Inclusion helped the audience to grasp the significance of gender equity as well as the effects of the activities that the SAKTEE team has been implementing since the inception of the Project. The session titled **Adaptation Technologies, Gender Equity and Social Inclusion** was organized by the SAKTEE team on 24 January, 2021. The session was chaired by Dr. Atiq Rahman, ED of BCAS and Co-chaired by Prof. C. Emdad Haque, University of Manitoba, Canada. Prof. Sharmind Neelormi, Principal Investigator, SAKTEE Project moderated the Session. The second session of the SAKTEE project at the Gobeshona Global Conference on LLA was held in March 2022. The graduate students (under the Exploratory Research initiative of the SAKTEE project) shared their study frameworks and the preliminary findings at the session. The proceedings of the session are attached in Appendix-8.

3. Achievements and Results by Four Outcomes

The project intended to generate a set of immediate outcomes that could have long-term impacts on people and their practices in relation to climate change adaptation and resilient livelihoods through reducing risks and vulnerability. The project also undertook various capacity-building initiatives, knowledge generation, demonstration of suitable adaptation technologies in water & agriculture, awareness and policy engagement and advocacy for scaling up the selected pro-poor and women-friendly adaptation in the two climate hotspots of Bangladesh. The immediate outcomes included the following:

- New knowledge generated with improved understanding on gender-differentiated vulnerability in the physical and social contexts as well as gender-responsive adaptation needs and priorities in small agriculture and WASH;
- Selection and demonstration of innovative, socially transformative climate change adaptation technologies for the poor, women, and marginalized communities are identified and scaled up;
- Enhanced capacity towards gender-focused development planning for Integration of gender equity and policy sensitivity at multiple institutional levels; and
- Reduced gender gaps and social inequity, especially in coastal and northeast wetland regions (*haor* basin) in Bangladesh.

OUTCOME-1: The implemented activities under the four objectives have generated a set of expected outcomes with a number of immediate and long-term impacts on vulnerable groups, local communities, institutions, stakeholders, and actors. For example, in achieving Outcome-1, the baseline study and exploratory research have generated new knowledge in areas of climate risk and vulnerability. The study team and the community actors have a deeper understanding on gender-differentiated vulnerability and multiple causes of vulnerability that are linked with social, cultural, and institutional factors and gender drivers. Critical awareness of adaptation needs, priorities and CCA that can meet the practical and strategic gender needs for transformative social change was raised among all stakeholders. The knowledge products were created in the forms of popular communication materials, policy briefs, technical papers and peer-reviewed journal articles; these have had as well as will have wider impacts on community people, actors and stakeholders in terms of enhanced awareness and influencing policy change and formulation of national strategies towards gender-responsive climate actions. The baseline study, with participatory research tools, and the exploratory research of the students have engaged poor women and community people in raising their awareness on climate change impacts, risks and vulnerability and their rights and entitlements. The processes have empowered the women and poor with information, and knowledge, and enhanced their analytical capacity to assess the social and cultural, institutional factors and gender drivers of vulnerability. Further, the pursuit and application of Participatory Action Research (PAR) by using a Feminist Research Approach have enabled the

empowerment of poor women and socially disadvantaged communities. The marginalized groups now have effective and sustainable linkages with the local government institutions, NGOs, and actors for accessing resources and support for planned adaptation and DRR.

Through the exploratory research component, the research reports and published knowledge products have encompassed the following themes:

- Differentiated climate change impacts on women in the wetland area in Sunamganj (wetland) district;
- Understanding the differential climate change impacts among impoverished and disadvantaged households in coastal Bangladesh;
- Impacts of climate change and agricultural adaptation technologies on social equity in the wetland communities in Sunamganj;
- Gender-differentiated vulnerability and adaptation of climate change in the north-western district of Sunamganj;
- Climate change impacts on women vulnerabilities and adaptation technologies in the coastal region of Bangladesh;
- Climate change impacts, responses and adaptation technologies in small-scale agriculture in coastal areas of Bangladesh with gender dimensions and women's perspectives; and
- The role of innovation and adaptation technologies in reducing climate-induced disaster impacts and enhancing resilience in Satkhira among the coastal communities.

Based on the study findings (from the wetland in Sunamganj), a set of policy recommendations for scaling up Climate Change Adaptation Technologies (CCAT) in agriculture and water sectors were made:

- Agricultural technologies should address different forms of social inequalities. Consideration of pre-existing social inequalities in adaptation interventions can minimize damage and loss of properties and crop production. Policy interventions, such as introducing new technologies, need to be aligned with local needs, and the abilities of the communities to adopt technologies;
- Towards a goal of more social equity and empowering marginal farmers, more subsidies should be provided to them. Poor farmers and women groups should therefore be targeted for providing subsidies. For example, it was observed in the field that subsidies for the adoption of combined harvester and bed-planters can result in more equitable outcome;
- For long-term sustainability and reducing vulnerabilities of the poor and women, income-generating activities and employment opportunities should be emphasized. The women-headed and disadvantaged families should receive special attention in this regard;
- To achieve equity goals, sustainable physical structures, such as protective walls, improved drainage systems, and embankments, should be implemented to reduce physical vulnerability and exposure of the poor and marginalized groups to climate hazards and risks;

- Flood forecasting and warning and disaster-related information should be disseminated in a timely manner for the last mile vulnerable communities;
- Flood forecasting and warning-related education programs should target the most vulnerable population; and
- To help quick recovery from crop loss due to climate hazards, crop insurance programs should be initiated on the basis of the economic and income statuses of local farmers.

Exploratory studies of SAKTEE Project have suggested that the coastal district Satkhira is always at risk of storm surges, tidal flooding, cyclones, and high salinity intrusion. They severely damage and disrupt coastal livelihood and resources. Over the past 15 years, the use of 'hard' adaptation technologies has been saving coastal resources through using increasing structural barriers such as block embankments, geobags, sea walls, polders, culverts, geosynthetics, sluice gates, cyclone shelter, and early warning system. Since 2000, the government and related authorities have constructed approximately 35 km of block embankments, 16 km of geobag, 32 sluice gates, and 7 multipurpose cyclone shelters in both study areas to protect vulnerable communities from various climatic disasters and minimize their impacts. It has been found in the field that innovation and adaptation technologies have contributed to saving hundreds of lives and the livelihood of vulnerable communities in Satkhira. The wider implementation of EWS, microfinancing, cyclone preparedness program (CPP), genetically modifying crops (saline, flood and other climate stress-tolerant), crop diversification, hydroponic agricultural practices, reverse osmosis, pond sand filters (PSF), deep tube well, shallow tube well, rainwater harvesting (RWH), cyclone shelter, Sea walls, Block embankment, Sluice gates, Polder, Culverts, Geobag, Geosynthetic and many others enabled the vulnerable people to address the many of the impacts of climate change and underlying challenges.

The exploratory study has suggested that amplifying innovation and adaptation technologies would be needed with resources and techniques to build adaptive capacity and resilience to climate change. However, many of these innovations and adaptation technologies have not been extensively embraced and put into use by vulnerable communities. The study put forward the following recommendations:

- Creating a knowledge learning center at the ward, village, and union level with proper training facilities;
- Creating an emergency fund for repairing and maintaining adaptation technologies during adverse conditions.
- Creating more sustainable embankments (block or sea wall);
- Integrating Nature-based solutions in terms of adopting different innovation and adaptation technologies; and
- Ensuring accountability and transparency with various innovation and technological projects.

OUTCOME-2: The outcome-2 relates to innovative adaptation technologies in water and agricultural sectors that are locally appropriate and socially transformative, particularly in terms of the reduction of social and gender inequities. These adaptation technologies were identified, evaluated, and demonstrated during the SAKTEE project implementation. To achieve the outcomes, a national inventory of innovative climate change adaptation technologies was prepared; several local and national stakeholders workshops were organized and appropriate CCATs were identified. Further, the Participatory Assessment Tools were developed for evaluating adaptation technologies in the two selected ecosystems. The technology inventory and the participatory assessment not only prepared a list of appropriate and socially-transformative technologies but also directly contributed to building capacity of the poor women and actors to access adaptation technologies and resources. Such resources are usually provided by the relevant government departments including the Department of Agriculture and Extension, Department of Women Affairs, Bangladesh Agricultural Development Corporation, Department of Local Government and Rural Development, and Bangladesh Water Development Board. In collaboration with the local and regional governments, selected CCATs were demonstrated with the poor women and local stakeholders of the Sunamganj and Satkhira districts. The activities under the themes have generated the following reinforcing outcomes:

- Enhanced accessibility to gender-specific (women-focused) adaptation technologies in water and agricultural sectors;
- Enhanced capacity in participatory evaluation of how the technologies can benefit vulnerable women, poor and disadvantaged people at the local level;
- Built capacity to assess the appropriateness and effectiveness of the technologies to address climate change impacts and vulnerability of women and poor people;
- Identifying the challenges and opportunities of scaling up adaptation technologies identified by the women, poor and disadvantaged groups; and
- Enhanced the linkage of the communities with relevant government departments, NGOs, and other stakeholders for collective efforts in adaptation and mitigation.

OUTCOME-3: Outcome 3 has aimed at enhancing awareness and capacity of the stakeholders to adopt locally appropriate adaptation technologies; to empower women, youth, and disadvantaged groups; to strengthen community resilience to climate disasters; to enable scaling-up socially-transformative adaptation knowledge, technologies, and strategies for accelerating national and regional climatic actions. Several activities were implemented to coordinate institutional integration through enhancing local (Union and Upazila), regional (District), and national level stakeholders' awareness and capacity to adopt and scale locally appropriate adaptation technologies; to empower women, youth/students, and the socioeconomically poor groups; as well as to strengthen the resilience of the local communities to climate change and natural disasters. The following activities with multilevel communities and actors have been instrumental to achieving the outcome:

- Organizing training workshops on CCAT for poor women and the stakeholders in Satkhira and Sunamganj districts;
- Demonstrating gender-responsive adaptation schemes on water and small agricultural sectors to local and regional stakeholders; and
- Mobilizing community people as adopter households by the trained women beneficiaries.

The poor women and socioeconomically disadvantaged household heads (women and men) at the local level became aware of and knowledgeable about climate change impacts. They are adopting locally appropriate adaptation technologies in water and agricultural sectors. Hence, one of the major activities of the SAKTEE project was to organize training workshops with the poor women and underprivileged households in Satkhira and Sunamganj districts. The workshops have enhanced awareness and capacity of the poor to understand the current and emerging risks and vulnerability as well as to undertake adaptation actions and DRR responses; required technologies for agriculture, WASH and resilient livelihoods. Training modules were developed based on the available training materials, baseline survey results, technology inventory and key stakeholders' inputs. The training contents mainly focused on issues related to the gender-responsive adaptation and application of adaptation technologies in water and agricultural sectors in light of women empowerment and promoting social equity.

A total number of 5,846 participants were trained in Shyamnagar and Kaliganj Upazilas of Satkhira district and Jamalganj and Doara Bazar Upazilas of Sunamganj district. Among them, 3,898 women have been trained in 216 CCAT in Para-based training session and 1,497 women and 452 men were trained in 108 IGA for resilient livelihoods. Training sessions were held through poster display, exchange of experience of the participants, and storytelling for increasing practical knowledge and skill for application in real life as well as to raise their voice to demand resources, technologies and support from the LGIs and NGOs. Many poor women have already begun to use the CCAT and IGA for promoting resilient livelihoods in both the coastal region and Haor basin.

Photo: Training Session in Stakhira with Poor Women on CCAT and Resilient Livelihoods

Further, about 300 women stakeholders at the local, regional and national level became aware and knowledgeable on gendered vulnerability, needs for adaptation and suitable technologies. It was expected that they will be coordinating regionally and locally for scaling up appropriate adaptation technologies. Three sessions on relevant issues and group work were organized in each training module with 30-35 participants including governmental officials, NGO representatives, academicians, and media. The training at the regional and local levels aimed to achieve the following specific objectives:

(i) sharing climate science with a focus on climate change Impacts, vulnerabilities and gender-responsive adaptation needs;
(ii) sharing the research findings in both coastal and Haor regions of Bangladesh on existing demands for CCAT in water and agricultural sectors;
(iii) facilitating conversations on the role of women stakeholders (both GO & NGO) in CCAT transfer, demonstration and upscaling;
(iv) ensuring the appropriate coordination and collaboration among the Government's service providers, NGOs and community people on suitable CCAT that support social and gender equity and enhance community resilience;
(v) exchange views on challenges and opportunities for scaling up adaptation technologies by empowering women, poor and disadvantaged groups; and
(vi) enhancing the linkages of the relevant government departments, NGOs and stakeholders (who develop and disseminate CCAT) with the poor women and socially disadvantaged groups for further supports (adaptation technologies and resources) for gender-responsive adaptation toward social resilience and gender equity.

The training and capacity-building activities with the local government institutions and the women stakeholders have generated and enhanced the following outcomes:

- The women stakeholders in the Haor and Coastal region became aware of and knowledgeable on appropriate CCATs in water and agriculture;
- Participants are able to communicate and support regionally and locally appropriate CCATs;
- Improved understanding among the participants about the role of women stakeholders (both GO & NGO) in CCAT transfer, demonstration and upscaling for the empowerment of women and gender equity;
- Enhanced capacity of women to identify steps for the appropriate coordination mechanism between the service provider and community people on suitable CCAT that support social and gender equity and enhance community resilience;
- Increased capability of exchanging views, confronting emerging challenges and availing opportunities for scaling up adaptation technologies by the women, poor and disadvantaged groups; and

- Enhanced capacity of the participants to contribute to enhance the linkages of these groups with the relevant government departments, NGOs and stakeholders to mobilize further supports.

OUTCOME-4: Outcome 4 relates to influencing the national climate change adaptation policies and programs by a firm commitment to accelerate the adoption of socially-accepted and transformative adaptation knowledge and technologies that will empower women and disadvantaged groups. To achieve this outcome, the project facilitated different activities including several discussion meetings and coordination meetings among relevant government sectors (particularly the Departments of women affairs, environment and climate change, and disaster management) and other stakeholders that may support and take up socially-transformative climate change adaptation technologies and local climate actions.

To contribute to the outcome, the SAKTEE Project organized a Symposium and Dialogue on Empowering Women and Enhancing Social Equity. The development professionals, government policymakers and women stakeholders attended the national events in a city hotel in Dhaka in October 2022. The events supported the planned institutional dialogues among relevant policymakers on the adoption of adaptation technologies and the reduction of gender and social inequalities. Presentations were followed by a panel discussion, questions and answers, and group work. The two-day-long symposium and dialogue sessions included the following activities for shared learning and reflections on climate change and gender equality:

- Adaptation strategies towards the reduction of gender and social inequities;
- Gender-responsive climate actions in the climate hotspots;
- Participation of women in locally-led adaptation;
- Participation and inclusion on the disadvantaged group (people with disabilities);
- Reflection on research findings and challenges;
- Promotion of a feminist lens in disaster management; and
- Reflection by the youths and women stakeholders.

The event was inaugurated by Dr. Saleemul Huq, Director of the International Centre for Climate Change and Development (ICCCAD). In his inauguration speech, Dr. Huq discussed the challenges of women's empowerment in the context of climate change. He also suggested: Firstly, they are in one of the most vulnerable positions due to climate change, and secondly, the people of Bangladesh have already begun to confront the problem, and hence, they must act to solve this not only for personal but also for the collective good. He emphasized enhancing knowledge from the grassroots level to the highest level to emerge as a leader in the climate change adaptation process by ensuring women's participation.

Two Learning Hub Events (LHEs) were organized by the SAKTEE Project in June, 2022 and September 2022 on Integration of Gender Equity in the National Disaster Management Plan and Bangladesh Delta Plan 2100. Over 120 participants from

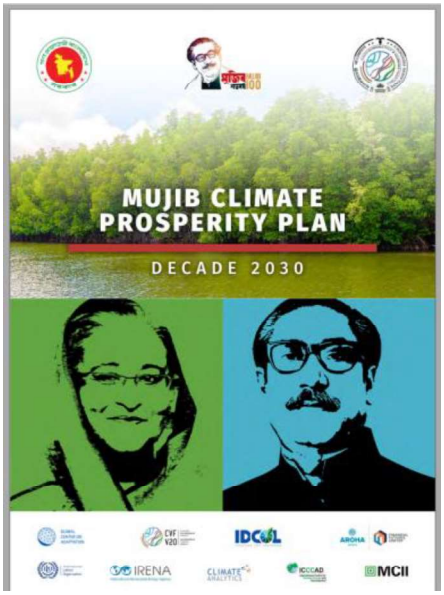
government's ministries and departments, donors and development partners attended LHEs. The aim of the LHEs were to influence the government policy and strategies for inclusion of gender-responsive climate actions and empowering poor women for gender equity and reducing their vulnerability to the current and future climate change impacts. The events were moderated by Prof. Saleemul Huq. He explained the importance and necessity of a learning hub event (LHE), particularly on the SAKTEE project's findings which aimed to empower climate-vulnerable women. This presentation was followed by long discussion, comments and ideas on the particular topic. Dr. Atiq Rahman, Executive Director, Bangladesh Centre for Advance Studies, explained the importance and necessity of gender inclusion of gender issues in the national planning processes. He further emphasized that gender inclusion does not exclusively deals with women rather it should undertake a broader perspective and include male, female, and transgender. He further emphasized the need for the inclusion of gender aspects in the implementation of Bangladesh Development Plan (BDP) 2100. Participants elicited their keen interest in the research findings of SAKTEE Project and expressed their commitments to uphold gender equity in the Five-Year Plan, Annual Development Plans and BDP 2100. The BDP 2100 is a current document, and the government is committed to integrating gender equity in the implementation plan of the BDP2100.

A Knowledge Sharing Event of the SAKTEE Project was held in Kathmandu, Nepal in 2022 that enabled dissemination of findings of the SAKTEE project among the researchers and academicians from low- and middle-income countries (LMICs). This one-day event took place on 16th October 2022 (Sunday) under the auspices of the Least Developed Countries Universities Consortium on Climate Change (LUCCC). The in-person knowledge dissemination provided an enabling environment and created a common ground of understanding among the policymakers, academicians and project partners of neighboring countries as well as the LUCCC partners. From a South Asian regional perspective, the sharing of findings of SAKTEE Project and the subsequent constructive discussion helped develop effective policy formulation and implementation strategies.

The session was initiated with a welcome note by Mr. Praveen Kumar Regmi, Academic Coordinator. Dr. Atiq Rahman, Executive Director, BCAS addressed the participants virtually and urged the participants to think seriously and find out effective ways of applying a gender-inclusive lens in research and academic practices and thus influence the policy and actions towards gender equity and social resilience in the face of rapid climate change with devastating impacts. Please see the report of the Knowledge Event with LUCCC in Nepal in Appendix-9.

The LHEs are process-led actions and advocacy with government policymakers and development planners with immediate and long-term outcomes to influence policy, strategies and practices. The earlier LHEs were organized to enrich the discussion with updated facts and evidence on climate change vulnerability, L&D and adaptation needs, amplifying southern voices in the global climate negotiations, climate finance, and justice. The process intends to enhance transformative changes in society, economy and institutions that require political commitment, motivation and changes in attitudes with

skills for integrated planning and resources as well as localization of plan in climate change adaptation, mitigation, DRR and resilient livelihoods. The SKATEE project has supported the LHE Program of ICCCAD and BCAS that contributed gender integration in NDMP, BDP 2100 and Bangladesh National Adaptation Plan (NAP) 2022-2050. The project partners of SAKTEE were involved in the formulation of NAP to ensure gender-responsive adaptation options in the national plan.



Government officials are now much aware of the importance of integration of gender concerns and gender equality issues in the relevant policies, strategies and plans. Many of them also know the key approach and steps for the empowerment of women gender integration in the Annual Development Plan (ADP), Five Year Plan and sectoral plans. They are committed to integrating gender-responsive climate actions and gender equity in the implementation plan of BDP2100. The Mujib Climate Prosperity Plan (MCPP) aims to accelerate adaptation and mitigation with increased public expenditure for the most vulnerable communities in the climate-affected zones. The MCPP emphasizes on comprehensive disaster preparedness in the face of rapid climate change and the promotion of technologies for adaptation, mitigation, renewable and energy efficiency for climate resilient development, where people live in peace, security, economic stability, well-being and prosperity.

A national inter-sectoral level Coordination Committee was formulated under leadership of the Department of Women and Affairs, at the MoWCA. Two annual meetings of the national inter-sectoral Coordination Committee were held in 2021 and 2022 for influencing policy and decisions. Two Pre-Gobeshona meetings and two sessions on CCAT and Findings of the Exploratory Studies were held in the Global Gobeshona International Conferences. The sessions aimed to enhance policy-institution-practice synergies in developing countries.

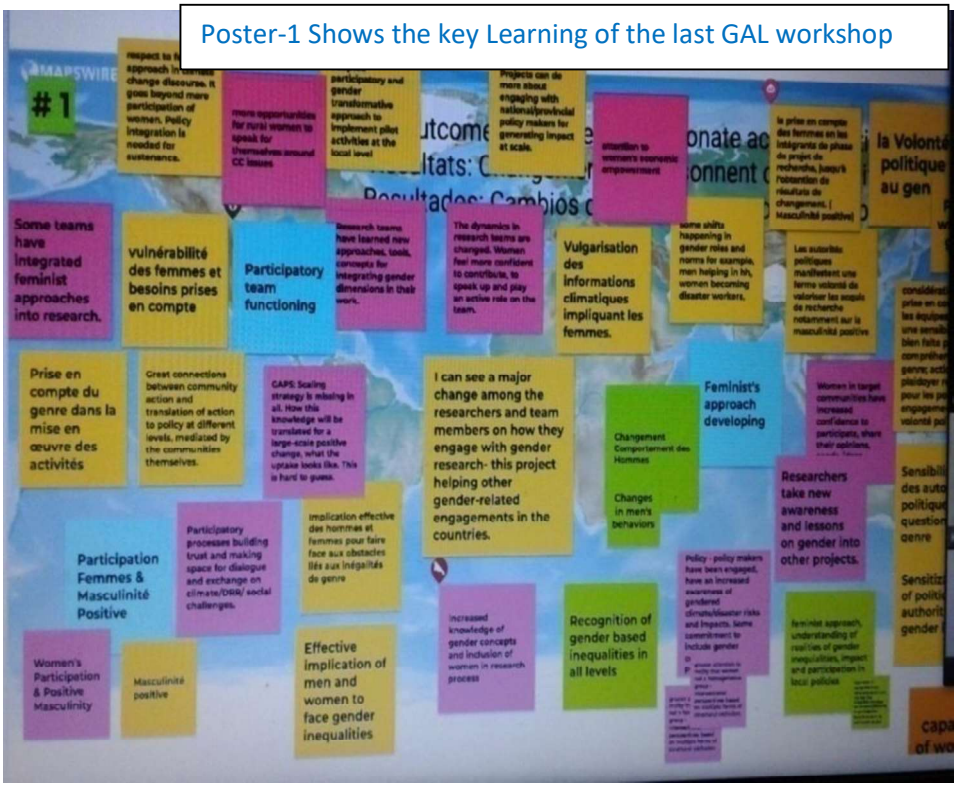
The SAKTEE project developed a knowledge-sharing platform for climate change adaptation technology and gender-responsive adaptation in Bangladesh. A Knowledge Management Network formed on climate change and gender inequity. Two meetings of the platform were held in 2021 and 2022. The aim of establishing the platform was to create a linkage between all levels of national and regional stakeholders in this field to motivate sharing of knowledge in climate change adaptation, empowerment of women & poor and gender equality. The platform helped develop more effective research outputs and evidence for policy advocacy and public awareness to tackle the challenges of climate change in Bangladesh.

The project opened a SAKTEE webpage hosted at BCAS webpage that enabled project partners to share information, articles, reports, and publications about events of the SAKTEE project. This will also create an opportunity for stakeholders and relevant actors to give feedback on the publications and interact among themselves. The network organized monthly seminars and dialogue sessions, which host a range of national institutions and experts on climate change adaptation gender, and development. The policy briefs, journal articles, and other knowledge products are influencing policymakers and their actions in Bangladesh and developing countries.

It is expected that all the activities have contributed to building awareness and scaling up appropriate, gender-responsive and socially transformative climate change adaptation technologies that promoted gender-focused adaptation and climate actions in the two climate-affected regions. The poor women, women stakeholders, and development planning personnel at the local and national levels obtained many insights and have enhanced capacity that support gender integration in adaptation, DRR and development planning. The enhanced institutional and policy responses will continue to promote pro-poor and gender-responsive adaptation to reduce gender gaps and social inequity in the forthcoming years.

The SAKTEE Project team members attended two very useful learning events in Year-1 that were very effective for a better and shared understanding of the approach and framework of IDRC on Gender and climate change as well as transformative social change. The team led by PI of the SAKTEE project participated in the Nairobi (Kenya) Workshop on Gender and Climate Change in November 2019. The SAKTEE Project organized a follow-up capacity-building workshop on Gender Action Learning (GAL) Approach in February 2020 in Dhaka. The GAL workshops (supported by the IDRC and G@W) were very helpful to improve the research framework and indicators of SAKTEE Project. The team has benefitted from an improved understanding of feminist approach and could improve the methods and tools of exploratory research and PAR further. The group or collective learning was shared with the colleagues at BCAS and partners that encouraged them to use gender lens and feminist approaches to integrate gender concerns and approaches (from gender aware, sensitivity and responsive to transformative approaches), in their projects and institutional Programs relating to climate change, natural resources management, poverty alleviation and livelihood promotion.

The team members also attended two online workshops of the IDRC on the issues in 2020 and 2021 that were facilitated by G@W, where we could learn the working experience, progress made and challenges from the other partners across the three continents. The following poster demonstrates the key learning outcomes of the last GAL workshop that was held online in December 2021.



Poster-1 Shows the key Learning of the last GAL workshop

4. Key Learning, Limitations, and the Co-produced Recommendations

4.1 Research and knowledge generation

The SAKTEE project endeavored to maintain scientific rigor in multidisciplinary and participatory research for knowledge generation, innovation in approach, and capacity building of the students, youths and women stakeholders. In the baseline study, combined and mixed methods with qualitative (feminist research) and quantitative were applied to examine the growing vulnerability of the poor, women and socially disadvantaged communities in physical, social, institutional, gender and cultural contexts. The orientation on the feminist and capability approaches has widened the understanding and learning of the young researchers at BCAS, ICCCAD and field researchers. The approach and principles of IDRC of gender and climate research have immensely influenced the SAKTEE research team in designing the tools and methods for field research. These were also used in the participatory assessment of adaptation technology identification with women and vulnerable communities in both coastal zone and *haor* (wetland) basin. The new learning has built capacity and skills of the individual researchers as well as enhanced institutional capacity for taking into consideration of diverse issues (climate change, socio-economic conditions, governance and gender drivers) and their inter-sectionality in the society.

The exploratory research endeavors, as part of their Masters and PhD theses, were carried out by nine students from public universities in Bangladesh and the University of Manitoba in Canada. The students explored the gender differentiated vulnerability, capacity of women and men, adaptation needs and institutional barriers using the key principles of feminist research and capability approach. The students received much orientation on the approaches and research methods and gained practical skills for conducting field research, data collection and analysis. Those efforts had not only built capacity and skills, but also enhanced positive attitudes and changes towards feminist approach and inter-disciplinary research focusing on climate vulnerability analysis, social resilience, empowerment of women and gender equity and transformative social change. It is expected that the research team and the students will use these approaches and expertise in their future research and knowledge generation. Several knowledge products including journal articles (on social learning, innovation, adaptation and community resilience) and technical papers for book chapters have already been published from home and abroad, and a few knowledge products are still being planned and generated.

BCAS and ICCCAD had partnership and collaboration on climate change adaptation through organizing CBA workshops and implementing ARCAB project; training and climate change negotiations through UN COPs. The SAKTEE project has created further opportunities for working together with community and actors including policy makers, academics and stakeholders on climate change and gender equity. The project has also renewed our partnership with the University of Manitoba (Canada), where young

researchers and senior professionals could work together on the current and emerging issues for improving the institutional approaches, activities and outcome relating to climate change adaptation, inclusive social development and gender equity. The project has also strengthened our partnership with government ministries and departments, particularly with the MoWCA and DWA, Ministries of Environment & Climate Change, Disaster Management, Planning, Agriculture, Health, Water Resources, Rural Development and their associated departments. The national project coordination committee meetings and the LHEs at the Planning Commission have strengthened and exchange and interaction. This will be continued through sharing research findings and advocacy on climate change, resilient livelihoods and gender equality.

BCAS and ICCCAD have excellent working relationships with both public and private universities in Bangladesh. The SAKTEE project supported the process through exploratory research, technology innovation, youth engagement and knowledge platform. This will be continuing for improving research methods, knowledge co-generation, outreach, capacity building of youths and policy advocacy. The SAKTEE project has also strengthened our relationships and collective actions with local communities and actors in the areas of participatory vulnerability assessment, PAR for technology selection and demonstration, gender responsive adaptation planning and implementation for risk reduction, resilient livelihoods and gender equity. We will keep our partnerships with village groups, CBOs and LGIs in the climate affected zones through other projects and initiatives of BCAS, University of Manitoba and ICCCAD. The DWA has already extended their community actions in WASH and resilient livelihood through National Resilience Programs (NRP).

4.2 Technology innovation and demonstration of CCAT in water, agriculture & livelihoods

The adaptation technology inventory (through desk review and wider consultation with actors and stakeholders) and PAR have empowered the poor women and stakeholders. The new and applied knowledge on socially appropriate and gender responsive technologies have promoted adaptation at the community level. These are supporting pro-poor and gender responsive adaptation in small agriculture, food security and livelihoods and water and health. The new knowledge on gender differentiated vulnerability, awareness on adaptation and linkages of the poor and socially disadvantaged groups with local government, technology holders (like DAE, BADC, DPHE etc) and actors (NGOs, CBOs and women led organizations in the locality) have enhanced the confidence and capacity of the poor and women to undertake planned adaptation and resilient livelihood activities.

The SAKTEE project has considered gender specific needs for adaptation in water, WASH, agriculture and livelihoods. The CCATs were assessed and demonstrated considering the five criteria including climate resiliency, pro-poor, women friendly, affordability and availability in the localities. These are proved for replication and scaling up with further innovation to local and social contexts. However, one of the learning of

CCAT is that a combination of hardware, software (knowledge and skills for application) and institutional arrangement work better in both coastal and wetland ecosystems. Further, more participatory research would be needed to assess the effectiveness of the selected technologies in the contexts of changing climate with intensity of impacts as well as where to improve the efficacy for sustainability.

The engagement of local government institutes (LGIs) and development agencies (who develop and disseminate CCAT in water, agriculture, and livelihood) through PAR and local consultation have enhanced the linkages of the poor women and members of the Union Parishads for accessing resources and services from the government that are crucially important for climate risk reduction, livelihood protection and resilience. The LGIs heard the voice of the poor and socially marginalized groups and they have committed to support the most underserved and vulnerable groups in the climate hotspots. These may also contribute to empowerment of women and gender equity in the long run. Hence, the poor women would need further organizational capacity building supports for raising their voices and demanding their rights for adaptation, food security, WASH and health security. The LGIs and Union Parishads are to be made accountable to the poor women and socially marginalized groups, where the CBOs and right based organization can work hand in hand with the poor.

4.3 Capacity building for empowerment of poor women and scaling-up of the CCAT for GRA

The project has undertaken various capability and training initiatives at grassroots, regional and national levels that resulted in good outcomes in terms of skills, linkages and renewed commitments of the duty bearers for supporting the poor, women and socially disadvantaged communities in both the climate hotspots. The trainings modules were developed considering their needs and training was conducted using large posters with pictures and key messages. These were easily understandable for the poor women and marginalized groups where women UP members and the local officials of the DWA worked as facilitators. They discussed the climate change impacts, gendered vulnerability, and locally appropriate adaptation technologies to address the climate change impacts and promote resilient livelihoods. The training covered thousands of direct and indirect beneficiaries in four Upazilas of the two most climate-vulnerable districts. The knowledge and expertise exist with the community and actors for addressing the practical problems, where UP members and DWA officials are committed to working collectively.

The trainings with women stakeholders and LGIs were very instrumental in building capacity and enhancing the linkage of the poor and women with the government duty bearers and technology holders i.e., DAE and BADC for seeds and agricultural inputs for resilient crops and vegetables as well as DPHE for climate resilient WASH facilities. Further, the consultations with LGIs and women explored the environmental, social and institutional processes that exacerbate gendered vulnerability and inequity and identified the mechanism for scaling up gender-responsive adaptation and locally tested CCAT in

water, agriculture, and livelihoods. It is expected that the capacity building in the local institutions and the linkages established with an enhanced commitment of the LGIs will sustain to support the local adaptation.

The linkages between the LGIs and project beneficiaries have also enhanced greater access of the poor and women to the government's support, services and SSN that are crucially important for adaptation and DRR. This collaborative effort has been a relatively new initiative by the project and local partners, which may continue in the face of growing impacts of climate change in both ecosystems. We learned from each other on how to enhance socially transformative and locally appropriate CCAT and gender-responsive climate actions that climate reduce risks and build social resilience. The capacity building and engagement of youths in the regional universities (in Sylhet and Khulna) led by the ICCCAD and the University of Manitoba will also have sustained impacts on future research and advocacy on GRA and gender equity. The development of SAKTEE project webpage, enhancing knowledge network through organizing online workshop and seminars (G*obeshona* conferences and LHEs with the planning commission) have created opportunities for enhancing the capacity of the BCAS and ICCCAD team on knowledge management and advocacy to influence climate policy and actions.

4.4 Policy engagement and influence on Climate risk reduction, resilience and gender equity

Many of the activities of the SAKTEE Project, particularly the field research under the exploratory study could not be started on the initially scheduled time due to the travel restriction imposed during the COVID-19 pandemic. This has also delayed knowledge generation and subsequent advocacy with the government and actors. A number of the activities under the policy engagement were planned in year 2, but those could not be implemented because of COVID19 impacts and restrictions on movement and physical meetings in 2020 and 2021. The planned activities on creating space and policy engagement were mostly implemented in the year-3 and during the no-cost extension period of the project in 2022. So the project had to work in parallel with other activities with greater attention and engagement. Several meetings of the SAKTEE project with DWA and the project coordination committee were held in the year-3 of the project to share the findings of the action research project with key ministries and departments of the government.

The project coordination committee members have made a commitment to put forward the recommendations of the project. The MoEFCC found the recommendations on gender-responsive adaptations (GRA) were nicely aligned with the Bangladesh National Adaptation Plan (NAP, 2022-50). The MoDMR has found that the recommendations are supporting the National Disaster Management Plan (NDMP, 2015-2021). The DWA, DAE, DPHE and LGRD are also very keen to promote GRA with the support from Ministry of Planning and Ministry of Finance under the NAP process. Ms. Parvin Sultana, the Director General of the DWA of the MoWCA has renewed her commitment at the national stakeholder workshop to promote GRA in the climate affected areas. In line with the

project findings, they are promoting GRA and empowerment of women and most vulnerable groups in the coastal villages under their National Resilience Program (NRP) with supports from the UNDP.

The LHEs were organized under the Science-Policy Dialogue of ICCCAD and BCAS in Dhaka at the Planning Commission of the government of Bangladesh in July and September 2022. The LHEs were largely attended by the mid-level to senior government officials from the key ministries and representatives UN agencies and development agencies. The learning events highlighted on the importance of integration of gender equity and GRA in NDMP and Bangladesh Delta Plan 2100. Khan Md. Nurul Amin, Member of the GED of the Planning Commission and (the Chief Guest of the LHE, held on 28 September 2022) has informed that BDP210 is a living document and there is scope of integration GRA in the strategy and implementation plan of the BDP2100. We hope that the impacts of the policy engagement of SAKTEE project will emerge in the coming years in Bangladesh.

The national symposium and dialogue on the empowerment of women and gender equity, held on 26-27 October 2022 in Dhaka, was largely attended by women stakeholders, researchers, development practitioners, and government officials. An enabling environment was created for sharing the ideas and challenges of GRA, empowerment of women and gender equity. Emphasis was given on transformative social change through political commitment, ensuring meaningful participation of women, resources allocation and implementation of NAP, Bangladesh Climate Change Gender Action Plan (BccGAP) and NDMP of the GoB. An important knowledge-sharing and advocacy workshop of SAKTEE project was held in June 2022 with LDC Universities and an academic group led by ICCCAD and BCAS. The experts and participants expressed their concerns about the growing impacts of climate change in South Asia and African countries. Examples were shared about differentiated risks and vulnerability of women and socially excluded communities in the fragile mountain, floodplain and coastal ecosystems. It was also argued that the universities in the LDC and developing countries in the global South must advance research, knowledge co-generation, and advocacy on gendered vulnerability, GRA and gender equity. The academicians and participants expressed their interest to start academic courses and practical research on the topics. They are keen to engage youths and girls in gender equity discourse following the approach of the SAKTEE project.

4.5 The emerging outcomes in social, gender, institutional and environmental contexts

The action research project has generated different sets of immediate and long-term outcomes. These are reinforcing each other to achieve the social goal (transformative social change), empowerment of women and gender equity through knowledge generation and innovation of adaptation technology, capacity building, and engagement of actor and stakeholders. The exploratory research and PAR with a feminist approach have enhanced deeper understanding and analytical capacity of the poor women and actors that challenged the existing socio-political and institutional arrangement, social

norms and patriarchal values. In many cases, the poor and women can demand their rights and have greater access to support and services of the government in the project villages.

The demonstration of CCAT and piloting of gender-responsive adaptations (GRA) will reduce the risks and vulnerability, promote resilient livelihoods and thus contribute to gender equity and social resilience in the long run. However, the project has initiated the social and institutional process, where the local actors including the CBOs and women let organizations would have to continue the process. It is a longer-term process, and the SAKTEE project has laid down the foundation by attempting changes and influencing the "thought process" so that behaviour change can take place in the coming days.

The project implementation was severely impacted by the global COVID19 Pandemic in 2020 and 2021. The fieldwork for exploratory research, PAR technology selection and capacity building of the stakeholders could not be implemented in the planned time due to the frequent travel restrictions and growing health risks that also delayed the knowledge products and advocacy in years 2 and 3. To overcome the limitations, we started online and hybrid meetings and consultations with actors and stakeholders were held. The team gained new skills and adapted to the unknown and rapidly changing situations. The exploratory research and technology demonstration could have been done in a better way time-schedule-wise if the COVID Pandemic did not occur. The peer learning meetings of the IDRC and exchange visits could be done with a physical presence that might help the project teams and partners to learn in more effective and interactive ways from each other.

4.6 Key Recommendations for the Government, Local Actors and IDRC

Based on the exploratory research, PAR and consultations it is viewed that since the vulnerability of the poor, women and socially disadvantaged groups is increasing, more GRA and practical actions are to be undertaken for the most underserved and vulnerable groups. The relevant ministries, departments and LGIs have to take the initiative to implement GRA under the NAP and BccGAP. Access to resources, services and livelihood skills are to be enhanced for locally-led climate actions and GRA. The NGOs and CBOs may follow right based approach (RBA) for adaptation, DRR, and climate/social justice. Women are to enjoy greater social mobility, participation and decision-making power for implementing locally-led GRA. The adaptation and livelihood technologies must reduce climate risk without increasing further burden on them, which would need further participatory research and innovation.

One of the learnings of SAKTEE project is that it is very important to see the problems of women in their eyes with a gender lens and feminist research framework for empowerment, GRA, and transformative social change. It is strongly suggested that women’s concerns (differentiated vulnerability and growing inequity, G,RA and social/gender justice) are to be raised in different forums with government and actors for

urgent actions and justice besides awareness raising on the issues. Women's economic empowerment is also necessary along with GRA and DRR, where economic and livelihood actions are to be taken in environment/physical, social, gender relation and cultural contexts. The LGIs, NGOs, CBOs and research institutions may work collectively with the vulnerable community for planning and implementation of LLA & GRA. The right based organizations and women-led NGOs may support these initiatives.

Youth engagement is also crucially important for addressing the climate change and gendered vulnerability with locally led climate actions. They can work as active change agents in society and can influence policy and influence with their forcefulness and bold steps. However, the youths and girls would need further orientation, skills and resource support. The leading universities and academic institutions may constitute these initiatives with youths and their organizations. The DWA and the local actors are playing an important role in women's empowerment and they are promoting GRA and resilient livelihood actions in coastal zone and wetlands. The DWA is to be empowered further with more resources and authority. Women's leadership are to be supported for PAR, capacity building, lobbying and advocacy with government and actors. Further participatory and multi-disciplinary research and actions are to be initiated for the generation of evidence and response strategies for the poor, women and socially disadvantaged communities in the rapidly changing climate and its devastating impacts on society, economy, and ecosystems. Hence, the collaboration of DWA and DoE with the research organizations and NGOs is to be continued further in the context of the growing impacts of climate change in Bangladesh.

The findings and recommendations of the projects are to be integrated into the Bangladesh Climate Change Gender Action Plan (BccGAP), which is presently under revision. Further, a specific M&E framework is to be developed to measure the progress and impacts of gender-responsive climate actions with appropriate indicators. The IDRC may support the research consortium in the new and emerging areas of research and development challenges. The partnership for the collective journey towards gender equity and climate and social justice is to be widened and strengthened. BCAS, ICCCAD, the University of Manitoba, and the partners are committed to strengthening the partnership with actors and stakeholders for future collaboration on climate change and gender equality.

5. Conclusions and Recommendations

Overall, the activities of the SAKTEE Project that were implemented over a period of approximately four years have made significant contributions to new knowledge, awareness, capacity building, adaptation technology generation, and linkages by creating new grounds for improved understanding of the differentiated impacts of climate change at multiple levels – both horizontally and vertically. Horizontally, through the process of the Project activities, engagement of the local level stakeholders such as farmers, fishers and their associations, women groups, informal organizations of the vulnerable populations. They have become engaged in the planning and implementation of adaptation and resilient livelihood actions with the local governments. Similarly, university students, young scholars, and activists have become aware of the effects of climate change on society and their implications for future generations through their exposure to the literature, demonstrations, workshops, and social media outputs. The research and scholarly community have had the opportunity to engage with the policy- and decision-makers in various platforms and the dialogues helped in identifying the policy directions for empowering women and vulnerable groups. In terms of vertical impact and outcome of the Project, the Project successfully mobilized and facilitated interactions, knowledge, and skill exchanges among the local stakeholders and local government personnel; regional (district level) stakeholders, students and youths, and national level researchers and policymakers. These impacts of the Project have contributed to both quantitative and qualitative changes in climate adaptation planning actions at various governmental and other institutional levels.

The project achieved key outcomes relating to deeper understanding and awareness on gender-differentiated vulnerability and gender-responsive adaptation planning; ensured community participation in vulnerability assessment and addressing the knowledge gaps, local adaptation planning and innovative technology demonstration, identification of best practices in gender-responsive adaptation (GRA); policy advocacy and institutional & stakeholder's linkages for scaling up CCAT for adaptation and social resilience; capacity building on CCAT and resilient livelihoods through promotion of income generating activities (IGA) by the poor women; empowerment of the poor women to raise their voice to the local government and development agencies for their rights and demands; and strengthening partnership with communities and actors for addressing climate change impacts with LLA, GRA, and GAL approaches.

The G@W and IDRC supported the SAKTEE Project team to organize workshops on Climate Change & Gender Equity. The crystallized horizontal and vertical networks among various actors and institutions are likely to sustain in the foreseeable future, as the gender-responsive transformative adaptation technologies would bring about benefits to society at large as well as to the specific stakeholders. It is envisioned, with the breakthrough impact of the SAKTEE Project, there will be new initiatives for furthering the empowerment of women and disadvantaged groups through climate change adaptation activities in Bangladesh as well as in other low- and medium-income countries. The study

team has further identified a number of key research and development challenges and recommendations in the following areas:

- Exploring and deepening understanding of the interrelationships

Social and gender inequities in developing societies have historically been rooted in unequal distribution of ownership of production means, primarily land and other valuable tangible assets, colonial tenurial system, and its associated inheritance rights, leading to the perpetual vulnerability of certain poorer socioeconomic groups and women. In Bangladesh society, even after the independence of the territory from the Imperial British colonial power, it remained a subject of colonial exploitation and deprivation by the then-Pakistan state regimes. Despite a change in the governance of the state by the Bengalis as a result of Liberation War-led independence in 1971, and multi-stakeholders-initiated efforts to address the social vulnerability of the poor and women as well as indigenous peoples (locally known as "tribal peoples"), the issues remained a major challenge for development goals and achieving the SDGs. Climate change is bringing new threats and vulnerability to the millions of poor, women, and indigenous communities. These are to be tackled with the right policy, strategies, institution, and approach. The SAKTEE project findings are giving directives to address the emerging challenges.

The geographical and physical exposure and very high vulnerability of Bangladesh's coastal plains, floodplains and wetlands to natural hazards (that include period-high floods, riverbank erosion, cyclones and storm surges, droughts, and more recently landslides) are well recognized in global literature. Our empirical research in both the coastal and wetland regions has evidently revealed that recent changes in hydro-meteorological hazards as a result of climate change have created incremental vulnerability of the marginalized populations, as noted above. One of the major research implications of these findings is the need for the application of an integrative approach to climate change along with socioeconomic, socio-cultural and political structures and processes as these factors and processes are intertwined. Further understanding of these complex relationships and addressing them with specifically targeted interventions are therefore urgently necessary in all the climate-affected zones, where local government, community, researchers, and development agencies bust work collectively.

- Scaling-up innovative, locally-tested adaptation technologies

Our empirical research in Bangladesh's local communities, particularly in the coastal and wetland regions, has revealed that there is a critical shortage of local knowledge, innovation, and technologies "transfer pipeline" from the local to senior policy levels in the country. In addition, in the water and agricultural sectors, despite considerable success in enhancing production, the integration of local knowledge and learning with scientific approaches has not been fully materialized. Further research and implementation initiatives by the concerned stakeholders, national governments, and donor agencies should therefore be undertaken towards such integration, especially in the context of socially-transformative and acceptable adaptation technologies in both water and agricultural sectors.

- Supporting empowerment of women, youths, and poverty-stricken disadvantaged communities

Our research in Bangladesh's most climate-vulnerable regions has indicated that the mean of empowering women, the poor, and other marginalized groups can most effectively be materialized via socioeconomic uplifting through the means of gainful employment and enhancement of personal and household income. Planned adaptation and GRA are crucially important for ensuring resilient livelihoods and inclusive social development. In addition, institutional assistance by bridging institutions such as private sectors, NGOs, and CBOs, towards linking them with public and governance institutions (such as government departments) as well as market-based organizations can play a crucial role in developing their social capital and resilience to climate change. Appropriate policy initiatives and measures should therefore be taken to embody the above-mentioned interventions to support and empower women at large, the poor, and other marginalized peoples including the Indigenous populations.

- Engaging and informing policy and decision makers

In a democratic nation, pluralistic governance mechanisms and their effective implementation are seen to be vital for achieving SDGs and climate-resilient development. Transformation of the conventional public policy institutions is also crucial to innovate and adopt morally and ethically appropriate interventions, especially in the context of climate change and social vulnerabilities of the poor and women. Our research findings have affirmed that building trust-based partnerships among the stakeholders as well as among the governing institutions, with an inter-sectoral and trans-disciplinary approach (among DWA, DEA, DPHE, DDM, DoE and Planning Commission) are required for achieving the goal of adoption of locally appropriate climate change adaptation technologies as well as for various risk and vulnerability-reduction measures. Undertaking and nurturing sustained platforms for enabling institutional partnerships, exchanging knowledge products and resources, and transferring and scaling innovations (with GAL, GRA and LLA approaches) are therefore required further. The social and natural scientists with gender lens, feminist research and GAL approach may work collectively with policymakers and stakeholders. The SAKTEE project has developed and demonstrated a successful showcase example. The universities and research institutes in the country can take learning from the SAKTEE project and build further capacity and partnership in this regard.

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Appendices

Appendix-1: Key Activities under the Four Outcomes/Objectives for the Final Year (2021-22)

Key Outcomes	Key Activities
Outcome-1: Improved understanding of the dynamics of various key factors of differentiated vulnerability	Conduct exploratory research on determining climatic, environmental, social, cultural, economic, institutional and political factors that aggravate differentiated climate change impacts **on women in the coastal communities** in Sathkhira District
	Conduct exploratory research on determining climatic, environmental, social, cultural, economic, institutional and political factors that aggravate differentiated climate change impacts on **socioeconomically poor in the coastal communities** in Satkhira District
	Conduct exploratory research on climatic, environmental, social, cultural, economic, institutional and political factors that aggravate differentiated climate change impacts on **women in the wetland communities** in Sunamganj District.
	Conduct exploratory research on climatic, environmental, social, cultural, economic, institutional and political factors that aggravate differentiated climate change impacts on the **socioeconomically poor in the wetland communities** in Sunamganj District.
	Undertake Master's theses on **processes that aggravate differentiated climate change impacts on (a) women, and (b) socioeconomically poor in the coastal communities in Sathkhira** District (at ICCCAD/Khulna Science and Technology University, Independent University, Dhaka
	Undertake Master's theses on the ***effects of adaptation technologies on i) empowering women, and ii) other disadvantaged populations*** in the coastal communities in Sathkhira District (at the University of Manitoba, Canada)
	Undertake one **PhD thesis on the effects of adaptation technologies** on on i) empowering women, and ii) other disadvantaged populations in the wetland communities in Sunamganj District (at the University of Manitoba, Canada)
	Prepare 4 journal articles/papers on climatic, environmental, social, cultural, economic, institutional and political factors that aggravate differentiated climate change impacts, particularly on women, and disadvantaged groups, in the coastal and wetland communities of Bangladesh (targeting 2 national and 2 international peer reviewed OPEN-ACCESS journals)
	Prepare **policy briefs on differentiated climate change impacts o**n women and disadvantaged groups in vulnerable communities
Outcome-2: Identify and evaluate innovative climate change adaptation knowledge and technologies in water and agricultural sectors	Evaluate Climate Change Adaptation Technology (CCAT) by stakeholders
	Analyze and identify best practice evidence on socially-transformative adaptation technologies reducing gender and social inequities
	Develop demonstration schemes on Water and Agricultural sectors at each of the selected Upazilas
	Facilitate mobilization of adopter households by each of the trained beneficiaries
	Facilitate policy-institution dialogue at the regional level on adaptation technologies and reduction of social and gender inequity among adaptation technology professional & women stakeholders

Outcome-3: Enhanced awareness and capacity of the stakeholders at multiple institutional levels	Organize training workshops on adaptation technologies among poor women stakeholders in Sunamganj district at each selected Union Parishads
	Organize training for women Stakeholders in 2 Upazilas of Satkhira districts
	Organize training for women Stakeholders in 2 Upazilas of Sunamganj districts
	Use electronic media/regional radios & local cultural programs as platforms for knowledge dissemination and prepare a project webpage for knowledge dissemination and exchanges among the stakeholders
Outcome-4: Space created in national climate change adaptation policies and programs	Organize a meeting of the National Intersectoral Steering Committee, led by Ministry of Women and Children Affairs (MoWCA)
	Organize a pre-Gobeshona (Research) international conference policy-institution-practice dialogue with policy and decision makers
	Organize a day-long dialogue forum with Least Developed Countries Universities Consortium on Climate Change (LUCCC)
	Prepare a technical report for decision-and policy makers on Adaptation Technologies and Reduction of Social and Gender Inequities; and Organize a Symposium on Empowering Women for Enhancing Gender Equality
	Organize dialogues on Integration of climate change, gender and social equity in Bangladesh Delta Plan 2100 and National Plan for Disaster Management (NPDM) 2021 as part of the SAKTEE project's Knowledge Management Platform
	Project completion technical & narrative report

Appendix-2: Summary of the Theses prepared under the Exploratory Studies

Titles of the Theses & Names of the Students their Institutional affiliation

Titles of the Theses	Names of the Students
Analyzing differentiated Climate Change Impacts on Women in the Wetland Area: A Case Study on Sunamganj District- MS Thesis	**Md. Kazi. Rokonuzzaman**, Department of Disaster Resilience and Engineering at the Patuakhali Science and Technology University
Understanding the differential climate change impacts among impoverished and disadvantaged households in coastal Bangladesh: A case study on Satkhira district- MS Thesis	**Ms. AsmaUl Husna**, a Masters Student of the Urban and Rural Planning Discipline, Khulna University
Climate change impacts, responses and adaptation technologies in small-scale agriculture in coastal areas of Bangladesh: Gender Dimensions and Women's Perspectives- MS Thesis	**Ms Alvira Farheen Ria,** Natural Resources Institute, University of Manitoba, Canada
Climate Change and Its Impact on Women Vulnerabilities and Adaptation Technologies in The Coastal Region of Bangladesh: Shaymnagar- MSThesis	**Ms Dolon Champa Dutta**, Department of Economics, Jahangirnagar University
Differentiated Impacts of Climate Change and Agricultural Adaptation Technologies on Social Equity in Bangladesh: A Case of the Sunamganj Communities- PhD Thesis	**Md. Abul Kalam Azad**, Natural Resources Institute, University of Manitoba, Canada
Climate Change and Its Impact on Agricultural Vulnerabilities and Adaptation Technologies in the Flood Prone areas of Bangladesh: Dowarabazar – MS Thesis	**Refat Hasan**, Department of Economics, Jahangirnagar University
Gender Differentiated Vulnerability and Adaptation of Climate Change in North-western District Sunamganj	**Woakimul Islam Shakil**, Department of Economics, Jahangirnagar University
Adaptation to water use through adoption of technology in Satkhira communities in Bangladesh- MS Thesis	**M. Kamruzzaman Shehab**, Natural Resources Institute, University of Manitoba, Canada
The role of innovation and adaptation technologies in reducing climate-induced disaster impacts and enhancing resilience in Satkhira communities of Bangladesh- MS Thesis	**Sabbir Ahmed Khan**, Natural Resources Institute, University of Manitoba, Canada

Summary Findings:

Md. Kazi. Rokonuzzaman, Department of Disaster Resilience and Engineering at the Patuakhali Science and Technology University

Title: Analyzing Differentiated Climate Change Impacts on Women in the Wetland Area: A Case Study on Sunamganj District

Background of the study

Bangladesh has a dominant and harmful patriarchal societal structure with norms and practices that place females of any age at higher risks of violence (UN Women, 2020). In Bangladesh, men tend to control income distribution, property, access to credit, decision-making processes, and sources of food. Even in normal times, women lack social power and their condition is being aggravated by the increased demands on them (IDS, 2008). Gender inequalities manifest themselves in differing roles, resources, rights, knowledge, and time to adapt to climate change. Two-thirds of the total land of Bangladesh is classified as wetlands (Nanda et al., 2015). Which have been projected at 7 to 8 million hectares (Rahman et al., 2001). Sunamganj the wetland area of Bangladesh affected by climate change adversely especially of its unique geographic location (Rahman et al., 2016). The areas are affected by subversive flash floods frequently. Flash floods arise from intense storms dropping large amounts of rain within a short duration with little or no warning. Haors with their unique hydro-ecological characteristics are large bowl-shaped floodplain depressions located in the north-eastern region of Bangladesh (CEGIS, 2012). In the haor area, the socioeconomic and livelihood conditions are much different from the other parts of the country (Hossain et al., 2017). In terms of social indicators, the wetland region is characterized by overall notably low rates of literacy of the total population as compared with the national rate, a high incidence of water-borne disease, and very poor indicators. Under the prevailing social and economic circumstances, women are lagging far behind their male counterparts. Women usually have fewer assets and rights than men, are more vulnerable to loss of these assets and rights due to separation, divorce, or widowhood, and have less access to capital, extension, inputs, and resources (Antonopoulos and Floro 2005). The lack of services is highly gendered and disproportionately affects poor women whose legal status, race, and other intersecting social circumstances can exacerbate inequities and make women more vulnerable to climate shocks.

The Objectives

• To measure differentiated climate change impacts on women in wetland areas of Sunamganj district, Bangladesh

• To explore the dynamics of numerous factors that aggravate differentiated climate change impacts on women

Site selection for the research

Sunamganj district is located in the north-central region of the country, which is bounded to the east by Sylhet district. The area is 3,669.58 sq. km, located in between 24°34' and 25°12' north latitudes and in between 90°56' and 91°49' east longitudes. There are 15 villages of 6 unions under Dowarabazar and Jamalganj Upazilas of Sumanganj district were selected for the research.

Research approaches and methods

Community Disaster Resilience Index (CDRI) was used to measure differentiated climate change impact on women. The Community Disaster Resilience Index (CDRI) method is considered for quantitative and qualitative analysis that consists of five dimensions or capitals.

Data collection

Quantitative and qualitative data are accumulated through both primary and secondary sources for this study from the respective areas.

Primary data

• Household questionnaire
• Focus Group Discussion
• Key Informants Interview

Secondary data

To develop a conceptual basis of the study books, journals, articles, newspapers, abstracts, internet documents, Govt. office records, NGO office reports, records of union and Upazila Parishad office, and published reports have used as secondary sources of data.

Results and discussion

Socio economic status & Income generation

According to the field survey, climate change has a high impact on economic sectors in the study area. The monthly income is very low which is represented in the above graph. According to the research objectives, less than 3000 to 10,000 taka per month are poor, from 10,000 to 30,000 are middle class and more than 30,000 takas are considered as rich people. To the following statement, the maximum is at the level of poor class participants. Because about 62.56% contribution to income generations. Especially during calamities, there are no opportunities to women for income generation and completely dependent on others. Besides, a large group earning money per month from less than 3000 to a maximum of 15,000 takas is not enough to maintain the family. Only a few persons are in the middle and rich class and earn money from more than 10,000 to more than50,000 takas per month. Although most of the cases poor and middle-class people fight with climate vulnerabilities and a few rich people can cope with their resources sometimes.

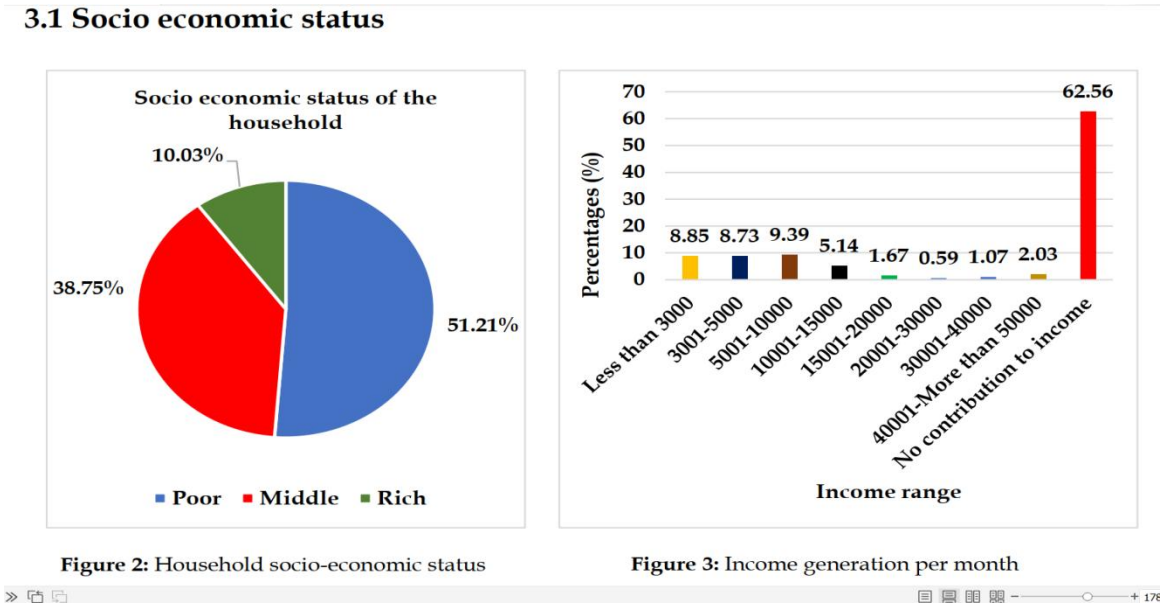
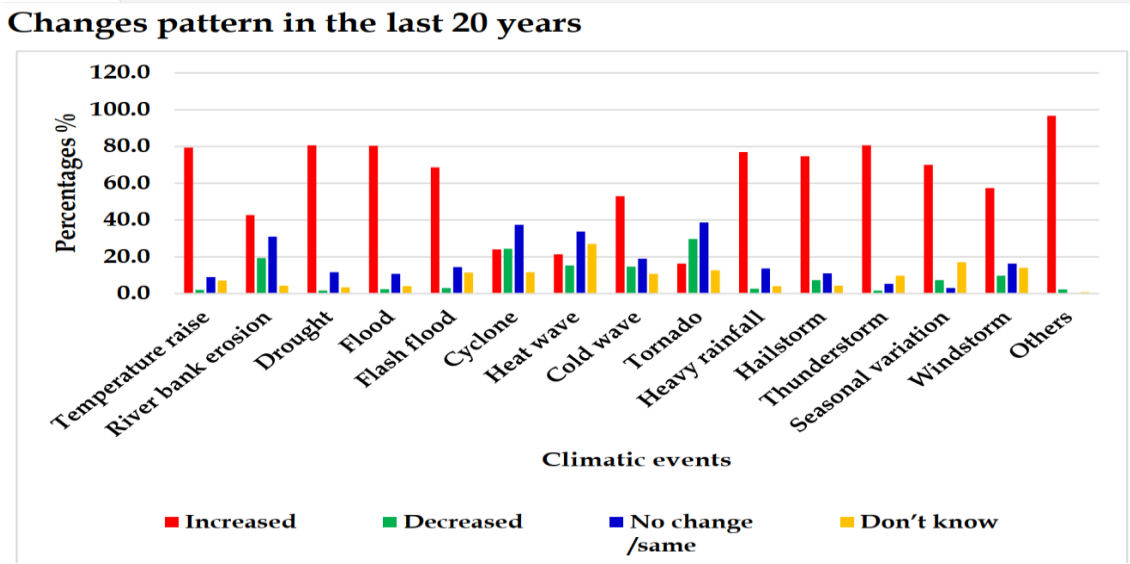


Figure 2: Household socio-economic status

Figure 3: Income generation per month



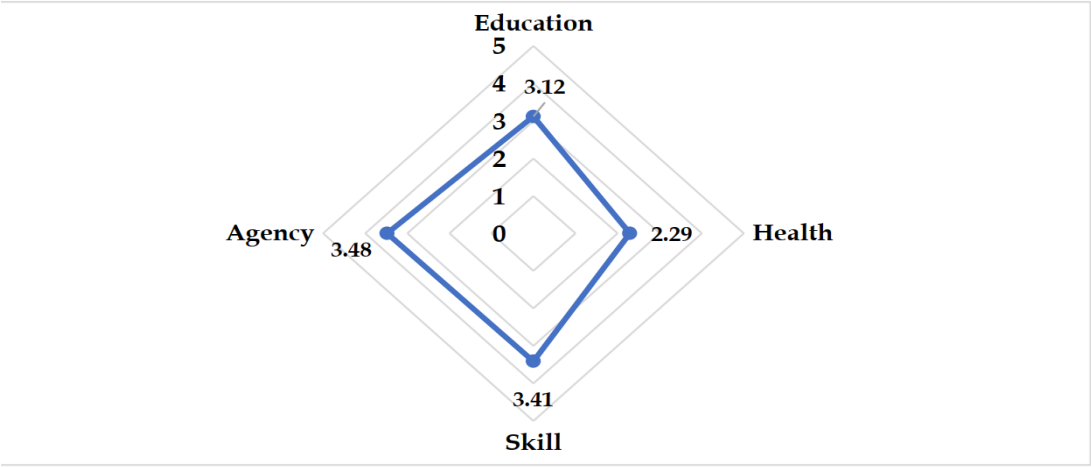


Figure 6: Impacts on women human capital

Overall climate change impacts on women

Social capital indicates that women in the study area are mostly affected due to social barriers and the ranking score is 3.54 which is the highest score in the research. From the research analysis, climate change impacts on the social sector within the weight between 3 to 4 and categorized as more than high impacts but less than a very high score. Social trust in women, networks, and norms are greatly affected due to climate change. Women are typically at higher risk than men in all cases like receiving education, health care, food intake. Women in this human capital is affected and the second highest score is 3.07 according to the study. Women's education, health, skills, and agency or decision-making severely breakdown due to climate stresses.

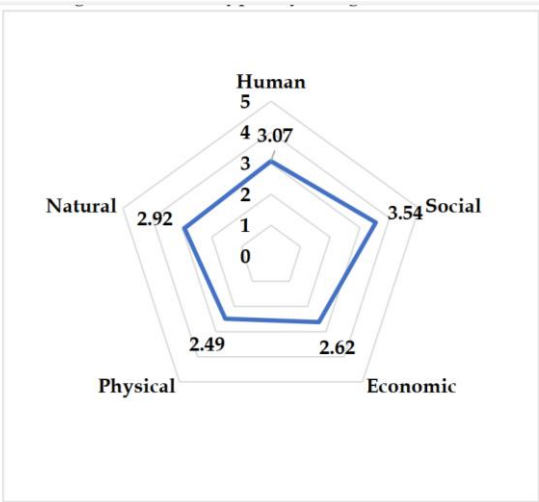


Figure 11: Overall climate change impacts on women capital

Although women can access
sometimes but cannot control
natural resources and other property
rights (Ribeiro and Chaúque, 2010).
The third impacted area on women is
natural capital and the score is 2.92
and it is medium type impacts. The natural capital includes water resources, forest resources, and ecosystem services and women get hampered moderately due to climate change. Wetland flood leads to reduce the farmer's economic condition that is mainly dependent on agriculture and other secondary occupations. Economic the fourth highest score of 2.62 and causes medium level climate change impacts on women livelihood than male household members. Economic wealth related to income, savings, and investment and women are not familiar with most cases. Climate induced flash flood in the wetland area affects settlement, agricultural production, road communication system and every year (Islam et al. 2010). In the study analysis, the moderate and fifth impacted area is shown for the physical capital of women and the score is 2.49 which involved the disruption of water, sanitation, and hygiene services and housing problems to women.

Conclusion

Generally, people living in haor areas are more vulnerable in terms of natural catastrophes of flood, flash flood, riverbank erosion, heavy rainfall, etc. The irregular natural events have severe impacts on women's income, livelihood options, education, health, infrastructure, assets, and skills. Besides, water table going down in dry season and 60% (according to field survey) of tube well under flood level during the rainy season. Water and fuel shortages are directly and indirectly affected by climate change on women. Pregnancy-related complications, different waterborne diseases like cholera, diarrhea, typhoid, skin diseases, menstrual health-related diseases, heart problem, alarzy for chili cultivation, etc. are common health diseases among women. During the flood, women do not go to the toilet for 6-7 days due to the inundation of toilets. Houses are also disrupted due to hailstorms and floods. In some cases, there is no educational institutions and health center at the community level and lack of the services makes women more vulnerable. Domestic violence in the summer season, higher-level migration for income generation both male and female are noticeable in the study area. People living in extreme poverty and to migrate other places due to the loss of property and sources of income.

Recommendations

From the field observations, data collection, and analysis, the following recommendations could be made for assessing differentiated vulnerabilities and in building women resiliency:

- Positive attitude to women and taking into consideration women in risk and resiliency for climatic disasters and policymaking and implementations
- Establishment of shelter near the agricultural field so that people can stay there during thunderstorms and hailstorm
- Ensuring equal rights on land acquisition for women

Ms. AsmaUl Husna, a Masters Student of the Urban and Rural Planning Discipline, Khulna University

Title: Understanding Differential Climate Change Impacts Among Impoverished and Disadvantaged Households In Coastal Bangladesh: A Case Study On Satkhira District

Background and context: Bangladesh is considered the most vulnerable country in the world to tropical cyclones and the sixth most vulnerable country to floods (*UNDP Annual Report 2004* , n.d.). Average temperature shows an increasing trend, especially during the monsoon season (June-August) at 0.07°C per decade and during early winter (September-November) at 0.12°C per decade. Sea level rise has been one of the factors that led to an increase in soil salinity in Bangladesh, from 1.5 million hectares under mild salinity in 1973 to 3 million in 2007 (Khatun & Islam, 2010)). Extreme events in Bangladesh, such as cyclones and floods, will be both heavier and more frequent (Thomas et al., 2013). Floods will not only be more frequent and cover a larger area of land, but inundation depth will also increase significantly in most of the country.

Vulnerability: The IPCC (2001)(Agassiz, n.d.) Considered vulnerability as a system's susceptibility to changes, and its ability to cope or adjust. It defines vulnerability as a function of exposure, sensitivity, and adaptive capacity. Exposure is defined as 'the degree, duration and/or extent to which a system is in contact with, or subject to, perturbation' (Kasperson R.E et al., n.d.). (Brenkert & Malone, 2005) defined exposure as the nature and extent of changes that a region's climate is subject to, with regard to variables such as temperature, precipitation, extreme weather events, and sea-level rise. Exposure is location-dependent. Sensitivity is defined as 'the degree to which a system is affected either adversely or beneficially by climate-related stimuli' (Agassiz, n.d.). Adaptive capacity is 'the ability of a system to adjust or adapt to climate change (including climate variability and extremes), to moderate potential damages, to take advantage of opportunities, or to cope with the consequences' ((*AR5 Climate Change 2014: Impacts, Adaptation, and Vulnerability — IPCC*, n.d.).

To understand the economic disparity extensive literatures are reviewed which shows cost of daily daily basic needs can be a standard. In Household Income and Expenditure Survey 2016 calculate the food poverty line using composite price indices about 2122 Kcal. per person per day (*(HIES) (2005-2016)*, n.d.)). The average cost of 2122 cal. per person per month is about 2268 taka per person per month which is considered a lower poverty line in this research, and the international poverty line of 1.90$ (160 Tk.) per person per day is considered as the upper poverty line.

Study area location: Kaliganj and Shyamnagar Upazila have been chosen for this research as it becomes the most affected region whenever we experienced any climatic disaster, the output of climate change. Both are the Upazila of Satkhira District in the Division of Khulna, Bangladesh. Both are nearly located at 22.3306°N 89.1028°E (Figure-1). It is bordered by the Sundarbans and Bay of Bengal to the south, Koyra and Assasuni Upazilas to the east, and the Indian state of West Bengal to the west. Kaliganj and Shymnagar are coastal Upazila of Satkhira, which is badly affected by cyclones, salinity, tidal floods, sea-level rise, waterlogging, and other climate stimuli such as temperature rise, heat stress, drought, erratic rainfall, and changes in seasonal patterns. Total 12 numbers of villages under these 2 Upazila will be covered under this study (Table-2). This study will explore the disaster management intervention of differentiated climate change impacts on impoverished and disadvantaged households.

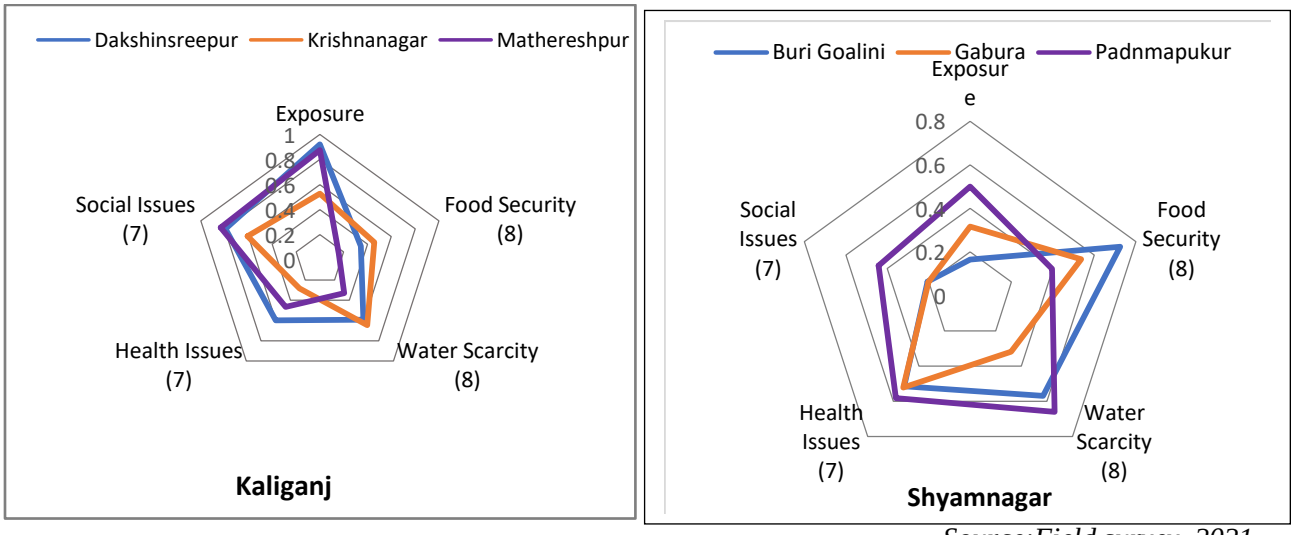
Target group: The target group for data collection is impoverished groups living below the poverty line at the selected unions; Buri Goalini, Gabura, Pdnmapukur, Dakshinsreepur, Krishnanagr, Mathereshpur. The data is collected from the different-impoverished community. The impoverished community is defined as a monthly income below 4700 takas per person in a household. The respondent covers both male and female-dominated households. As gender-responsive planning is significant to understand the impacts of climate change, the data collection covers both male and female-dominated households. Therefore, the study covers the specific roles both females and males are playing to adapt themselves.

Justification of Study Area

Kaligonj and Shyamnagar Upazila are the most coastal Upazila of Bangladesh. The people of this Upazila mainly depend on fisheries activity and the resource of Sundarbans for their livelihood. Climate-induced hazards such as extreme cyclones, tidal surges, severe floods, river erosion, excessive rainfall, and high salinity intrusion are taking place more frequently in this area. Due to the geography of these unions, it is considered to be more vulnerable to the effect of climate change and less resilient and prepared for extreme weather events. These Upazila are more dynamic and representative for the research of vulnerability and resilience of coastal people in the context of climate change; therefore, this was the reason behind selecting these two Upazila as study areas.

Key Findings: This study focus on profiling the differentiated impact be climate change induced disaster in terms of differentiated vulnerability. Vulnerability is illustrated by degree of susceptibility of the community and adaptive capacity (resilience) to hazardous events induced by climate change. Evaluation of differential climate change effects at the union level demonstrates how different factors contribute to the major components of vulnerability. This chapter also mentions, why spatial variation takes place due to the effects of climate change depending on the sensitivity and adaptive capacity of the vulnerable groups. Finally, LVI demonstrates key difference to impact of climate change.

Exposure and susceptibility: Here, the Livelihood vulnerability Indexing score for major components is preferred at six unions. This chapter focus to clarify the spatial variation for the factors of vulnerability at union level.



Source:Field survey, 2021

Figure-*1*: Comparing LVI major components (susceptibility) among the communities

Exposure: Firstly, people in kaliganj (Krishnagar, Dakshinsreepur, and Mathereshpur) have responded highly towards confronting hazardous events like drought, flood, heatwave, cold waves due to climate

change. Whereas, in Shyamnagar Upazila (Buri Goalini, Gabura, Padnmapukur) salinity and storm surge effects are higher than that in kaliganj.

Food security: In regards to food security, due to high salinity intrusion and effects of cyclone, Shyamnagar Upazila; particularly, Buri Goalini and Gabura, facing agriculture and fish-production loss that leads to food insecurity as well as unemployment. Whereas, Kaliganj people lived by small jobs and labor force**.**

Water scarcity: In concern to water scarcity, the water crisis is one of the major problems both Shyamnagar and kaliganj. Buri Goalini, Krishnagar, Dakhinsreepur, Padnmapukur have higher vulnerability. Nevertheless, the respondent preferred that Buri Goalini and padnmapukur are vastly affected after storm surge due to surface water pollution. Hence, they are to walk along the long distance to collect drinking water than that in kaliganj.

Health problem: Health issues exist all around the area. Due to emerging-unexpected events like drought, variation wind flow, cold wave, salinity, water crisis, and water pollution different types of diseases have prevailed, such as waterborne, cardiac, skin, feminine. All this results in rising treatment costs in climate change-affected areas.

Social issues: Dakshinsreepur, Mathershpur, Krishnagar union in kaliganj are vastly dependent on the smaller labor-based job. Hence, the community faces transitional poverty regarding climate change-induced disaster. Their poverty leads to create social strain, like early marriage, child labor, hampering child education to relax the financial situation.

Figure-2: Adaptive capacity (Resilience):

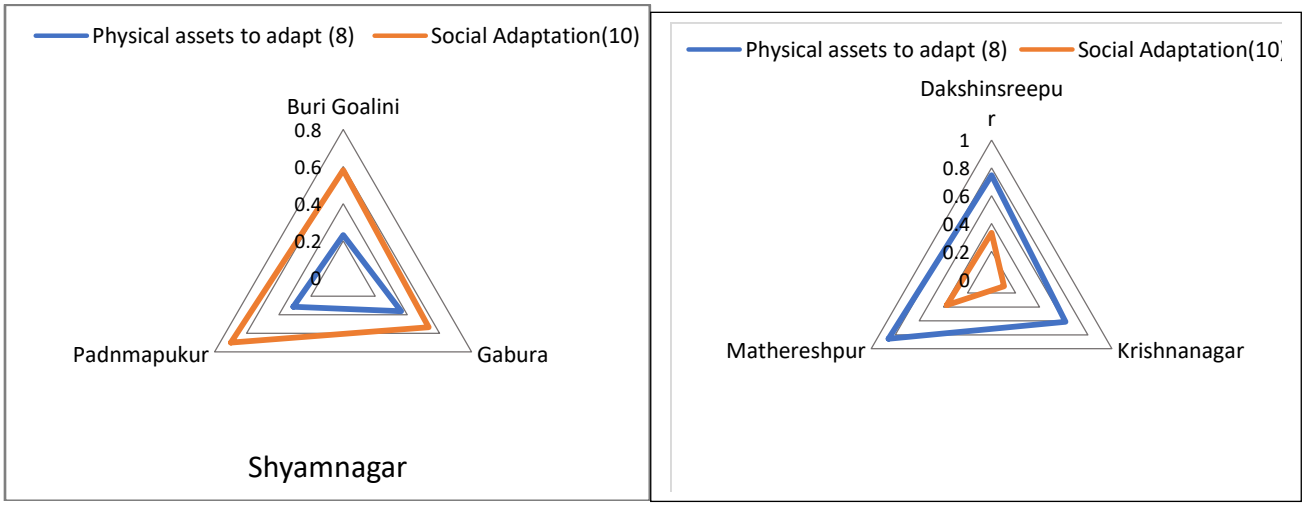
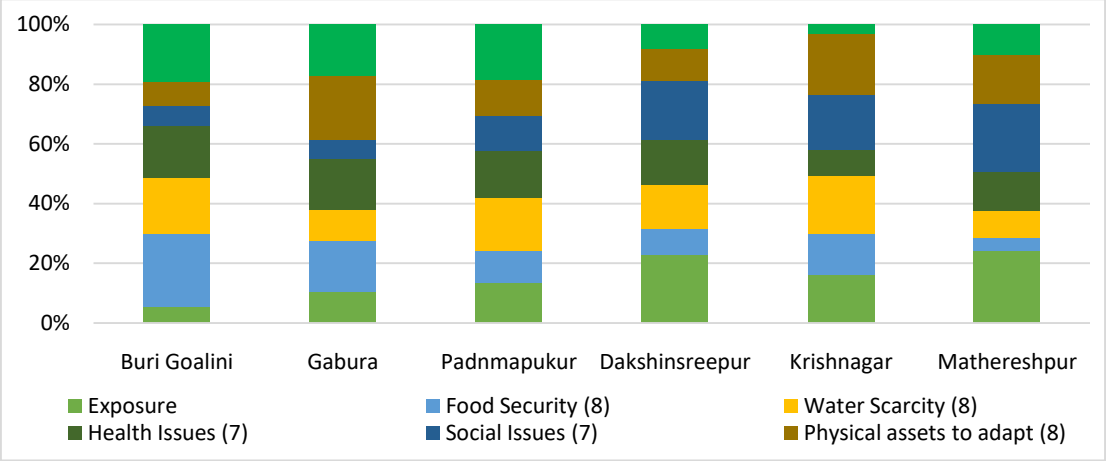


Figure 1 : Comparing LVI major components (resilience) among the communities Source: Field *survey, 2021*

Adaptation with physical assets: The charts demonstrate that the community in Kaliganj Upazila has a poor adaptive capacity to get back into normal life. Because of the greater impact of the cyclone, the affected community in Padnmapukur, Gabura union are the victim of poor housing and sanitation. They are habituated by living with disaster despite People are to walk for long distances or pay a high price to get water. The people in kaliganj are less likely to struggle to cultivate land or survive in worst conditions than that in Shyamnagar. In most cases, they are dependent on a small job in kaliganj. Hence, the situation becomes pathetic after a disaster due to income loss. On top of that, the community in Mathershpur and Krishnanagar unions are the victim of river erosion that leads to poor adaptive capacity with extreme land and cultivation loss. Again, corruption by the local union members is also responsible for not assisting the victims in time.

Social adaptation: In Buri Goalini, Gabura, and Padnmapukur union, proximity to distance is a prime factor to define physical adaptation. Due to a poor communication system, the people have weak access to government projects, community support as well as support from NGOs. People take loans from informal loan providers to survive an emergency. Some communities are desperately marginalized to get support enough from the union center that is given by national or international aid. A large number of marginal communities are isolated from national communication, who dependent upon Sundarban. On the contrary, Mathereshpur union people are less likely to join community programs and also the victim of corruption by local union members. In fact, in Kaliganj Upazila, proper road communication creates social bonding that assists them as a socially resilient community to survive.

Figure-3: Evaluate the vulnerability at Union level



Source: Field survey, 2021

The graph presents the contribution of vulnerability factors in LVI score at the union level. Different components create spatial variation in contributing to vulnerability. In the case of kaliganj Upazila (Dakshinsreepur, Krishnagar, Mathereshpur) high exposure to socks, social issues, and health issues are major contributors to vulnerability. Whereas in Shyamnagar (Buri Goalini, Gabura, Padnmapukur), problems in social adaptation and food insecurity are the major contributors. On the other hand, the problem of water scarcity exists both in Shyamnagar and Kaliganj Upazila.

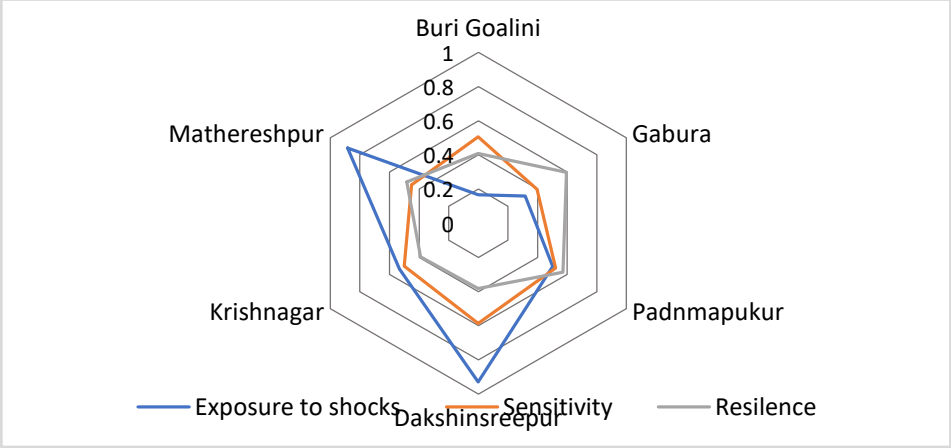


Figure-4: Major dimensions of vulnerability at union level. *Source: Field survey, 2021*

Major LVI dimensions are preferred considering the major components of vulnerability, such as exposure to socks, sensitivity, and adaptive capacity. Exposure to socks is high in Mathereshpur and Dakshinsreepur. In regards to sensitivity, Buri Goalini, Padnmapukur, Dakshinsreepur, Krishnagar union are sensitive to climate change-induced disasters. Finally, Gabura and Padnmapukur have poor adaptive capacity compared with other unions. The detailed illustration of spatial variation in LVI dimensions is described in this research.

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Thesis title: ***Climate change impacts, responses and adaptation technologies in small-scale agriculture in coastal areas of Bangladesh: Gender and women's perspectives***

Background and Context

Bangladesh ranks 7th on the Global Watch's Climate Risk Index 2021, with the majority of its land less than 10m above sea level and having experienced 8 cyclonic events in the past decade alone (Eckstein et al., 2021, Rabbani et al., 2021). During 1976 to 2019, Bangladesh had an average rise in temperature of 0.5°C, which is expected to up to 1.5°C by 2050 (Mahmud et al., 2021). The country is also projected to experience an annual increase in rainfall of 74 mm between the period of 2040 and 2059 (Mahmud et al., 2021). Moreover, salinity intrusion is a major problem affecting 37% of its coastal regions, with the rate of salt affected land increasing at 146km2/year, as per 2010 data from the Soil Resource Development Institute in Bangladesh (Jalal et al., 2021)

Satkhira, a coastal district in Bangladesh, is one such high climate risk area which experienced 603.15 million USD in climate change losses during 2009 - 2014 that affected 24.65% of its population (Rahman et al.,2022). Major sources of income in Satkhira are climate-sensitive and include farming, shrimp farming, and fisheries with 62.56% of its population involved in the agriculture sector alone (Rahman & Ferdous, 2018). The district has a multidimensional poverty rate of 23.42 % and an extreme poverty headcount of 9.3% (BBS, 2013). This study is based on the Kaliganj sub-district of Satkhira, which is located in the southwest region of Bangladesh, surrounded by the district of Jessore on the North, Khulna on the East, the Bay of Bengal on the South and India on the West (BBS, 2013). With an area of 333.78 km2, the Kaliganj is bounded by Shyamnagar upazila on its south, the Assasuni upazila on its east, the Debhata and Assassuni upazilas on its north and West Bengal, India on its West (Pitol, 2020; BBS, 2013).

Due to its geographical location, frequent exposure to cyclones, socioeconomic conditions and climate dependent livelihoods, the study area experiences the brunt of climate change impacts. According to the Population and Housing Census 2022 Preliminary report, 49.76% of Satkhira's population is male and 50.2% is female, with higher male literacy rates at 78.57% and female literacy rates at 71.94%. The majority of its population is Muslim (84.25%), while 15.34% are Hindu and 0.28% are Christian (BBS, 2022). Rural women, minorities and poor populations in

these regions are particularly vulnerable groups experiencing disproportionate impacts of climate change due to existing societal inequalities and intersecting factors such as poverty, marginalization and low socio-economic standing (Reggers, 2019). However, women also play important roles in the climate change adaptation process, especially in the agriculture sector, and have gender-specific needs that need to be addressed.

Scoping and Objectives: This research explores the pronounced climate change impacts on the marginalized groups of the coastal region of Kalganj, Satkhira, with a focus on gender disparities. It also delves into women's role in local climate change adaptation activities while exploring local agricultural technologies and methods that are used to cope with climate change impacts.

Methods: This study followed a mixed method approach using focus group discussions (FGDs), key informant interviews (KIIs), household surveys and observations. The following is a breakdown of the data collection methods -

- 358 household surveys were conducted in Manpur village of Krishnanagar Union and Berakhali village of Dakkhin Sreepur Union in Kaliganj, where 308 households were randomly selected and 50 female headed households were purposely selected.
- 9 FGDs were conducted in Kaliganj with - i) minority groups (two), ii) people involved in agricultural work (two mixed and two with women), iii) people involved in fishing activities (one with fishermen and one with women involved in fishing activities) and iii) people involved in other livelihoods (one mixed).
- 25 KIIs were conducted with government officials, NGO workers and representatives of minority and marginalized communities.

Major Findings and Observations

Agriculture and Adaptation

Erratic rainfall, drought, temperature and humidity changes, salinity intrusion and changing seasonal patterns lead to crop losses and reduced agricultural yield, sometimes also increasing farmers' reliance on store bought rice and vegetables for consumption. Farmers suffer from reduced income and investment losses and incur additional expenses in the form of irrigation and agricultural input costs. To cope, most farmers take loans, and some locals migrate for 6 months every year to work in brick fields, which pays more than agricultural work. Many farmers have gotten involved in shrimp farming due to its saline friendly nature and economic benefits, where they also grow vegetables like tomatoes, gourd and taro root on the aisles of the shrimp enclosures (*ghers*).

To adapt to the lack of water availability, locals use shallow tube wells, pump machine, pond water and rainwater harvesting for irrigation purposes. Some dig large holes in the ground beside fields that can store water when it rains, and use this water for irrigation. To deal with waterlogging, farmers create drainage systems in their fields and use raised bed farming as it

allows water to pass easily. Other adaptations include use of the "Machan" method, where vegetables are grown on bamboo structures set up over other vegetable/crop beds, so that the vegetables do not touch the water if there is waterlogging, and more can be grown in limited space. The "Bosta" (sac) method is also popular, where vegetables and ginger are grown in sacs containing mixtures of soil and fertilizer, which can easily be placed in their small homestead spaces. Some people also grow vegetables like pumpkins on their thatched rooftops (Picture 1). These methods are important as land loss and damage to cultivable land is a major impact of climate change, and helps locals to use all available space, earn an extra income and feed themselves.

Farmers have rely heavily on salt tolerant varieties of crops like BRRI 67 (salt tolerance 8dS/m), BINA Dhan 10 (salt tolerance 10-12 dS/m) and BRRI 47 (salt tolerance 6dS/m), waterlogging tolerant varieties such as BRRI Dhan 52, BRRI Dhan 85 and BRRI Dhan 51 and high yielding crop varieties such as BRRI Dhan 22 and BRRI Dhan 33. Another adaptation used by farmers is opting for crops that grow during a shorter period of time, and give high yield such as BRRI Dhan 49 and BINA Dhaan 7, to make use of the time when there is less salinity in the soil and water. Furthermore, they change the schedule of sowing according to seasonal expectations, and use early sowing seeds to avoid the risk of floods, such as BRRI Dhan 22 and BRRI Dhan 33

A popular local adaptation method also involves adding sugar water to soil, whenever farmers sense that the soil is getting too dry and saline. According to them, this sugar water with Gypsum brings a visible change to crops and vegetables, which would otherwise wilt. However, expert key informants do not agree and attribute it to other factors like the use of gypsum and rain/irrigation.

Exacerbated Impacts on Poor, Women and Minorities

Poor people often suffer from greater losses due to climate change in comparison to the rich, when considering losses in proportion to their already limited wealth (Hallegette & Rozenberg, 2017). Survey results reveal that in the past 20 years, the majority of households experiencing very severe to severe damages were poor (8.54% and 30.25 %), while rich households experienced the least severity of impacts (Fig 1).

Moreover, among respondents stated their house was damaged by the recent Cyclone Amphan in 2020, 57.41 % belonged to poor households, 35.93% belonged to middle income households and 6.67% belonged to rich households (Fig 2). Qualitative findings also reveal that poor suffer more from drinking water problems as they cannot afford to buy water or have it delivered. Instead, they have to take the extra effort and time from their day to pick water up from free sources farther away.

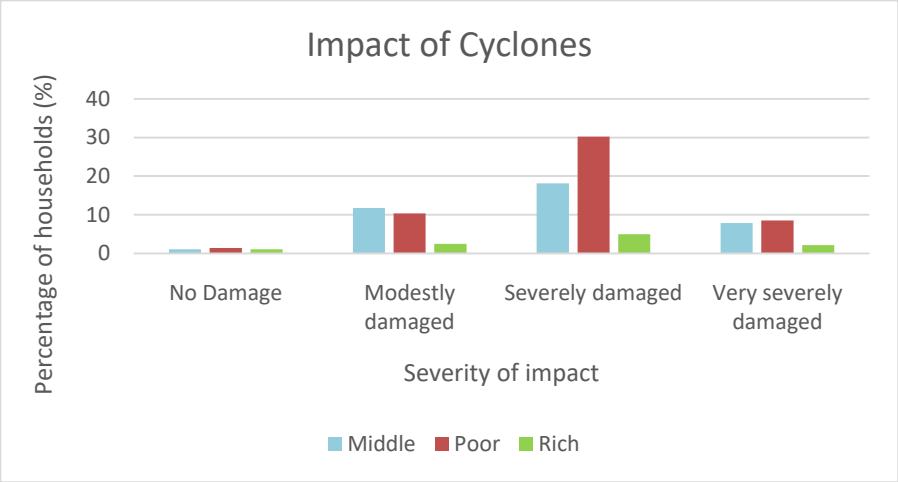

Figure 1: Severity of cyclone impact experience in the last 20 years based on household socioeconomic status

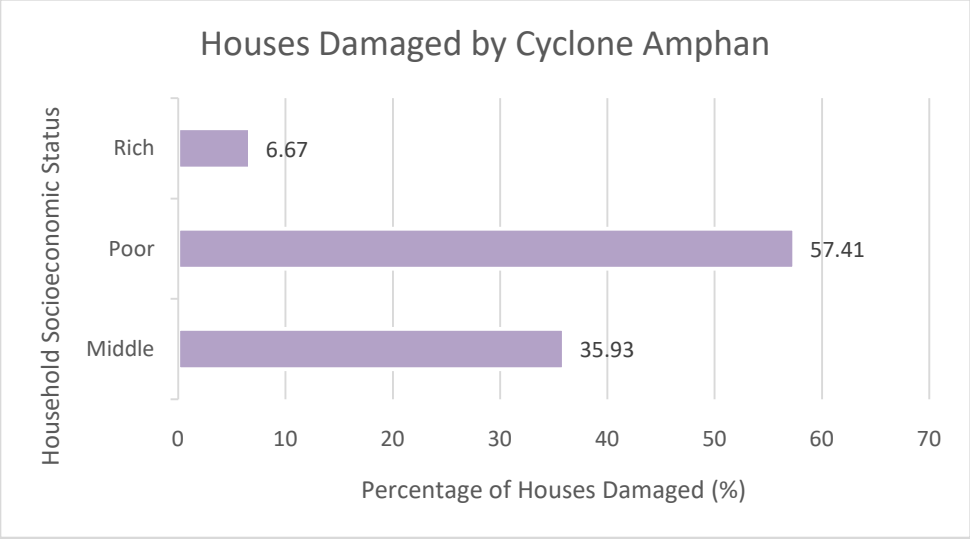

Figure 2: Number of houses damaged by cyclone Amphan based on household socioeconomic status

Women also tend to experience more pronounced impacts due to gender roles, responsibilities and existing gender inequalities, which is made worse by intersecting factors such as poverty and age (Reggers, 2019). For instance, although men can cycle to collect water, women have to walk that same distance carrying pots, where younger girls are sometimes eve-teased on the way. Women omen tend to prioritize their kids and husbands and eat and drink less when there is a shortage of food or water is running out. On the other hand, elderly widows involved in agriculture find it difficult to cope with the costs of climate change and to arrange irrigation, agricultural inputs from the market and sell their produce, and have to hire labour for help. To afford these expenses these widowed women, as well as other women who need additional

income, work as wage labourers in shrimp enclosures. However, although men and women do the same work of picking out algae from the shrimp enclosures and for the same number of hours, women's wages are Tk 100/200 (0.97/1.95 USD), while men's wages are Tk 200/300 (1.95/2.92 USD).

In Kaliganj, lower caste Hindu communities such as the Rishi community are minorities at a disadvantaged position. They tend to stick to their traditional work, or low wage occupations, such as producing bamboo products and handicrafts (*bash bet er kaaj*), shoe repairers, hairdressers, wage labourers and goat rearing. These communities find it difficult to move away from their traditional occupations as they don't have enough capital. It is also more difficult for them to get larger loans to cope with climate change impacts on their bamboo business and other livelihoods as they do not have official documents for land or money in their banks to show the microcredit organizations. From this study, it was also observed that there are some resource conflicts and climate change impacts like salinity intrusion make the situation worse. Inability to use the same pond as Muslims for bathes and washing dishes have created many problems for these communities One such community has to take bathes in the surrounding shrimp enclosures (*ghers*) which are saline, or canals (*khals)*, which have dirty water and have been giving them skin diseases. These issues with water and bathng are particularly difficult for women, especially during menstruation, and many have said they experience infections, itching and swelling in their private regions.

Women's Roles in Agriculture and Adaptation

Women play active roles in agriculture, either working with their husbands in their own farms and rented farmlands *(borga jomi*) or as wage labourers. They are typically involved in transplanting, weeding, thinning, helping with drainage of water, winnowing, drying of grains, and packaging. Some women also partake in adding fertilizer to vegetable gardens. When women work alongside husbands, it saves the agricultural labour expenses for the household. Female wage labourers get paid Tk. 300 (2.92 USD), which is less than men labourers' wages of Tk. 500/600 (4.87/5.84 USD), despite working the same hours, as it is believed men work faster in the same tasks and often do the more difficult and strength requiring tasks.

The machines used in agriculture are not gender friendly and according to a key informant from the government, this concept is not considered at all when designing agricultural machines. For instance, spraying machines require carrying 15litres of chemical mix on the back, which is too heavy for women. Irrigation pumps are difficult to operate for women, especially the ones that require oil as an input. Meter irrigation devices that only need a switch to be turned on are easier to use, however they are more expensive and require electricity. Power tillers and crop cutting machines are also difficult to use and require skill and strength. Although there are some gender friendly machines like the Japanese weed cutter, farmers would rather have family members do the task than spend extra money on it.

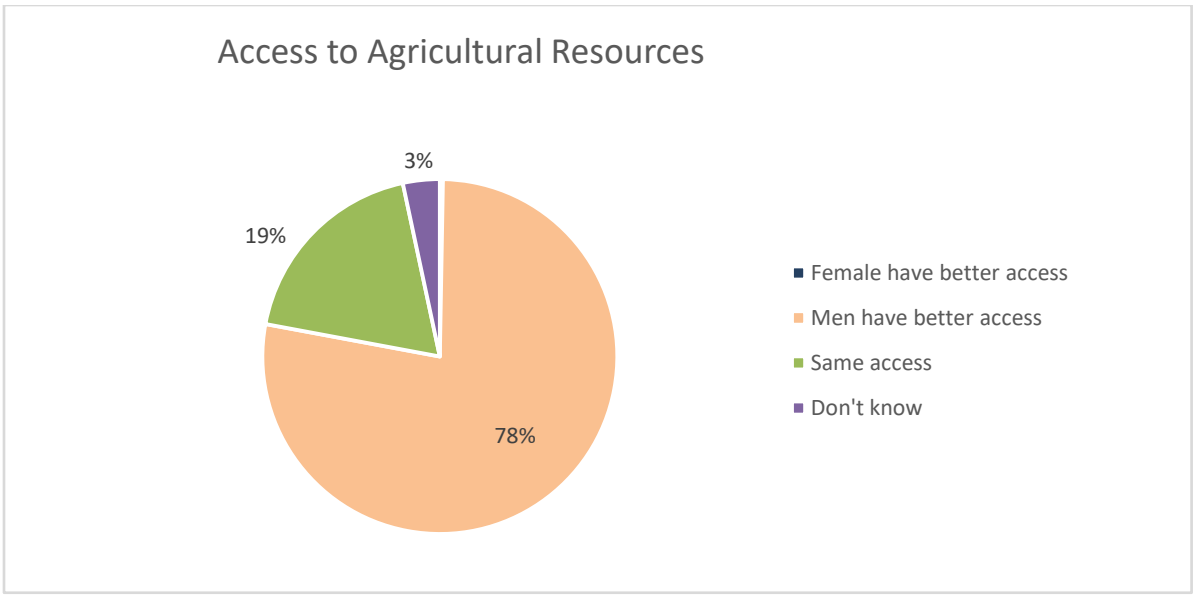

Figure 2: Perception of access to agricultural resources

In this study's survey, it was found that most respondents (78%) thought that males had better access to agricultural resources, while 19% believed both genders had equal access (Fig 2). Also, only 5% of households are aware of agricultural technological trainings and skill trainings targeted towards women from the government. However, information from key informants reveals that workshops and programmes from the government have a requirement of having 30 to 33% women participants. Among lead farmers, who are the local contact points for officials when distributing resources and gathering farmers for training purposes, there are also a few women employed. Although women are encouraged to come to trainings, in reality, this mandate is not always met, with women's names being added from the household, but men attending instead. This may be due to factors such as a lack of interest from women, household chores and the notion that men would benefit more from the information, among others. Trainings provided for women are often based on additional income generating activities (IGA) and post-harvest productions, rather than agricultural skillsets and technical training.

It should however be noted that majority of loans taken from NGOs and governments are given only under the name of women, which enables them to play a significant role in one of the major coping strategy for climate change impacts, especially for agriculture. Moreover, women's additional income earning strategies like making pickles, and rearing livestock, also serve as an adaptation strategy.

Conclusions and Recommendations

Although climate change impacts do not discriminate, societal inequalities cause disproportionate impacts on certain disadvantaged groups of people. Apart from income, other factors like gender, age and minority backgrounds can also shape vulnerability to climate change. Women (especially widows), minorities and poor are the greatest sufferers, and need extra support from NGOs and government to cope with climate change. These supports need to be sustainable and transformational and not just short-term. They should focus on empowering

and educating these marginalized communities, and involving them on a grassroots level in policy implementation.

Furthermore, women are not just victims in climate change discussion—they are also active actors and contributors to the adaptation processes, especially in the agriculture sector. There is a need for climate change interventions and agricultural adaptaion technology to be more gender friendly and affordable. Alongside male farmers, their spouses and other women involved in agriculture should also be given technical training and information on agricultural practices. Moreover, the gender pay gap in labour and agriculture should be addressed, and more village level agricultural clubs and committees should be formed for collective community improvement. Access to safe drinking water and salinity intrusion is a pressing issue in Kaliganj that is affecting the quality of life of people, which needs to be addressed urgently. More funds need to be delegated to installing drinking water sources like tube wells and rainwater harvesting tanks, and communities need to be engaged to ensure everybody has equal access.

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Title: Climate Change and Its Impact on Women Vulnerabilities and Adaptation Technologies in The Costal Region of Bangladesh: Shaymnagar

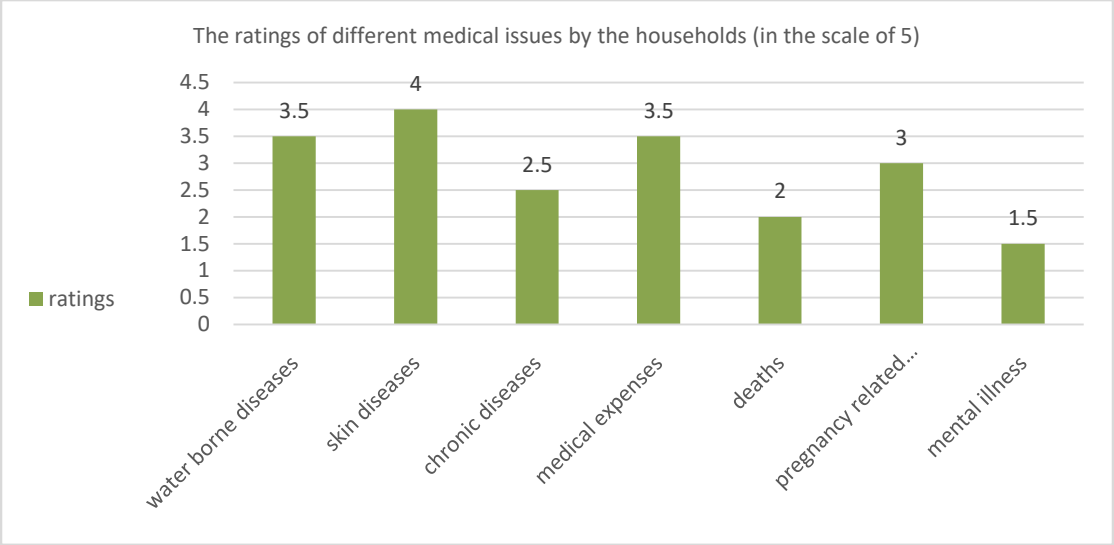
Bangladesh is a small low-lying deltaic country in south Asia. The geographical position and man-made factors collide the country with different natural hazards and water-related extreme events. This country is frequently referred to as one of the most vulnerable countries to climate change. Climate change is acted as a fate decisive factor in South Asia as well as in Bangladesh. Previous studies illustrated mounting pieces of evidence that the change of climate impacts the increasing number of natural hazards like floods, cyclones, sea-level rise, river erosion, and rainfall variability in the country (IPCC, 2022). The study aims to analyze the impact of climate change in one of the most vulnerable areas of Bangladesh. The cope-up technologies, the strategies and other factors which lead to achieve climate resilience will be discussed in the paper.

Climate changes and vulnerabilities have a strong relationship. Economically Bangladesh is under the group of Least Developed Countries. It is one of those 100 countries which are most vulnerable in climate change. (Huq, 2007). In the South western region Shaymnagar Upazaila is one of the most affected areas. Tropical cyclones and coastal erosion are the two primary natural threats. The UNDP report also mentions the devastative impact of tropical cyclone on Bangladesh (BCCSAP, 2009, p. 25). The effect did not only change human livelihood but also the mangroves (impact score 0.62). The upazila of Shaymnagar received a score of 0.77 on a scale of 0 to 1 for the number of persons affected by natural disasters. (Goosen, et al., 2008, p. 158). Due to the climate change issues government also take preventive measures to reduce the impact. The government has a roadmap to follow climate action in Bangladesh. It is known as Bangladesh Climate Change Strategy and Action Plan (BCCSAP). As per BCCSAP there are six pillars of climate action in Bangladesh. The first pillar is ‘food security, social protection and health’. This pillar is very significant for the vulnerable groups like women. The social protection or security means the secured livelihood of the people, safe drinking water and services (BCCSAP, 2009). But in Bangladesh, women are primarily restricted from accessing property, money, and food production. Females are shown as managing food production rather than being its producers. The cultural gap is overlooked in the BCCSAP. As a result, the policy guidelines must take into account how women's groups can access various services and properties (Neelormi, 2015, p. 19).

Research Approach: This is mixed-method research, where both qualitative and quantitative data were used. Qualitative data was collected from Focus Group Discussion (FGD), Key Informant Interviews (KII), and in-depth case studies. Quantitative data were collected from household survey questionnaires and previous studies. The quantitative data are utilized to comprehend the vulnerability caused by climate change in the areas of livelihood, health, and education. Additionally, the qualitative data are used to gain a deeper understanding of and acquire evidence for the concerns that are revealed by the survey.

Analysis with Key Findings: The main question of the research was 'How the climate change and climate resilience impact the vulnerability of women?' Variables like socioeconomic level, culture and custom, geographic region, etc. can affect vulnerabilities in different ways. Different groups are affected differently by vulnerabilities. In climate-related incidents, women are more affected than men (Brouwer, Akter, Brander, & Haque, 2007). Economic census 2013 said that Working Proprietors of females in Satkhira district is 5.78%, full-time workers are 13.88% and part-time workers are 23.05%. Besides, unpaid female workers are 46.45% (Economic census 2013 District Report: Satkhira, 2013). So, women have to depend on the other male counterpart's income. The dependency creates more vulnerabilities. Reducing the climate change impact, women have to take control and take ownership. They have to take more adaptation technologies for surviving.

The study finds that 3% of women individually and 26% of women migrate with family. It indicates that the women are now coming out from the vail for the survival instinct. Secondly, there is an interconnected relations between education and income. Covid-19 and devastating climate change limited the scope and access of education for female. In Gabura, for higher education most of the students have to cross the river Kholpetua by boat and come to Nildumur (mainland) for accessing the higher education. But the culture and the conservative social structure stands here as the obstacle. So, the conservative Muslim parents are not interested to send their girls for higher studies. The consequence of the phenomena is early marriage, dowry etc. Last of all the climate changes introduce different patterns of diseases in these villages. The salinity and cyclone affect the sanitation system and it also impacts on the reproduction system. In 2001 the annual growth rate of Satkhira was 1.56 and in 2011 the growth rate reduced in 0.62 (Population & housing census 2011 zila report : Satkhira, 2011, p. 17). The locals said that the high salinity introducing uterus problem and some cases women have to remove the uterus. It is one of the major causes of the growth rate drop. Beside that some NGO's offer stipend to the women for one or two children. The stipend encourages family planning. That is why women use different pills for unwanted pregnancy without any consultation with the doctor. These pills have impact on fertility and pregnancy. In most of the cases these pills stop menstrual cycle altogether which have long term effect on health. Beside this in Gabura, most of the households cannot often afford menstrual pads for young women and adolescent girls. It enforced them to use old cloth rags that they clean in water which is highly contaminated with saline. This old cloth rags are one of the major causes of uterine diseases. On the other hand, in Burigoalini the households are concerned about the menstrual issues. Most of the young women and adolescent girls use menstrual pads in this locality. The rain water harvesting support the households for maximum 6 months of the year. Rest of the year most of the households have to spend taka 30 for 30 litter of water jar for drinking. For other purposes they use saline contaminated water of river, ponds and tube-wells. Many kinds of diseases like skin disease, itching, hair loss, sore on fingers. diarrhea, gastroenteritis, hyper-tension, blood-pressure etc. are originated from this water.



Graph-1: Ratings of salinity induced disease

To reduce the vulnerability technologies has a great impact. Water, sanitation and communication are the major technologies available in the coastal area to create climate resilience. In the contrast of Gabura, Burigolaini has more technological access and freedom for the women. Advanced fisheries and advanced agricultural tools can reduce the obstacles of women to access the assets. So, policy guidelines need to added some special ordinance to handover technological supports towards women.

Observations and comments

Climate change bring vulnerability towards the coastal area. The urban people may think that they can keep them safe from the devastated effect. The impact of climate change is not limited to a single geographical location. The impact is far reaching and no one can be escaped from the curse. The SAKTEE project desires to support the disadvantaged and vulnerable women group who are highly impacted by the climate change. The climate change is not impacting a single society or a locality, its impact is ubiquitous. For sustainable climate action, combined measures from all sectors are needed.

The sample size is insufficient for vulnerable analysis. It is necessary to use a high sample size for a better understanding. A team of trustworthy and meticulous enumerators is required to conduct this kind of delicate research. Climate resilience adaptation technologies need to receive more attention from those who determine climate change policies. More attention must be paid to the gender issue and gender vulnerabilities.

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Thesis title: *Differentiated Impacts of Climate Change and Agricultural Adaptation Technologies on Social Equity in Bangladesh: A Case of the Sunamganj Communities*

Background and context

This study was conducted in Jamalganj upazila[1] of Northeastern Sunamganj district. The total area of the sub-district is about 338.74 km^2 (Lat: 24.9833^0 N, and Long: 91.2333^0 E). The sub-district as a low-lying region is situated in the *haor* basin of the underneath of the Indian Meghalaya. Several rivers, such as the Surma, the Peian, the Rakti, the Jadukata, the Dighar Peian, the Dhamalia, the Bemuna, the Daulata, the Kanaikhali and the Boulai have created a spatial feature of this sub-district. Local people use these rivers as a communication channel to carry stones, sands, and for business. Jamalganj comprises of five unions – Fenarbak, Schna Bazar, Beheli, Jamalganj, and Vimkhali with a total of 29935 households. The total population of the sub-district is 167260 with a density of population of 541 km^2. The average literacy rate in Jamalganj Upazila is 32.5% (BBS, 2011). Because of its location in the *Haor* basin, agriculture is the main sources of income, which is constituted about 73.92%; other earning sources include non-farming activities (5.12%), manufacturing (0.31%), business (8.13%), transportation (0.45%), foreign remittance (0.84%), and others (11.23%). A significant number of population about 45.79% are landless whereas 54.21% of populations have agricultural land (Banglapedia, 2014).

The tropical weather in this region is extremely hot with humid in a summer period and relatively cold in a winter season. The highest and lowest temperature is 38^0 C and 10^0 C respectively. The mean precipitation is 4000 mm yearly and the maximum rainfall occurs between May and September (MoDMR, 2014). Due to high variation in weather, the locality is highly vulnerable to climate change related stimuli. In terms of extreme weather-related hazards, it is identified that early flash flood has appeared as one of the main challenges in recent years, while normal flood, early heavy rainfall, thunderstorm, hailstorm, nor'wester, and drought, and arsenic contamination are also persistent in this area. According to local stakeholders, the pattern of flash flood has changed due to global climate change, which has amplified exposures and vulnerabilities of community members to early flash floods. In 2022, the sub-district experienced two consecutive early flash flood in early April and in June because of heavy precipitation in the Meghalaya. These catastrophic floods caused enormous damage to crops, houses, community properties, and livestock.

[1] Upazila: A rural administrative subdivision of a district.

Goal and Objectives: The goal of the study is to improve our understanding of the impacts of climate change and adopted agricultural technologies on social equity in Northeastern Bangladesh. The research also aims to examine the differentiated impacts of climatic variability and climate-induced environmental extremes on various socioeconomic groups; identify and map adopted adaptation technologies in the agricultural sector; and explore the nature of social equity and the effects of agricultural adaptation (climate change) technologies on social (in)equity, and community resilience to environmental stresses and disaster-shocks.

Methods: The unions of Jamalganj Upazila are categorized into high and extremely high-risk profiles based on factors contributing to vulnerability and opinions of the local-level stakeholders. Most of the participants including community people reported that Fenarbak and Beheli unions are more susceptible to flash floods, especially the 2022 flash flood damaged crops production and livestock completely. Considering the severity of the 2022 flash floods, Fenerbak and Beheli unions were selected as study area. The selected unions are surrounded by *Pakhner Haor*, *Halir haor*, and *Sanir haor*, which have been intensifying susceptibility of it to climate change-induced events (Figure 1). For this present study, I have selected Five villages namely, Gangadhorpur and Razapur village from Fenerbak union and Horinakandi, Hoaoriaalipur, and Bodorpur from Beheli Union.

In order to understand the effects of climate change, primary data were procuded by conducting household survey following a face-to-face interview technique. A total of 377 housheolds survey were conducted in two unions following a structured questionnaire. Additionally, 44 indepth interviews were also conducted; of them, 12 are focus group discussions with farmers, fishers, and vulnerable women fighting with flood water. Thirty-two key informant interviews with several stakeholders – including government officials, academia, research institutions, NGO officials, local dealers along with sub-dealers, and agricultural officials. Interviews were designed to explore the nature of agricultural technologies and adaptation process of farmers in northeastern area of Bangladesh.

Key Major Findings

The study found results in three broad criteria: (i) distributive impact of climate change, especially caused by the 2022 flash floods; (ii) various technoloiges adopted by local farmers to adapt to climate change; and (iii) social equity in agricultural technologies on the basis of access and adoption capacity. These results have been elaborated in the following sections.

Distributive impacts of the flash floods

The impacts of climate change stimuli, especially the 2022 flash flood differ in terms of household categories. The results unveild that the mean loss in crop production in 2022 was BDT 43766.58 (SD=1518.43). The highest percentage of male-headed households lost in crop production from BDT 35001 to 45000, which constituted about 22 percent housheolds out of all

male-headed housegolds, whereas nearly 14 percent of male-headed families incurred loss above BDT 65000 (see figure 1). In comparison to male-headed households, both women-headed and disadvantaged households encountered the adverse losses in crop production in terms of their households pattern and capacities to recover from damages and losses in crop production. For example, nearly 29 percent of women-headed out of all female-headed families incurred more than BDT 65000.00, followed by 25 percent disadvantaged families out of 20. The overall trend showed that frequent disasters cause devevastating losses in agriculture, but the experience to climatic hazards are different in terms of households' capacities, landownership, and housing structure. For example, the qualitative study found that households, who have fragile housing structure made of straw and tin and owning limited agricultural land, experienced the highest losses in housing and crop production. Therefore, it is evidenced that the impacts of natural disaster are unjust in terms of preexiting ability to recover and adapt to climate change. In words of a female-headed woman:

> "In 2022, the early flash flood damaged my crop in Sanir Haor. It worths around BDT 70000.00. I highly rely on crop production. This flood will create acute hardship in managing food, cloths, and education for my child. Large farmers can manage it as they have many lands. The losses of crops in my tiny land comptelely destroyed my livelihood."

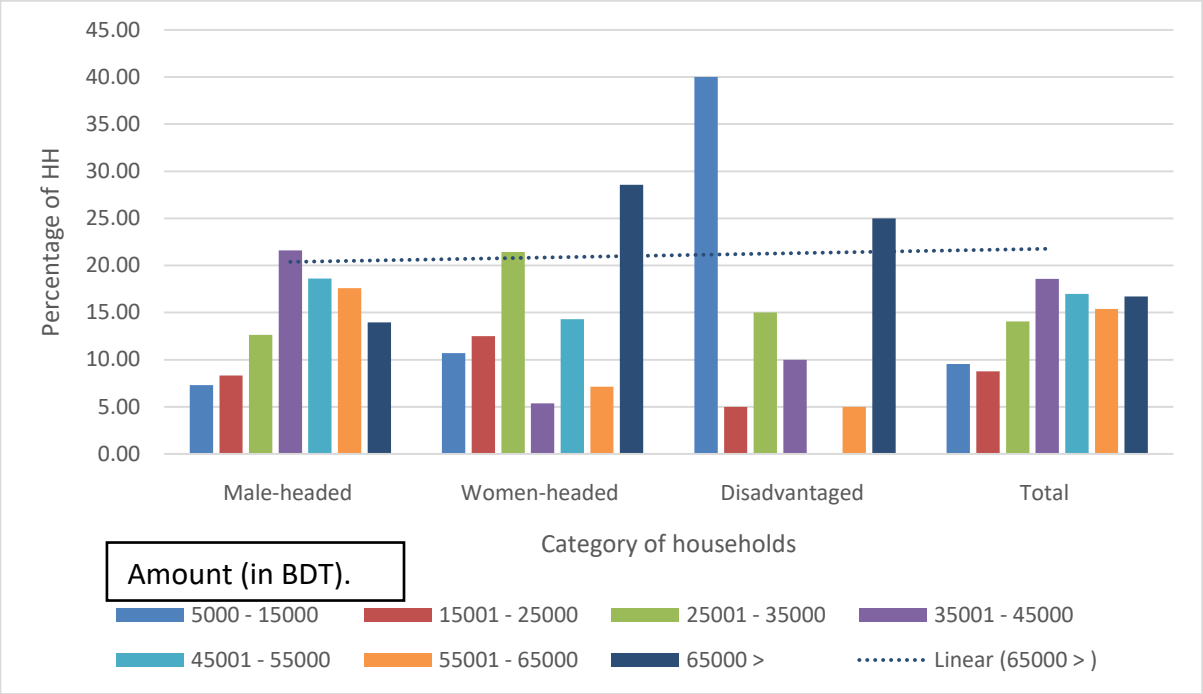

Figure 1: Loses in crop production by household categories in 2022

Factors influencing to adopt agricultural technoloiges and its nature

The findings of the study unveiled that different types of technologies are evident in the stdy location. These types of technologies can be grouped into three categories following Christiansen et al.'s typology (2011). Following this typology, we can identify three broad types of technologies – hardware, software, and orgware. Table 1 presents details examples of different types of agricultural technoloiges applied by susceptible community members to manage their livelihood means.

Agricutlral adaptation technologies in agricultural sectors are multifaceted in terms of place and factors influcing farmers to adapt these technologies. Manifold factors ranging – *from individual level to institutioanlal* are major drivers that motivate farmers to apply diverse technologies to adapt to climate change. For example, economic ability, risk perception, productivity are key factors influcing farmers to use diverse technologies in agricultural sector. It is notable that risk perception developes over the period of experience with climatic disasters, which often influce farmers to select appropriate technologies such as flood-tolerant seeds for adapting to disasters. Similarly, different factors, especially social learing that brings changes in their understanding to adopt agricualtual technologies. The findings of the study found that farmers organize resources together and share resources to manage large technology. For example, compined harvester costs around BDT 30. Smallholders organize resources together and purchage combined harvester for harvesting.

The access to local institutions is also fostering the adoption prospects among local farmers. For example, local agricultural extension offices and non-government organizations bring new information and introduce new technologies among local farmers. The sharing information and the introduction of new technologies encourage local farmers to adopt new technologies (e.g., bedseed planter, compbined harvester). These novel technologies are highly adopted by local farmers when they are aligned with their needs and local environment. While local institutions foster different agencies, such as training and knowledge, unequal access and inability to adopt technology hinder the adoption process of local farmers.

Table 1: Salient factors influeining farmers and types of agricultural technologies

Level of factors	**Salien factors and enablers**	**Typology of agricultural technologies**		
		Hardware	**Software**	**Orgware**
Individual level	Sociodemographic, risk perception, economic ability, cost-effectiveness, profitability, productivity, local knolwdge	N/A	Floating agriculture, preparing seedbeds in yard; Mulching. Seedbeds in polythene bags, shallow-tubewell Plough machine (Tractor)	N/A

Community level	Social learning, social network, farmers association, self-help group	Crop-protection embankment	Compbinded harvester, tractor, Husking machines	Farmers' assotation
Institutional level (GOs, NGOs, and local market)	Information sharing workshop, introducing technologies, partnership and collaboration	Embankment, sluice gate, submergible embankment and road	Early maturity and high-yielding crops (BRRI dhan 28, 29, 51, 89, 92), Bangabandhu 100. Seedplanters, combined harvester, subsides;	Farmers field school; field demonstration

Social equity in agricultural technologies on social equity

Access to different types of technologies are imperative to have palpable impacts on the reduction of climate change impacts and adaptation to climate stimuli. Table 2 presents the nature social equity in the process of adoption agricualtural technologies. The findings of this research showed that technologies slightly foster equity considering social differences, capacity of local farmers, and historical pattern of society. For example, hard structure – such as embankment, sluice gate implemented by government – rarely ensured participation of local and smallholders in the implementation process. The less recognition of colonial pattern (e.g., gender and disability) was also addressed rarely; therefore, hard structure often increase exposure of vulnerable populations, especially women and smallholders.

However, soft technoloiges make sufficient impact on the process of adoption of technologies. The reason is that some technologies, especially different flood tolerant varities are less costly, which encourage marginal farmers to adopt these technologies. Additionally, NGOs and GOs consider historical pattern of inequality in distributing soft technologies as sub-sidies. However, such technologies – for example – combined harvester and seedplanter – are highly adopted by large farmers as they can afford the cost of these technologies. On the other hand, Smallholders have to rely upon large farmers for harvesting and ploughing their land. Similar to soft technologies, orgware such as farmers school or association is a place of social learning and a platform of all farmers that fosters for new knowledge and technology. On the basis of economic ability, farmers adopt different forms of technologies. Overall, we can ague that social equity in technologies highly depend on institutional procedures and rules, economic ability, and political factors.

Table 2: Types of agricultural technologies and social equity in fostering adoption capacity

Types	Examples of technologies	Types of social equity		
		Procedural equity	**Distributive equity**	**Recognition equity**
Hardware	Embankment, sluice gate, submergible embankment and road	Lower participation of community membrs. High political influence in controlling sluice gate and crop-protection embankment.	Hard structure (e.g. embankment affecting vulnerable groups); increasing unemployment migration among poor farmers.	Less recogniction historicall legacies, such as gender, disability.
Software	Plough machine (Tractor), early maturity and high-yielding crops (BRRI dhan 28, 29, 51, 89, 92), Bangabandhu 100; husking machines; combined harvester	Consultation with locals rarely takes place before introducing technologies. Such technologies (e.g. harvester) demands high capacity and understanding of local farmers. Political factors hinder the adoption process.	Soft technologies such as BRRI 28, 29, 51, 89, 91 ensure access all groups. The distribution of technologies, such combined harvester, seedplanters depends on the capacity of farmers. Combined harvester causing fodder crisis among poor farmers.	Historical legacies such as disability, women-headed are recognized in distributing soft technologies, such as flood tolerant seeds, fartilizers. Social differentiation is rarely recognized in the adoption process of combined harvester, bedplanters.
Orgware	Farmers association, field school, demonstration plot	Large farmers ensure their access and influence the decision-making process	Increasing social network to adopt technologies collectively.	Male-headed farmers receive high priority in the meeting.

Conclusions and Recommendations

By analyzing the findings of the study, we can make three arguments (i) the impacts of climate change-triggered disasters, such as flash floods are unfair. As climatic disasters interact with pre-existing capacity and infrastructure and cause damage to crops and properties, the disproportional damage results from prevailing ability to adapt to climatic events, such as flash floods. (ii) In order to adapt to climate change, small, marginal, and large farmers adopt diverse

technologies, but the adoption process of technologies highly relies various factors – including economy, risk perception, access to information, education, and knowledge. Thus, various factors and access to reliable information are key to the adoption process of technologies. (iii) Agricultural technologies nurture various forms of equity, such procedural, distributive, and recognitional equity.

The practice of equity differ in terms of institutional procedures, social factors, and histrorical pattern of society. For example, hard technologies ensure access of large farmers to the decision-making process and participation in the implementation process. Large technologies are creating losers and winners as large farmers can afford these technologies due to their economic ability, political power, and access to local institutions. Therefore, equity shape the access to technologies and it is shaped by local context, political and economic ability, and institutional procedures. Besed on the findings of the study, we can make several policy recommendations:

- Agricultural technologies should address different forms of social inequalities and equities. Recognizing pre-existing social inequalities in adaptation interventions can minimize damage and loss in properties and crop production. Policy interventions, such as introducing new technologies need to be aligned with local needs, abilities to adopt technoloiges.
- For empowering marginal farmers, more subsidies should be provided in an equitable way; especial subsidies can be introduced for women and poor farmers. For example, subsidies for the adoption of combined harvester and bedplanters are equitable. It is only affordable for large farmers.
- For long term sustainability and reducing unfair vulnerabilities, income-generating activities and employment opportunities are needed, especially for women-headed and disadvantaged families.
- Sustainable structure – such as protection wall, improving drainage system, and embankment should be implemented considering uneven vulnerability and exposures.
- Flood forecasting and warning and disaster-related information should be distributed appropriately and timely. Flood forecasting and warning-related education programs can be taken to aware local vulnerable populations.
- Crop insurance programs can be initiated on the basis of economic and income capabilities of local farmers to recover from crop loss.
- The government should control and monitor local market to ensure access of all farmers to fertilizers and new technologies, such as new varieties of paddy seeds and vegetable. Illegal affiliation of local dealers with local agricultural offices often increase prices of fertilizers and technologies. Good governance can ensure equity and access of all farmers.

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Title: Climate Change and Its Impact on Agricultural Vulnerabilities and Adaptation Technologies in the Flood Prone areas of Bangladesh: Dowarabazar

Background & Introduction:

A tiny, low-lying deltaic nation in south Asia is Bangladesh. Different natural hazards and intense water-related phenomena clash with the country due to its geographic location and man-made elements. This nation is regularly cited as one of the most climate change susceptible nations. In Bangladesh as well as South Asia, climate change is a fate-determining force. Previous research outlined rising evidence that the country's increasing number of natural catastrophes, such as floods, cyclones, sea-level rise, river erosion, and rainfall variability, are being influenced by the country's changing climate (IPCC, 2022). The study's goal is to examine the effects of climate change in one of Bangladesh's flood-prone northeastern regions. The paper will examine the adaption technologies, the plans, and other elements that help to attain climate resilience. As per the data of Food Security Cluster Situation Report in the flood of 2022, 13,803 hectors of agricultural land were impacted by the second phase of flash flood. Due to the flood the inflation rate increases 7.43 to 8.30. (Rony, 2022). This natural hazard impacted the life of 7.2 million people of 9 districts where 3.5 million children were also affected. 52 deaths happened and 472,856 people were evacuated for safety centers (Unicef, 2022) .

The floods occurred because Bangladesh lies in the delta of three of the largest rivers in the globe. During the flood season the maximum discharge of water is 180,000 m^3/sec. The water also carries 2 million tons of alluvium with it. This alluvium is reducing the navigability of the rivers and narrowing the river channel (BCCSAP, 2009, p. 07). As a result, frequent floods are happened. The image bellow shows the hazards line of the year in the study area and the business of the livelihood (District Disaster Management Committee, 2014, pp. 40,42).

Research Approach

This is mixed-method research, where both qualitative and quantitative data were used. Qualitative data was collected from Focus Group Discussion (FGD), Key Informant Interviews (KII), and in-depth case studies. Quantitative data were collected from household survey questionnaires and previous studies. The quantitative data are utilized to comprehend the vulnerability caused by climate change in the areas of livelihood, health, and education. Additionally, the qualitative data are used to gain a deeper understanding of and acquire evidence for the concerns that are revealed by the survey.

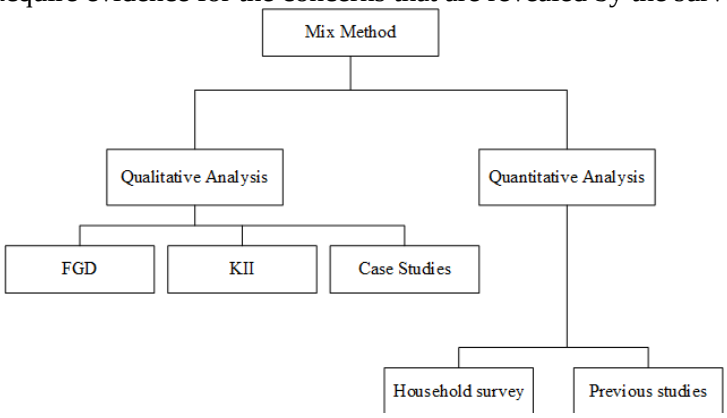

Diagram-1: Research approach diagram

Research Questions

The main research question is: How the agricultural technologies impacted the life of local farmers?
The underlying questions are

i. What is the agricultural vulnerability in this locality?
ii. Which technologies they used for good yield?
iii. Is the flash flood or monsoon flood affecting their crops?
iv. What will be the community approach to overcome the problems?
v. How can be the suitability come in agriculture?

Key Findings: Social or economic development is a continuous process. Development needs continuous efforts. Some times for economic development the institutions try to ignore the key variables. But these variables are important for social development and changes. Therefore, its slowdown the process of development or the development lost its accomplishment. However, to keep the accomplishment of these developments, sustainability is important. To keep the sustainability of development a framework can be followed (Ozili, 2022). The natural hazards of the locality in some cases is the result of unplanned structural developments.

The study area is a flood prone area and most of the agricultural lands are single crop land. Therefore, the flash flood and monsoon flood affected the livelihood of the inhabitants. The main food source of the region is paddy but some other vegetables are also cultivated. A large share of the households directly or indirectly involved with agricultural activities (~30%, 91 households). From where 15.8% are directly involved with agricultural production, 5.6% are agricultural labor, 2% are shared crop producer and 2.3% are involved with fish farming and 4.3% are involved with fishing. The agricultural industries were most severely affected by the flood of 2022. Additionally, it affects the year's food security. This year, there were two episodes of flash flooding: the first occurred at the end of May, and the second occurred in the middle of June. Both the land's paddy and the paddy that had been stored were impacted by the first phase. The locality's food security was impacted by the second phase. Respondents to the FGD stated that rice production can feed people for 6 to 8 months. But the flood completely destroys their years' worth of storage.

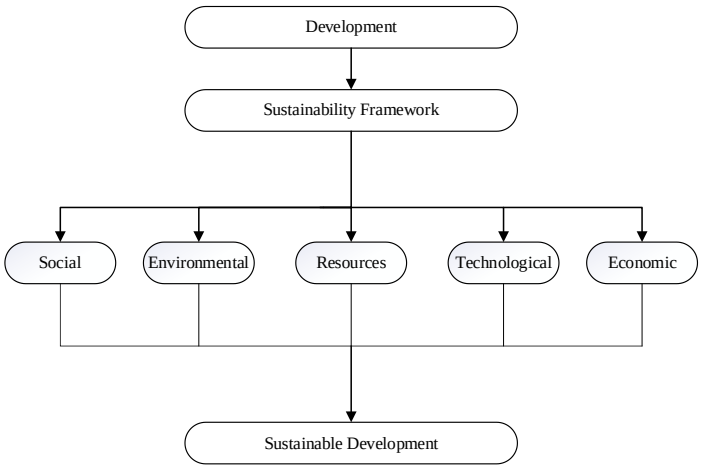

Diagram-2 Development to sustainable development framework

To analysis the question it is necessary to know the capacity of the agricultural advancement in this locality, the cope-up technologies and challenges in this area. The agricultural sector of the study area mostly impacted by flash flood. But other natural hazards also hammered the agriculture a lot (District Disaster Management Committee, 2014, p. 44).

Sl. No	Occupation	Natural hazards					
		Flash flood	Monsoon flood	Thunderbolts	River erosion	Nor ‘westers	Arsenic
01	Agriculture	√	√		√	√	
02	Fisheries	√	√				
03	Day labor	√	√	√	√	√	√
04	Business		√		√	√	

Table-1:The impact of natural hazards in the study area

So, flash flood is not only the vulnerability in the area. The others also in count. Though the previous data is not mentioned but in recent days the farmers are scared to cut the yield from the land due to the excessive number of thunderbolts. So, capacity building is the necessary for proper agricultural output. As per IPPC AR4 the capacity building depends on some variables. The graph described it (Goosen, et al., 2008, p. 176).

Observation and Commentary

It is high time to accept that climate change happened. As per the news channel the flood of 2022 is the biggest flood of last 122 years. The flood impacted the life of the whole country. The inflation rate increased 8.30 and the price of commodity increases its highest peak. The previous infrastructures like Pandargoan dam in Pandargoan union is one of the causes of waterlogging in Doarabazar union. Nearly 50 years ago people from Cummilla, Laksham make their inhabitant in the area due to the impact of monsoon floods on those area. Nowadays those areas are safe from flashfloods and this locality washed away by the water. The government should focus on the infrastructures of the locality before unplanned development. This is the way by following which the sustainable development can achieve. Insufficient sample size exists for vulnerable analysis. For a better understanding, a large sample size is required. This type of sensitive research requires a group of reliable and diligent enumerators. The people who decide on climate change policies need to pay more attention to climate resilience adaptation technology. The gender issue and gender vulnerabilities require more focus.

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Title: Gender Differentiated Vulnerability and Adaptation of Climate Change in North-western District Sunamganj

Background and context

Climate change has now become a global security concern. It poses a serious threat to both current and future generations' sustainable development, social justice, equity, and respect for human rights (Aguilar, 2009). Climate change impacts differ across regions, as well as between generations, income levels, and occupations, as well as between men and women (Shanta,2009). Climate change is expected to have a disproportionately negative impact on developing countries (Duong,2010). Because of poverty, conflicts, a lack of gender and social equality, environmental degradation, and a lack of food, many of these countries are especially vulnerable to climate effects.Climate change has a very different effect on men and women. Based on their various roles and responsibilities in their community and their level of access to natural and other resources, men and women are affected by the effects of climate change in different ways (Rahman, 2013; Wamukonya & Rukato, 2001). Women were identified as one of the categories most susceptible to the effects of climate change in the IPCC report (IPCC, 2007). Despite doing 70% of the work in the world, women are disproportionately more susceptible to climate change than males.

Climate change is also the most pressing issue for Bangladesh's expanding economy. High temperatures, heavy rainfall, high humidity, floods, cyclones, droughts, sea level rise, storm surge, water logging, river erosion, and salinity intrusion in soil and water characterize it (Nishat, 2016).Bangladesh is the most vulnerable country in the world due to the increasing trend of disasters caused by climate change (Germanwatch, 2009). By signing the Convention on Climate Change in 1992 and the Kyoto Protocol in 2005, the government acknowledged climate change as a top priority issue. The government has launched a number of initiatives to deal with the effects of climate change. Nonetheless, climate change is endangering the livelihoods and existence of approximately 160 million people in the country (Nishat, 2016).Nearly 50% of the population of Bangladesh is made up of women (Sarker, 2007). Because of their poverty, socially prescribed tasks and obligations, and marginal status within the social structure, they are more vulnerable than males to climate change (Islam, 2009; Tanny & Rahman,2016). The burden of climate change on women in our country is disproportionate. The goal of the current study is to draw attention to how climate change implications differ depending on gender. It explains how gender roles might improve men's and women's capacity to adapt to shifting climate-related dangers and explores how climate change can affect men and women differently.

According to Nanda et al. (2015), wetlands make up around two-thirds of all land in Bangladesh and are thought to cover 7 to 8 million hectares (Rahman et al., 2001). A wetland is a place that is considered to be of the utmost importance for its hydrological, ecological, biological, zoological, or limnological conditions (Haque and Basak, 2017; Blasco and Aizpuru, 1997). Bangladesh has around 461 distinct types of wetlands (Chakraborty, 2005). Lands that are around 7-8 meters below Mean Sea Level (MSL) that are flooded for 7-8 months are categorized as haor based on elevation from MSL (Salauddin and Islam, 2011). Generally speaking, Bangladesh is considered to be a country that is sensitive to climate change, especially in haor regions because of its peculiar geographic position (Rahman et al., 2016). Floods are among the most frequent and regular dangers and catastrophes in Bangladesh (Abedin et al., 2018; Zannat, 2016; Rayhan, 2010), and are regarded as one of the biggest obstacles to development (Paul and Routray, 2010; Younus et al., 2013). Flood is one of the notable natural disasters that affects people's lives and means of subsistence by harming ecosystems and agricultural productivity, causing more water pollution, disrupting communication networks, and negatively affecting the economies of the surrounding areas (Islam et al., 2014; DeClerk et al., 2006).

The Objectives: The present study assesses the climate change induced disaster like flash flood impacts and explores existing gender differentiated adaptation strategies in pre, during and post flash flood situations. The study also investigates the effectiveness of the strategy taken by the *Haor* inhabitants in different flood periods. This study intends to expose ground-level information of flash flood impact and dynamism of flood and inhabitants of the low-lying haor area consider with gender sensitiveness. It is expected that the outcome of the research will serve as a reference source for researchers, academics, policy maker and planer for sustainable disaster management particularly in haor areas in Sunamganj. The specific objectives of the study to:

i. assess the differentiated impacts of climate change and vulnerability of women considering Socio-economic and cultural factors.
ii. investigate the adaptation technology and strategy to mitigate the climate impact on women.

Methodology: This research includes both primary and secondary data. Primary data were collected through multiple methods, including field observation, transect walks, questionnaire survey on 305 households, 4 oral history interviews, focus group discussion (FGD) from four different villages, ten (five from each Upazila) key informant interview (KII) of local representatives and Upazila government officials. To know the impact of flash flood on socio-economy of the study area detailed exploratory field investigations were done in September 2022. Before starting data collection, transect walks were conducted both within the village and within haor area to identify haor people's problem with flash flood hazards. Household data along with loss assessment and adaptation strategies before, during and after the flash flood were collected through semi-structured questionnaire from directly affected two unions (Jamalganj North and Surma), selected through purposive sampling method under two upazilas (Jamalganj and Dewarabazar) of Sunamganj district.

The villages were selected based on physiography, population size, ethnic minority, proximity to market and 2022 flash flood severity. A total of 305 samples were collected based on (equation- 1) (Mathers et al., 2007; Perera et al., 2018).

Sampling equation:

$$n = (z_{\alpha/2} \times \sigma / E)^2 \qquad (1)$$

Where n = sample size, Zα/2 = confidence level, σ = standard deviation, and E = error.

Table 1 Data collection and sampling method

Data collection tool	Respondent type	Sample/Interview		Total
	Jamalganj North/Surma	Jamalganj North	Surma	
Household Survey	Household head	151	154	305
FGDs	Woman and occupational participants group	2	2	4
KII	Local representatives (chairman, members) and Upazila government officials (Agriculture, Social welfare, Engineer)	5	5	10

For Key Informant Interview (KII), three key informants covering teachers of different educational institutions, religious leaders, local political leaders, farmers, fulltime and seasonal fisherman and elderly people were interviewed from each village to reveal the impacts of recent and retrospective flash floods, its consequences and people's adaptation strategies regarding the situation based on their respective experiences. To find out the detail information of the sectoral impact of flash flood and their respective adaptation strategies five individual occupation classes were selected for focus group discussion (FGD). The total 4 FGDs were conducted in two unions. Where one woman and one occupational participants group per union were ensured in discussion severally. The surveyed occupation groups were farmer, fisherman, businessman and day laborer as well as with women and ethnic minority people. Secondary data for the research were collected through literature review and data/materials from concerned offices including Bangladesh Bureau of Statistics (BBS), Ministry of Disaster Management and Relief (MoDMR), Bangladesh Institute of Development Studies (BIDS), International Union for the Conservation of Nature (IUCN), Haor Development Board (HDB), Bangladesh Water Development Board (BWDB), and District and Upazila Administration of Sunamganj.

The Study Area and Geography

The study was conducted in two unions Jamalganj North and Surma, under two upazilas respectively Jamalganj and Dewarabazar of Sunamganj district. The Jamalganj upazila occupies an area of 309.38 sq. km. It is located between 24 º50´ and 25º04´ north latitudes and between 91º05´ and 91º19´ east longitudes. The upazila is bounded on the north by Tahirpur and Bishwambarpur upazilas, on the east by Sunamganj Sadar upazila, on the south by the Derai upazila and on the west by Dharmapasha upazila(BBS,2011). Main rivers are Nawa Gang, Baulai and Dhanu; Pakna Haor and Hail Haor are also notable. Patilachura, Pangna, Lamba, Baska, Chhatidhara and Kachma beels are noted (BBS,2011;

Banglapdia,2021). Moreover, the Dowarabazar upazila occupies an area of 263.35 sq. km. including 22.49 sq. km. forest area. It is located between 24º58´ and 24º11´ north latitudes and between 91º24´ and 91º43´ east longitudes. The upazila is bounded on the north by India, on the east by Companiganj upazila of Sylhet zila, on the south by the Chhatak upazila and on the west by Sunamganj Sadar upazilas. Most of the Surma system falls into the Haor Basin, where the line of drainage is not clear and well defined. In the Piedmont tract from , the network Durgapur to Jaintiapur of streams and channels overflows in the rainy season and creates vast sheets of water which connect the HAORS with the rivers. In the haor basin too, the rivers overflow and inundate the haors in the early part of the rainy season and get back much of the water as soon as the monsoon rains slacken(BBS,2011; Banglapdia,2021).

Adaptation technology and strategy to mitigate the climate impact on gender responsive community

To fully comprehend if the current coping mechanisms used by poor households, and especially those headed by women, are significantly or sufficiently assisting in climate change adaptation, long-term monitoring and research are required. Future planning may benefit from knowing what causes these coping mechanisms to work or not work (IUCN, 2012). Some of the micro strategies employed by underprivileged women to deal with recurring tragedies include the following:

Prevention Strategies: To protect their lives and property against disasters, people who live in Bangladesh's disaster-prone areas take a variety of precautions. The vast majority of individuals are fully aware of both the benefits and drawbacks of each preparedness step. Due of the severity of disasters, these efforts frequently are ineffective in assisting victims (IUCN, 2012). Disaster forecasting and preparation: Vulnerable populations in flood-prone places have developed their own science and artistic methods to forecast floods. The community is left with little alternative but to rely on whatever early warning system is in place as this conventional tool is becoming less and less useful due to the changing nature of disasters. *Protecting homes and farms:* Before a flood or flash flood, families work to make their homes more disaster-resistant by using locally available materials to reinforce the walls and roofing, raising the plinth level of their homes, and raising the level of their cow shelters. Households with better financial standing have deeper tube wells.

Keeping important goods safe: Women make portable mud stoves for future use and store fuels, matches, dried food (such rice, peas, puffed rice, flattened rice, and molasses), ropes, and medicine at home. Women frequently gather firewood to keep in dry locations for future use. Women also use machas (high wood or bamboo buildings for storage) to protect goats and poultry from flood water and to store feed for domestic animals, seeds, food, harvest, blankets, and treasures. Many women bury cooking utensils, productive assets (such as ploughs and fishing nets), and other valuables to keep them from being washed away by storms.

Educating children: Educating the younger generations about how to protect oneself has been a crucial approach utilized by households living in disaster areas. Teaching life-saving skills such as swimming and knowing cyclone signals are examples of how parents prepare their children. No institutional system for teaching children disaster preparedness exists, however, children normally learn from family discussions or meal-time dialogues. Other activities include animal rearing, grazing, and participating in plantation work with their parents, during which children have the opportunity to learn their parents' traditional wisdom.

Management Strategies

Family member safety: During disasters, women must continually watch after youngsters, elderly and disabled family members, and animals to protect their safety. Women in flood-prone communities construct higher platforms for disabled family members using the chouki (traditional bed) and bamboo. To keep kids safe and from being carried away by floodwaters, parents frequently build a "fence-in" to confine them in one spot.

Ensure food security: Because most households rely on agriculture, flooding season is especially dangerous. In general, the flooding season and the critical rice harvesting season overlap. Flooding early in the monsoon season kills the standing crop, resulting in food shortages. Disasters also have an impact

on the local economy, which is critical for creating job possibilities for non-farmers in both rural and urban locations. When a household faces a food crisis during or after a disaster, women are responsible for adjusting household food consumption by changing the type of food consumed (for example, instead of consuming rice, they resort to alternate foodstuffs such as kaisha or kolmi, local vegetation) or consuming less. According to several research, because women's job is strongly tied to agricultural production, household food, and revenue generation, the weight of food scarcity falls on them.

Protecting assets: When flood water reaches the level of the livestock shed, people no longer keep their animals at home. In some cases, they send their cattle to relatives. Some poor families try to sell livestock in an attempt to hold cash security, preparing against the possibility that regular income could be jeopardized.

Household works: Workload allocation within the family disproportionately impacts women after a disaster. When spouses or male family members lose their jobs, women's daily workload increases because they must manage resources, feed the family, and care for the elderly. Caregivers for people with impairments are typically female. However, new research shows that job distribution is changing: a substantial percentage of female participants reported that their spouses changed their regular behaviors during flooding; many cook at home or care for children. Other popular survival techniques include selling other items, mortgaging or borrowing against assets, and borrowing from neighbors. Many rural women are now members of microfinance institutions, where they can obtain loans.

Migration and alternative employment: Many women migrate as a kind of adaptation. After a calamity, migration for employment increases as people flee areas with job shortages in search of work. Female migration accounts for a sizable portion of the informal urban labor market. Domestic help, brick breaking, stitching, jute bag making, ash selling, fish and vegetable vending, selling rice cakes, and working in the RMG industry are some of the key occupations that employ women in cities. For money, they may compromise with their principles and dignity (i.e., begging). Women with alternative livelihood options prefer not to move as laborers; for example, households with boats generate money by ferrying people.

Recovery Strategies: Recovery from disasters include repairing homes, replenishing livestock, ensuring an income, paying back loans, caring for affected family members, and reestablishing other facets of daily life, such children's education. Women are actively involved in each of these activities.

Recommendation and Conclusion

The current study examines the direct and indirect effects of a flash flood disaster caused by climate change and reveals the adaptation measures low-lying harbor residents have taken to lessen the effects. It has been discovered that flooding, particularly flash flooding, has intricate and varied effects on the socioeconomic makeup of haor residents and rural poor. Poor peasants, expectant mothers, elderly people, children, and others are among the most susceptible populations, and during flash floods, their best course of action is to use their native knowledge and experience of flashback floods, eventually relying on mohajans, neighbors, and family members. The ability to recover from a flash flood is mostly dependent on money because the impoverished residents initially lost their homes, crops, and precious goods, which ultimately reduced their ability to cope. Haor residents' attempts to recover from direct economic loss frequently result in additional indirect property losses, which eventually confronts a vicious cycle of debt and poverty. This is due to occupation loss, resource damage, and income volatility. Poverty and a lack of resources or supplies significantly hinder farmers' ability to recover from flash flood disasters. The poor community is subsequently more susceptible to further disaster recovery due to this cycle of debt and poverty. The current leasing policy and unmatched power structure place restrictions on the extraction of haor resources at various stages for poor permanent and seasonal fishers.

The women's roles are typically unnoticed, but this study discovered that they play a variety of roles during and after flash floods, including caring for the sick, processing food, cleaning, raising children and the elderly, and caring for livestock. They also found that their efforts to safeguard their homes and lessen household damage were very successful. Rural women are more severely affected than urban men by flash flood-related issues since they are a sudden and catastrophic phenomenon. Poor rural women have

broader obligations than their male colleagues, which ultimately keeps them busier and more effective with their families. The haor community and other marginalized groups must receive more attention if the Sustainable Development Goal (SDG) and Vision 2041, which the Bangladeshi government has announced, are to be realized

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Thesis title: ***Adaptation to water use through adoption of technology in Satkhira communities in Bangladesh***

Context and background

Climate change has become a forefront issue for global leaders and policymakers in recent decades. Water-related ecosystem services are the extremely vulnerable sector and the key medium through which the effects of climate change can be perceived (Arnell, 1999; Chang & Bonnette, 2016; Elliot et al., 2011; Misra, 2014; UN-Water, 2010). Worldwide, countries are now impacted by climate change to varying degrees, and Bangladesh is no exception to this. According to the long-term Climate Risk Index (CRI), Bangladesh is ranked as the seventh most vulnerable county globally (Eckstein et al., 2021), where the water sector is immensely affected by climate change (Ahmad, 2012; Kundzewicz et al., 2014; Nishat & Mukherjee, 2013). The coastal areas of Bangladesh are more exposed to climate change impacts due to their geographic location, where agriculture, fishing, shrimp farming, and tourism are the main economic sectors (Abedin et al., 2019). These regions are more vulnerable compared to others due to climate-related hazards such as cyclones, rising sea-level, waterlogging, and salinity intrusion (Abedin et al., 2019; Moniruzzaman, 2011). The rainfall pattern in the coastal areas has drastically changed in the recent past and often results in heavy precipitation in the monsoon period (Abedin et al., 2019), which causes floods and waterlogging (Chowdhury & Ward, 2007; Nishat & Mukherjee, 2013; Shahid, 2010; Shahid, 2011). Rising sea level and its associated hazards such as increasing storm surges, frequency of coastal flooding, salinity intrusion, and coastal erosion are the major threat to coastal regions in Bangladesh (Carretero et al., 2013; Elliot et al., 2011; Hallegatte et al., 2010; Moniruzzaman, 2011; Paprotny et al., 2021; Roebeling et al., 2013; Vitousek et al., 2017).

Globally, technology-based adaptation solutions have gained increased acceptance as a way to mitigate the consequences of climate change (Kim, 2021). Utilizing technology in the water sector may significantly improve resistance to extreme climatic threats, reduce water pollution, and promote diversification and resource conservation. Some of the most important adaptation technologies that are in practice throughout the world are rainwater collection, water storage, water reuse, desalination, enhancing irrigation efficiency, and effective use of water (Elliot et al., 2011; IPCC, 2007). The most widely used technology-based adaptation strategies in the water sector in Bangladesh include rainwater harvesting, pond sand filters (PSF), and tube wells (Rahman & Islam, 2013). However, social injustice and gender disparities are concerning issues in the climate change discourse. A review of the adaptation research in developing countries reveals that uneven distribution of resources and benefits, and unequal participation in the decision-making process not only affect negatively on the adaptive capacity building among the rural communities but also influence to increase pre-existing inequalities in society (Abebe, 2014; Ahmed & Islam, 2013; Alston, 2013; Bhattarai, 2020; Deressa et al., 2009).

Purpose: The purpose of the study is to critically examine the climate change adaptation measures in drinking, domestic, and agricultural water use through technology and how such technology-based adaptation approaches affect access of resource-users to resources, income, asset, and gender disparities in the coastal communities in Bangladesh.

Study site and methods of data collection: The district of *Satkhira* is cited as one of the most vulnerable areas of Bangladesh's 19 coastal districts. Given the area's exposure to natural disasters and the long-term effects of climate change, *Kaliganj* Upazila's vulnerability index is 0.66, which is much higher than that of other Upazilas in the *Satkhira* district (GoB, 2018). Considering the climate change vulnerability, *Kaliganj* Upazila from *Satkhira* district was considered the primary research location. Out of 12 unions in the *Kaliganj* Upazila, *Krishnanagar* and *Mathureshpur* unions were randomly selected as the study site for data collection. To address the research questions, the study has used a mixed methods approach which includes both qualitative and quantitative techniques (Creswell & Creswell, 2018). A multi-stage, stratified random sampling approach was used for collecting 303 household survey data from *Krishnanagar* and *Mathureshpur* unions in the *Kaliganj* Upazila, where 50% of respondents already participated in the previous baseline survey of the SAKTEE project.

For the qualitative part of this study, the snowball sampling approach was followed, where 7 Focus Group Discussions (FGD) were conducted with specific community members such as farmers, fishermen, day laborers, mixed professions, and women, both in *Krishnanagar* and *Mathureshpur* unions. In addition, 20 Key Informant Interviews (KII) were conducted in *Kaliganj* Upazila with the key stakeholders of the community such as male and women farmers, shrimp farmers, local representatives from different community-based organizations, Union Parishad chairman and members, NGOs practitioners, school teachers, and government representatives.

Major findings

Socio-economic attributes: In both societal and intra-household affairs, men dominate the leadership and decision-making roles in the studied region. Only 10.89% of homes in the sample population are led by a woman, compared to 89.11% of families headed by males. According to the sample population's educational status, 30.36% of household heads attended elementary school (class 1 –5), and 30.69% of households attended secondary school (class 6 – 12). Only 2.97% of household heads completed higher education. Crop production accounts for just 26.73% of families' principal occupation. In the past 5-10 years, there has been a substantial decline in the number of farmers involved in crop cultivation, and more especially, rice production. Climate-related risks like salt intrusion and artificial waterlogging for expanding shrimp production have a negative influence on agricultural productivity and soil fertility (Alam et al., 2017; Khanom, 2016). The farming community is concerned that output levels in the future might fall. Many people in this village have now switched from cultivating crops to shrimp farming, which is more profitable. Shrimp cultivation and collecting shrimp fry make up the principal occupation of 22.44% of households at the moment. Furthermore, 23.43% of families work for wages, with most of these workers in the brick factory working mostly from November to March each year. Although women are given preference in the wage labor market, they are paid less than males for the same job.

A total of 78.22% of families in the sample population are estimated to be living in extreme poverty based on the 2022 International Poverty Line of US$2.15 based on 2017 purchasing power parity (The World Bank, 2022). The poorer community's average monthly income is around US$34.58 per capita. Only 21.78% of households are financially solvent, and their average monthly income is approximately US$114.26 per capita per month. Approximately US$27.09 per person per month is spent on average by the underprivileged population, compared to US$69.24 per person per month for the financially stable community.

Water sources for drinking, domestic use, and irrigation

Figure 1 illustrates the percentage of households in the sample population who collect water for drinking, domestic use, and irrigation from various sources. Only 5.67% of people rely equally on rain and pond water, whereas the majority of people utilize groundwater as their source of drinking water. However, people mostly rely on groundwater, rainwater, and pond water for domestic use. Over 50% of the sample

population uses groundwater for irrigation. The facilities to use cannels to provide agricultural water needs are only available to 20.57% of the population.

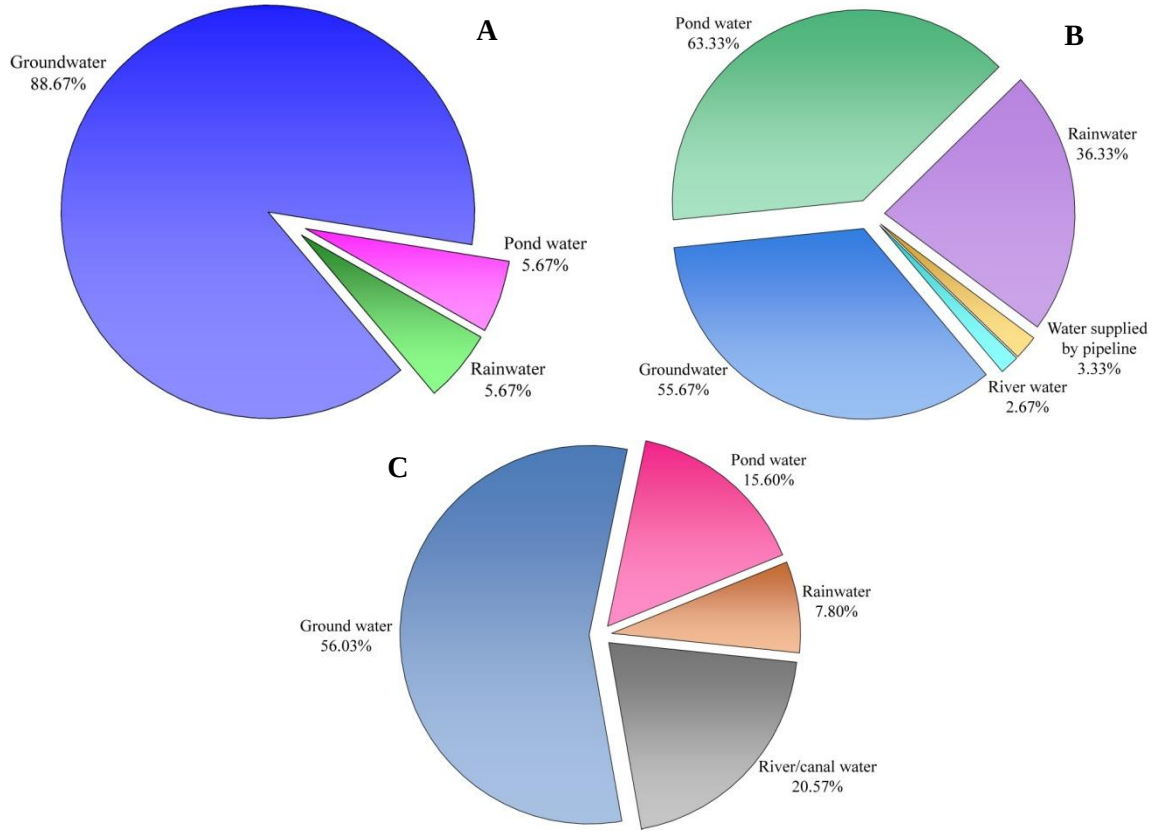

Figure 1: Graphical presentation of sources of water for different purposes; (A) water source for drinking; (B) water source of domestic use; (C) water source for irrigation.

Climate-induced impact and other issues perceived by the locals

The participatory research method used in this study is intended to critically examine the impact of climate change and other important issues that people are now concerned about. Key informant interviews help identify the research area's significant problems, including those caused by climate change. Following Roy et al. (2022)'s adaptation research, Table 1 reveals a comparative evaluation of economic losses to the people's livelihood due to such problems by using equation 1.

$$P = \frac{1}{N}\sum_{j=1}^{j=5}(nD) \quad (1)$$

In this equation, *P* represents the problem ranking score, and *N* indicates the total participant number in the focus group discussions. *j* indicates the limit for the damage to livelihood due to the specific problem (very huge damage = 5; severe damage = 4; moderate damage = 3; less severe damage = 2; least damage = 1). n is the total participant number in the focus group discussions in the *j*th category. *D* is the degree of damage (very huge damage = 5; severely damage = 4; moderate damage = 3; less severe damage = 2; least damage = 1).

The majority of people in the research region are suffering greatly as a result of extreme salinity intrusion which have a negative impact on the availability of water for drinking. This result is comparable to

research on global sea level rise and the consequences that are associated with it (Barlow & Reichard, 2010; Carretero et al., 2013; Hallegatte et al., 2010; Paprotny et al., 2021; Rice et al., 2012; Roebeling et al., 2013; Vitousek et al., 2017). Groundwater aquifers have recently become excessively saline and unsuitable for drinking due to salinity intrusion. Few financially solvent households have the means to store rainwater for a few months while still providing for drinking water needs. Additionally, salinity intrusion has turned into a burden for those whose arable land is adjacent to a river basin (Khanom, 2016). Negative effects on crop yield and soil fertility are caused by a lack of sweet irrigation water supply, insufficient rainfall, using saline water for irrigation due to sweet water scarcity, and less application of climate-smart crop varieties (i.e., saline tolerant varieties, flood tolerant varieties, and drought tolerant varieties) due to insufficient supply.

Table 1: Major problems and their ranking score perceived by the local communities

Problem list	**Total participant number in FGDs**	**Problem ranking score (*P*)**
Safe drinking water scarcity	79	4.04
Salinity intrusion		3.77
Lack of availability of climate smart seeds		3.57
Inadequate rainfall		3.48
Waterlogging		3.22
Virus attack in shrimp farming		3.20
Lack of water supply for irrigation		2.94
Excessive rainfall		2.94
Weak embankment		2.82
Pests attack in rice production		2.81
Lack of availability of good quality seeds		2.71
Pests attack in vegetables production		2.46
Water scarcity for domestic use		2.05
Virus attack in other fish farming		1.96

Technological adaptation in the water sector

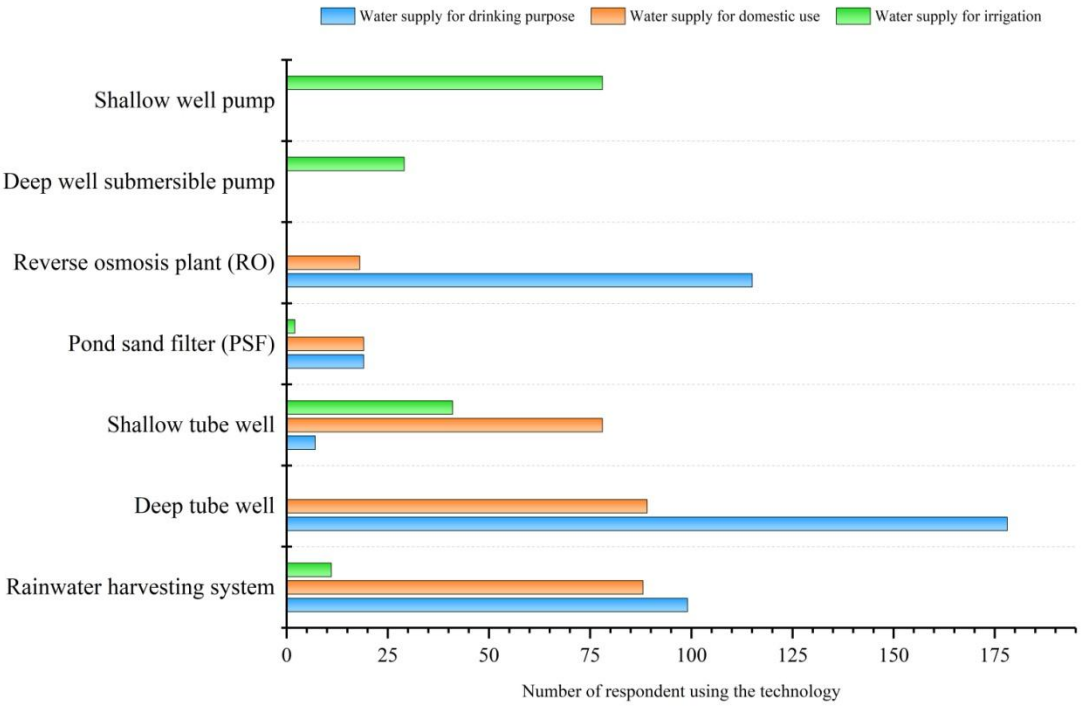

Figure 2: Usages of technology in the water sector.

Figure 2 depicts the overall picture of what portion of local communities are using technology in the water sector to adapt to climate change. The most often utilized technique for drinking water supply in the study area is the hand-driven deep tube well (the minimum boring depth is 250ft or more). Additionally, 33% of the sample population uses rainwater harvesting systems to supply their drinking water. Since the implementation of the reverse osmosis (RO) plant in the coastal region of Bangladesh, the propensity to use such technology for drinking has decreased substantially. Reverse osmosis is a membrane-based technology for water purification that eliminates dissolved solids, regulates pH levels, and removes other impurities (Clever et al., 2000; Shamsuzzoha et al., 2018). Currently, 33.95% of the sample population in the study area depends on RO plants for drinking water supply. The NGO took the first initiative in 2015 to implement a RO plant with locally owned fee-based business model (WV, 2021). Such initiatives to reduce drinking water shortage are becoming more well-liked, and financially solvent people are more inspired to be "water entrepreneurs" by installing groundwater-based RO plants in the study region. Installing an RO plant with a capacity to produce 1000 liters per hour need an investment of approximately US$26000, including all cost of machinery and civil structure (WV, 2021). People collect the drinking water from the RO plant at US$0.005 per liter, and the price increase to US$0.01 per liter if home delivery is desired. However, for domestic usages such as cooking, bathing, and drinking water for domestic animals, people mostly depend on rainwater harvesting systems, hand-driven deep tube well, and sallow tube well respectively.

The diesel-driven shallow well pump is the most commonly used technology for irrigational water supply as 25.74% of the sample population depends on it. With 3-inch boring width, a diesel-driven shallow well pump can meet the water demand for irrigation for 825 – 990 decimal agricultural land. This pump is not highly effective as it frequently fails, particularly in the dry season due to lowing groundwater aquifer. Furthermore, only 9.57% of the sample population have the access to the deep well submersible pump for irrigation. The main obstacle preventing access to the deep well submersible pump for irrigation is the

lack of good quality water from groundwater aquifers due to salinity intrusion. Installing a 6-inch boring width and an average of 800ft depth electricity-driven deep well submersible pump with a capacity to supply water for irrigation in 1320 decimal agricultural land requires an investment of approximately US$4900. Farmers spend US$40 for 33 decimals of arable land to have irrigation water supplied by the deep well submersible pump for four months during the *Boro* season (December to March).

Major constrains and discrimination in access to technology

The reverse osmosis (RO) plant is recognized as a necessary component of everyday life in the study area for reducing climate-induced stress on drinking water availability. Implementing a RO plant is expensive where only financially solvent individuals can satisfy the locally owned business model. NGOs provided partial financial support only to financially sound individuals so they could install and operate RO plants. However, with financial support, NGOs generally imposed particular standards for the operation of a RO plant, such as the water from RO plants needs to be affordable to all community members and provided free of charge to the disabled. But in reality, these prerequisites are not followed. Additionally, most residents of the studied region are living in poverty and find it difficult to acquire drinking water from the RO plant because of their affordability. The economically disadvantaged communities buy water from RO plants and cannot afford to take home delivery services. The sufferings of women from such communities are severe as they play the major role as the water carrier for their families. To collect the drinking water from a RO plant, women need to travel an average distance of 1.5km by walking. People from extremely poor communities cannot afford to buy water, still rely on shallow tube wells and pond water, and are at health risks associated with contaminated water and arsenic pollution.

Major discrimination is seen in society when it comes to having access to water resources for irrigation, particularly when using the deep well submersible pump. The deep-well submersible pump is mostly owned by wealthier people and local elites, with very little engagement from NGOs or governmental entities. The farmer who has more arable land is given priority over the poor when it comes to providing water for irrigation during the dry season. Lack of financial capability to install deep well submersible pumps, lack of the appropriate soil layer to draw high-quality water from groundwater aquifers, and reaching the pump's maximum limit by supplying water to the rich farmer and local elite's arable land, poor and marginalized farmer are deprived to access to resources and suffers the water scarcity for irrigation.

Recommendations

Most of the respondents in the participatory research mentioned that the development activities of NGOs in the study region decreased substantially after the Rohingya refugee crisis in Bangladesh. Increasing financial assistance and NGOs' development initiatives to address the drinking water issue caused by climate-induced impacts, such as increasing the number of RO plants and maintaining more reasonable water prices for impoverished communities are strongly advised. More household and community-based rainwater harvesting systems and pond sand filters with proper training and maintenance facilities need to be installed to reduce the water crisis. Irrigation canal systems with good quality water need to be developed to secure crop production in the coastal area of Bangladesh. In addition, government bodies and NGOs need to take the initiative and increase the subsidy to install more deep submersible pumps. Besides, establishing a licensing system for those who want to have such technology and an effective monitoring cell for managing equity in access to resources is highly recommended.

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Thesis title: ***The role of innovation and adaptation technologies in reducing climate-induced disaster impacts and enhancing resilience in Satkhira communities of Bangladesh***

Background and Context: Climate change poses a significant threat to Bangladesh because of its geographical situation, high population density and inadequate infrastructure. Over the last few decades, it has caused frequent and unpredictable extreme climatic events such as cyclones, tidal storm surges, severe floods, river erosion, excessive rainfall, thunderstorm, and overwhelming salinity intrusions, mainly in the coastal regions of Bangladesh (Salequzzaman et al., 2009; Ahmed et al., 2007). The local inhabitants of the coastal areas are becoming more vulnerable and exposed to increasing climate-induced disasters (Kamal, 2013; Wisner et al., 2004). Coastal people's lives and livelihoods are affected disproportionately by extreme climatic events. However, they always strive to return to their regular life after every severe extreme event. At present, innovation and technologies are widely used, and the aggregation of science and technology has enormous importance and potentiality to mitigate climate risk at various levels. They provide useful tools and resources to deal with vulnerabilities and climate hazard conditions. The significance of innovation and adoption technologies has been empirical in many ways, from early warning systems; to community resilience; stakeholder engagements, and institutional networks (Izumi et al., 2019). A wide range of innovative approaches, technologies and learnings has embedded the development and mitigation process in coastal Bangladesh to deal with climate risk. However, it has always been challenging to identify the appropriate and effective means for a vulnerable community as the intensity and variability of climate risk varies frequently.

The research has been conducted in the southwestern part of Bangladesh and part of the Satkhira district under the Khulna division (BBS, 2011). Based on the baseline study (IDRC project), two *Upazilas*, namely Kaliganj and Shayamnagar, are selected for the present research. They are considered among the most vulnerable coastal zones in Satkhira districts to climate-induced disasters (Kabir et al., 2016; Shaibur et al., 2017). In recent years, the Satkhira district experienced numerous extreme events, including cyclones, coastal flooding, tropical storms, and tidal surges that have caused the loss of thousands of human lives and livelihoods (Rahaman and Esraz-Ul-Zannat, 2021). These extreme events include Cyclone SIDR in 2007, that affected 2.3 million households with physical destruction, close to US $1.1 billion, and Cyclone Aila in 2009, which affected 3.9 million people with a total financial loss of US $240 million (Islam et al., 2015; CRED, 2009; Tajrin & Hossain, 2017; also see Khan et al., 2015). The overall impacts were catastrophic in these two areas damaging thousands of acres of cropland, livestock, fish farms and physical infrastructures.

Objectives: This study aims to identify two major research questions, and they are:

i. What are the existing innovation and adaptation technologies used in the coastal community?
ii. How are these existing innovation and adaptation technologies benefiting the vulnerable local communities?

Methods: For conducting this research, the primary and secondary data were collected using various data collection methods. These include household surveys, key informant interviews (KII), focus group discussions (FGD), and secondary data sources. In this study, 300 household surveys were carried out using a semi-structured questionnaire. Considering the two selected *Upazilas*, Kaliganj and Shayamnagar, it followed the household sample's equal distribution, i.e. 150 households from Kaliganj *Upazila* and 150 from Shayamnagar *Upazila*. The household units were the Primary Sampling Units (PSU), which were

selected using simple random procedure. As the household head was the primary participant, but in (his/her) absence, other members within the household with adequate knowledge and understanding were chosen as a participant in the research. The duration of each household survey was for 60-90 minutes.
This research also includes five focus group discussions (FGD) with 6 participants in each group, involving multiple key stakeholders such as 1 with a local farmer group, 1 with a local fisherman group, 1 with a social network group, and 2 with community people. The participants were selected based on their social entity, age, gender, experiences, socioeconomic condition, and occupations. All the FGDs were organized within the selected *Upazilas*, and the duration for each FGD was for 90-120 minutes using a set of guiding questionnaires. In addition to that, 17 key informant interviews (KII) were conducted to add more valuable insights to the study. The participants were selected depending on their role in the community and institution with having substantial knowledge and understanding of the issue. Among the 17 KIIs, 6 were from local GO representatives, 5 NGOs, 1 community leader, 1 farmer, 1 fisherman, 2 from community people, and 1 from the local elite. The duration for each interview was for 60-90 minutes.

Major Findings

Innovation: Innovation works as the process of combining scientific, social, and technological knowledge with new and existing ideas, as well as the integration of innovative and appropriate theories (Lei et al., 2016). In Bangladesh, over the last decade, Early Warning System (EWS) has been saving millions of lives and the natural environment and eventually minimizing the impacts of climate-induced disasters. EWS is considered as a critical source of information to the local communities of Satkhira that allows the vulnerable people to establish preparedness plans and strategies to reduce the risk to lives and livelihoods.

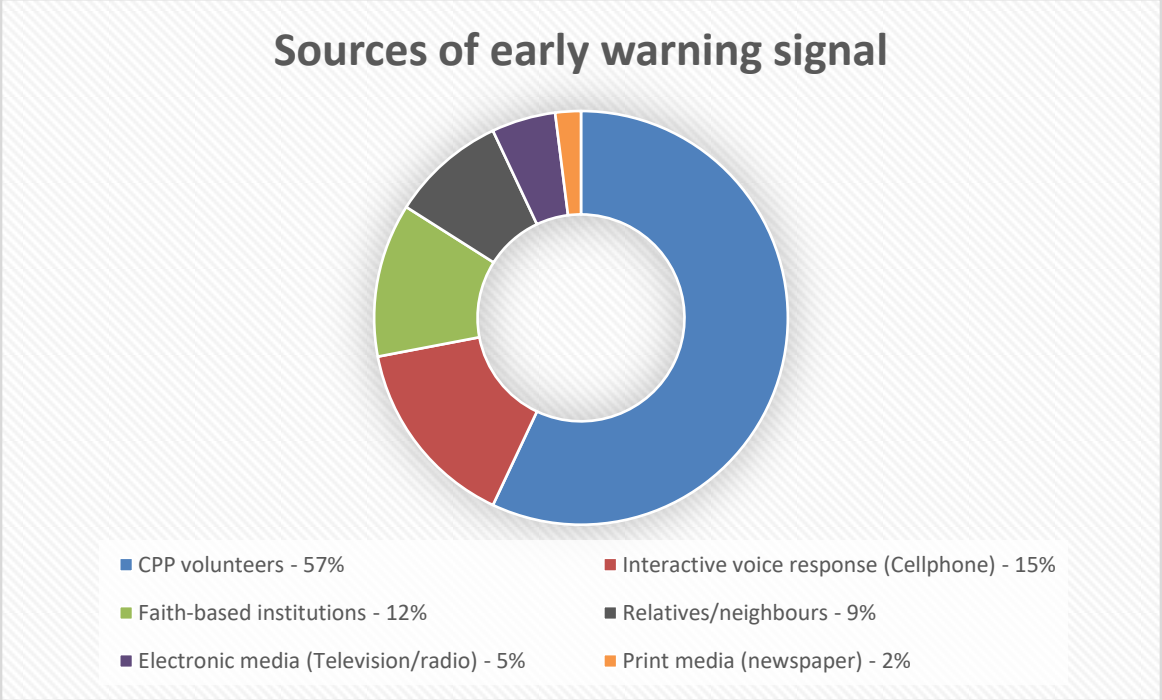

Figure-1: Sources of early warning signal

The survey results (see Figure 1) reveal that most of the coastal people of Satkhira receive early warning signals from the cyclone preparedness program (CPP) volunteers (57%) during any climatic disaster. They disseminate the warnings through sirens, megaphones, and upholding red flags depending on the severity in local dialects and to mobilize communities. In coastal Bangladesh, CPP has been pivotal in disaster risk reduction. With the new initiatives of CPP, the overall process of forecasting to dissemination at the local level takes place within 8 minutes. In Shymnagar and Kaliganj, CPP has more than 4,980 active volunteers, with 20 volunteers in each ward.

Photo-1: Cyclone preparedness program (CPP) volunteer (Courtesy: Sabbir Ahmed Khan)

Further, the study found that interactive voice response (cellphone) (15%), faith-based institutions (12%), and relatives/neighbors (9%) significantly allow the coastal communities with early warning information for any climatic disaster.

Innovation in the microfinancing sector has been remarkable for developing nations, like Bangladesh, over the past four decades. Microfinance has been working as a provider of financial services to poor communities. The study in Satkhira found that MFIs such as Grameen Bank, Brac, PKSF, Nowabenki Gonomukhi Foundation (NGF), Satkhira Unnayon Sangstha (SUS), Uttaran, ASHA, BK safety net, and many others provide credit facilities to the poor and disaster-affected communities, ranging from Taka 1,000 to 50,000 (US $10-500) with an interest rate from 2% to maximum of 13% in various terms and conditions. However, depending on the adversity of the disasters, the credit amount may increase to Taka 10,000,000 (US $1,00,000).

BOX: 1 During cyclone AILA 2009, PKSF and Nowabenki Gonomukhi Foundation (NGF) in Satkhira provided credit facilities of Taka 7,000-10,000 (US $70-$100) to the affected people in repairing and rebuilding houses, agricultural and livelihood restoration activities with 0% interest rate for 12-15 month's time period. Through this program, around 25,000 households were benefited. Further, in cyclone Amphan 2020, the affected communities in Shymnagar and Kaliganj received cash incentives (Non-Refundable) of Taka 5,00,000 (US $5,000) and 2,00,000 (US $2,000), respectively.

Adaptation Technology: Adaptation to climate risk aims to ensure the survival and development of the ecosystem (Jia, 2021). Using adaptation technologies is a complicated process that involves integrating multiple stakeholders and actors at different levels. Moreover, it requires consideration of social, economic, and political aspects that necessarily help linking numerous factors, such as capacity development, transfer of technologies, and knowledge sharing to mitigate disaster risk reduction.
Technological approaches to adaptation include both "*hard*" technologies, such as capital goods and mostly physical tools, and "*soft*" technologies, such as knowledge of methods and techniques required for the application of "hard" technologies (Levina & Tirpak, 2006, p. 11). Climate change adaptation

technology is therefore a continual process that involves information development and knowledge building to ensure its effectiveness at all levels (IPCC, 2000).

BOX – 2: Hydroponics, also called aquaculture, nutriculture, soilless culture, or tank farming, is the cultivation of plants in nutrient-enriched water, with or without mechanical support. This type of farming is quite popular worldwide, with up to 5 times more profitable. It can provide crop yields 30% faster than traditional farming methods as it involves little or no cost in land preparation, irrigation, and chemicals.

Photo-2: Hydroponic farming (Courtesy: Sabbir Ahmed Khan)

In Shyamnagar, due to high exposure to salinity intrusion, a group of 27 female members (Popi Group) is currently involved with Hydroponic farming supported by the Center for Natural Resource Studies (CNRS), a local NGO which actively works to minimize climate risk reduction in coastal Bangladesh. The farm started in January 2022 with the aim of commercial profit and meeting household nutrition demand. Presently, various vegetables are cultivated, such as tomatoes, brinjal, and green pepper. The group is expecting an 800 Kg production of vegetables at the end of this year with a profit of Tk 20,000-28,000, and the profit will be shared among the members.

CNRS provided training to all the group members on the crop cultivation process in such farming. Further, irrigation is done through rainwater harvesting plant and sweet water ponds; the water is then supplied to the farm by pumping in growing vegetables. Thus, hydroponic farming is creating employment opportunities in poorer communities that significantly contribute to household income.

Table 2: "*Hard*" and "*Soft*" and adaptation technologies in Satkhira (Kaliganj and Shyamnagar)

Sector	"*Hard*" adaptation technologies	"*Soft*" adaptation technologies
Agriculture	Biotechnology: Genetically modifying crops (saline tolerant such as BRRI-52, 47, 67 and 72, BINA-10 floods tolerant such as BRRI-55,68,73,87, and other climate stress-tolerant such as BRII-27, and 10).	Hydroponic and aquaponic agricultural practices, homestead gardening, vermi and organic compost, vertical towering, mulching method, agricultural practices using gunny bag, concrete pot, or cork box, integrated farm management (IFM) and crop diversification based on seasons.
Water Resources (Drinking and Irrigation)	Reverse Osmosis (RO), Pond Sand Filters (PSF), Deep Tube well, and Shallow Tube well	Rainwater Harvesting (RWH), Drip irrigation, Freshwater Mini Pond
Infrastructures	Multipurpose cyclone shelter, Sea walls, Block embankment, Sluice gates, Polder, Culverts, Geobag, Geosynthetic, Early Warning System (EWS)	Dissemination of Early Warning information

In the coastal region, freshwater availability is limited, and climate change is expected to exacerbate the situation. Various means of adaptation technologies are widely used in Satkhira (see Table 2). To adapt to changing climate in the agricultural sector, the Government of Bangladesh (GoB) and other agencies, including NGOs and INGOs, have introduced various saline and flood-resilient crop variants, mainly benefiting the local farmers. Rice variants such as BRRI-27 and BRRI-10 are commonly known for being favorable to climate-related stress. They provide the highest yield, around 30-40%, with a net marginal profit of 81% greater than other variants.

For Water Resources (Drinking and Irrigation), technologies such as Reverse osmosis (RO), Pond Sand Filters (PSF), Shallow Tube well, and Rainwater Harvesting (RWH) have been introduced Shyamnagar and Kaliganj due to higher salinity in soil and groundwater. Most of these RO plants (new 7 and renovated 3), PSF (new 6 and renovated 4), and RWH (about 59.5% of the household uses rainwater harvesting system in the study area) have been implemented by local NGOs, including Nawabenki Gonomukhi Foundation, Rupantor, Leaders, World Vision, Satkhira Unnayon Sangstha (SUS), Center for Natural Resource Studies (CNRS), Shushilan and Friendship in collaboration with the United Nations Development Programme (UNDP), Department of Public Health and Engineering (DPHE) and other governmental agencies. The study identified that about 60-70% of the total agricultural activities rely heavily on Rainwater and 20-25% on PSF and shallow tube well water. Presently, they support the communities with sources of pure drinking water, domestic use, and agricultural activities.

Satkhira is always at risk of storm surges, tidal flooding, cyclones, and high salinity intrusion. They severely damage and disrupt coastal livelihood and resources. Over the past 15 years, the use of 'hard' adaptation technologies has been saving coastal resources through using increasing structural barriers such as block embankments, geobags, sea walls, polders, culverts, geosynthetics, sluice gates, cyclone shelter, and early warning system. Since 2000, the government and related authorities have constructed approximately 35 km of block embankments, 16 km of geobag, 32 sluice gates, and 7 multipurpose cyclone shelters in both study areas to protect vulnerable communities from various climatic disasters and minimize their impacts.

Conclusions and Recommendations

Innovation and adaptation technologies have contributed to saving millions of lives and the livelihood of vulnerable communities in Satkhira. The wider implementation of EWS, microfinancing, cyclone preparedness program (CPP), genetically modifying crops (saline, flood and other climate stress-tolerant), crop diversification, hydroponic agricultural practices, reverse osmosis, pond sand filters (PSF), deep tube well, shallow tube well, rainwater harvesting (RWH), cyclone shelter, Sea walls, Block embankment, Sluice gates, Polder, Culverts, Geobag, Geosynthetic and many others enabled the vulnerable people to address the underlying climate challenges. All these mechanisms and interventions allowed multiple stakeholders to participate in minimizing climate-induced disaster impacts and offer solutions to foster community resilience.

Amplifying innovation and adaptation technologies is considered a potential instrument since it offers communities with resources and techniques to build adaptive capacity and resilience to climate risk. However, many of these innovations and adaptation technologies have not been extensively embraced and put into use by vulnerable communities. The recommendation from this study is followed below:

- Creating knowledge learning center at the ward, village, and union level with proper training facilities.
- Creating emergency fund for repairing and maintaining adaptation technologies during adverse condition
- Creating more sustainable embankments (block or sea wall)
- Integrating Nature-based solutions in terms of adopting different innovation and adaptation technologies
- Ensuring accountability and transparency with various innovation and technological projects

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Report on

LGIs and Women's Stakeholders Training Workshop

Dowarabazar – Shunamganj

Date: 19th April 2022
Venue: Upazila Hall Room, Dowarabazar, Shunamganj
Organized by: Bangladesh Centre for Advanced Studies (BCAS)
Assisted by: IDRC, Canada

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Background:

The SAKTEE is a multi-institutional and collaborative research project for 3 years (May 2019 to April 2022) in Bangladesh. Coordinated by BCAS, the project is being implemented by Department of Women's Affairs (DWA) of the Government of Bangladesh, International Centre for Climate Change and Development (ICCCAD) and the University of Manitoba (UoM), and Canada. Supported by the International Development Research Centre (IDRC), Canada the project aims to improve understanding of the dynamics of the complex set of factors that aggravate differentiated climate change and disaster impacts and vulnerability. The project also aims to fill identified knowledge gaps in the areas of gender responsive adaptation to climate change, DRR and empowerment of women for enhancing social resilience. The focus is to understand deeply the effects of climate change on women and impoverished populations in the most vulnerable regions i.e., coastal region and Haor (wetland) basin in Bangladesh. The project has a consistent focus on empowerment of women, youth, students and disadvantaged families through enhancing their knowledge, adaptive capacity, income-generation activities and skills for climate resilient-alternative livelihoods of the poor and socially disadvantaged groups in the two climate affected regions. In doing so, the feminist research and participatory action research approaches are applied to all components of the project. Action research on adaptation technology selection and demonstration in water and agriculture, exploratory research by the university students, capacity building of the poor women, disadvantaged groups, youths and students as well as the women stakeholders were the key areas of focused interventions of the project in year-2.

The project had a good start in the year1, but encountered some problems in field implementation from the last quarter of the first year (March 2020) and throughout the project year2 (May 2020 to April 2021) due to the wide spread impacts of the COVID-19 Pandemic and frequent lockdown situations in Bangladesh. However, the project team at BCAS and the partners developed a contingency plan (which was adjusted in the changed situation) in consultation with Program management at the IDRC and made all sincere efforts to carry out the activities at different levels with communities and actors. This annual technical report describes the planned activities, approach and methods, progress of implementation of the action research project, limitations, barriers and the key learning of the project team.

Objectives:

The key objectives of this project are as follows:

- **Explore and understand** the interrelationships of various environmental, socioeconomic, political and cultural factors and climate change that may exacerbate social and gender inequity

- **Scale-up innovative, locally tested adaptation technologies** to address worsening climate change impacts, particularly on water and agriculture, through promoting multi-level institutional coordination and integration

- **Support empowering women**, students and poverty-stricken disadvantaged households in the climate-vulnerable regions; and

- **Engage and inform policy and decision makers** about transformative climate change adaptation technologies and the potential for their integration with social and gender equity programs.

Inaugural Session:

The session started with the speech of the honorable Director General-DWA *Ms. Farida Parveen* where she welcomes everyone including the participants, organization, as well as the government officials. After she got to know the overall situation of Dowarabazar, which was not well in the haor areas, she mentioned how it is also a part of climate change and the level of global warming is also increasing due to this. For a fact, the consequences of the global warming is being seen in Shunamganj now. Dowarabazar is now under water and she has acknowledged what this upazila has to go through for quite a very long time. She also said what global warming is doing worldwide as the glaciers are melting, there is a rise in the sea level and that happens the water rise in those areas and productivity decreases. The DG mentioned about the GCA project in Shunamganj that is being formed to see the kind of productivity that can be produced in those areas. As the saline water keeps entering the haor regions, it is difficult to cultivate staple items and so, among a lot of things the production of watermelon was a success. On the other hand, there is an adversity of clean drinking water in those areas due to this calamity, so women are kept responsible in transporting water from distant places, moreover, due to this unavailability of drinking water women gets more distinct diseases compared to men. As a result, this GCA project has started working in this with the help of UNDP and helped quite a few families in harvesting rain water to drinkable water in households and community levels. A card process is being created for water and ration for the families so that they can survive well. She also mentioned about the crab harvesting for the families since there is a lot of saline water. Regarding the risk indicators the current position of Bangladesh is on the 7^{th} position according to the year 2021. Also, government has accepted some of the strategies and precautions

presented by the Department of Women's Affairs (DWA) and hence climate fund was accepted to be provided in this regard. Lastly she talked about the variation of the seasons and their consequences that we are facing and the unfortunate condition where children of this generation do not understand the difference between seasons due the the effects of climate change and so we have to fight these adverse reactions and start with the first step of planting more trees.

Subsequently, the director *Ms. Monowara Israt* welcomed all the participants in the inaugural session. She wished everyone well and thanked the organizers for organizing such an important training workshop for the stakeholders. She acknowledged the purpose of the training so that it can be achieved fruitfully and most importantly so that the locals can learn something from this training after overcoming the hazards.

Virtual Speech of the Director, DWA

This training was organized to overcome these challenges regarding this climate change effects and how we can work through the processes through this training was described. After a short introduction from the respected DWA members, *Dr. Atiq Rahman*, Executive Director of BCAS welcomes everyone and says that climate change is no new news and it has been there for over 30 years and recently it is being analyzed to a greater extent now. According to research, climate change is not just affecting now, but it will be causing a great damage in the future if we do not start the adaptation processes. There are places where there is a lack of pure drinking water and these problems is still increasing. A lot of government and non-government organizations are coming now and then to investigate these problems and so, comparatively these problems are

reducing a little and we are being able to move forward to a sustainable development world. He mentioned that Bangladesh is still luckily in a good position today and it is still standing well. As a matter of fact, a workshop is being conducted due to these reasons.

Technical Session:

The first technical session was conducted virtually by *Dr. Dwijen Mallick*, Fellow of BCAS where he said that there are three main risks and they are the physical situations and the global trends of climate change. He said that he will be talking about the the vulnerable women and the women friendly adaptation processes. The key trends of climate change will be discussed, as well as the challenges and factors for the adaptation process. After a while, due to some technical problems, the presentation was unable to continue and so meanwhile the introductory session was conducted where all the participants present introduced themselves by telling their name and designation. Afterwards, the next presentation took place briefly.

The following session was conducted by *Mr. Monowarul Islam*, Head of Training & Knowledge Management. He said that the conversations, discussions that will be talked about will be

Virtual speech given by Dr. Atiq Rahman to the participants

regarding their current situation, basically the state they are in presently. He discussed what weather and climate was and how climate change is affecting our current conditions severely for the last 50 years. Previously, we were able to distinguish the seasons, however, now we cannot determine what will happen in which season. Meanwhile the lecture, a participant mentions that now a day when it rains there is a lot of lightning and wind at the same time. Different things keeps happening during the off seasons and so, we try to compensate the weather conditions with different process of cultivation and adaptation techniques. Flash flood is considered as one of the crucial conditions in the Haor areas, affecting our cultivations even though there is no rain. The irrigation that destroying and affecting the crops are basically coming from the outside channels, where 92% of the water is from the neighboring countries. So, even if it does not rain, the rivers were supposed to flow through the bed of Bangladesh, however, the owner source of the water is the other countries that typically makes it difficult for us. We are very much dependent on

rainwater, hence the solution to these problems are adaptation and for these adaptations, we have to make use of some of the technologies. Another participant acknowledged that it takes about 500 – 1000 years to form this ground water that we are taking out so easily, but it does not refill as fast as we take it out. According to some of the participants, the farmers, tubewell users do not realize it well, hence the water level decreases. Dowarabazar has a lot of water problems and during the dry season it is even harder to get the drinking water. It has been seen that even after digging 700 feet underground, it is hard to find water in this entire area. Moreover, the upper layer of water from the underground are not even healthy rather it is all stale. So, a project will be implemented on treating surface water and providing it as pure drinking water. On the other hand, women plays a key role in collecting water and bringing them every morning. He also

indicated that we need the local demand and it can only be created when the stakeholders will get involved with the water and can heed to these matters. On the other hand, in the case of the agricultural processes we have land but we cannot cultivate throughout the years. So, during the six months when there is the availability of water, it can be used for proper cultivation. Lastly, he shared his concern by saying that if we can make the methods more strong, the stakeholders who are involved can also implement these aspects more wisely.

In this regard, one of the member in this workshop mentioned that we still use a lot of pesticides and if this matter is being asked or questioned, the people in charge of this matter ignores them. It was also interrogated about the beneficiaries for the local communities in these demonstrations of the stakeholders. Two things that came to surface was the communication process and the features of the demonstration are the exhibitions which interested the farmers to see the type of cultivations. Another participant said that two towers will be constructed for the lightning so that farmers can run to those shelters during the time of the storm while working on an open field, but this matter of building such shelter is still a long shot. Furthermore, we have to plant more trees and prepare ourselves for the lightning and other natural disasters. With these suggestions and comment the open discussion session as well as the entire workshop comes to an end.

Participants sharing their opinions in the 'Open Discussion Session'

A group work was conducted where the participants were divided into three groups; GO, NGO and Female Member Group. There they shared some of their opinions and crucial point of views in terms of providing a solution to the problems that had occur. These are as follows:

GO Group:-

1) To give training through pen and paper by inspiring women in agricultural production work
2) To raise awareness about agricultural work through backyard meetings
3) To ensure atleast 30% of women in the group based agricultural trainings.
4) A group based IGA training system is running
5) A training is ongoing for the agriculture, fisheries and groceries business in exchange of food.
6) Through the 'Ma' assembly, a woman's further education and awareness raising is being ensured.
7) DAE is giving training for raising awareness of women in improving their knowledge in planting trees and conservation of the environment.
8) To increase awareness in disaster preparedness and the number of female members in the union disaster committee.

NGO Group:-

In case of Agriculture:-

1) To arrange training on agriculture for women.
2) To arrange the agricultural materials from different NGOs
3) To create opportunities to communicate with different governmental departments
4) To arrange the use of agricultural materials with the help of the modern technologies.

In case of Drinking water:-

1) To arrange communication links with the public health prosecutors.
2) To arrange communication links with the NGOs those who works with WASH
3) To arrange sources of wealth from different NGOs with simple terms.

Female Member Group:-

The types of service we provide to the ordinary people.

1) Extensive harvest is being affected due to the natural disasters.

The services that can help us to give a better service to the people from the government and non-governmental organizations. The followings in brief are described below:

1) Collaboration of the government is required for the resolution of the excavation of the canals and waterlogging.

Concluding Remarks: Lastly, Mr. Monowarul Islam made the concluding remarks and said that Shunamganj is one of the climate hot-spot zones for all the disasters that occur. Their ecological, geographical and environmental context is different. It has more negative impacts than positive ones due to climate change and so, a joint effort is required for all the participants present from different sectors can work together to make a good change in making the situation more favorable. He also said that if we are able to use the abilities we consist of, only then we will be able to be a safe population from all the disasters of climate change. As a result, today's workshop is regarding the use of our knowledge in field level and to build a link between each other while it is considered to be an integrated process to work together.

NATIONAL DIALOGUE & SYMPOSIUM ON EMPOWERING WOMEN

SESSION ON

CHALLENGES OF IDENTIFICATION OF THE GENDER RESPONSIVE ADAPTATION TECHNOLOGIES

DATE: 26 OCTOBER, 2022

CHALLENGES OF IDENTIFICATION OF THE GENDER RESPONSIVE ADAPTATION TECHNOLOGIES IN AGRICULTURE AND WATER IN COASTAL AND HAOR REGIONS

DR. DWIJEN MALLICK

FELLOW OF BCAS

BCAS

University of Manitoba

ICCCAD International Centre for Climate Change and Development

IDRC CRDI Canada

OUTLINE OF THE PRESENTATION

- Adaptation Technologies: Needs and Priorities in Bangladesh
  - About the SAKTEE Project
  - Local Climate & Social Contexts of Coastal Region and Haor Basin
- Identification of Climate Change Adaptation Technologies (CCAT) in two Ecosystems
- Adaptation Technologies for Agriculture & Water in Bangladesh
- Poor & Women-Friendly Adaptation Technologies
- Challenges Ahead

ADAPTATION TECHNOLOGIES: 3 KEY DIMENSIONS

- **Adaptation to climate change involves identification, demonstration and implementation of wide range of technologies with 3 key dimensions:**
  - **Hard-ware** such as sea-wall, improved dykes and irrigation management in the growing salinity and frequent floods
  - **Soft-ware** such as change in seeds and cropping patterns, information, skill and knowledge for adaptation; and
  - **Org-ware** ,which is related to the ownership and institutional arrangement of technology development and dissemination
- Adaptation is evolving with blending of modern and local knowledge: that need huge capacity & skill development and technological innovation

PURPOSES OF ADAPTATION TECHNOLOGIES

- **Adaptation technologies involve knowledge and skills of vulnerable groups and people; Development and transfer of climate change adaptation knowledge and technologies (CCAT) primarily for**
  - Reducing risks & vulnerability
  - Protecting assets and resources
  - Protecting and improving lives of people and
  - Enhancing climate resilient livelihoods

GLOBAL FRAMEWORK & STRATEGIES ON CLIMATE CHANGE ADAPTATION TECHNOLOGIES (CCAT)

- The Cancun Agreement on Climate Change in 2010 has adopted the **Climate Adaptation Framework and the Technology Mechanism**, which provided the opportunities and insight to step up and scale up adaptation technologies
- In 2015, the Paris Climate Agreement have **provided the way and steps** for identification of urgently needed climate technology development and rapid transfer of appropriate & effective technologies for both adaptation and mitigation
  - The PCA (2015) further strengthened the technology **mechanism for research, technology development, demonstration and capacity building** for technology transfer in the developing countries

GLOBAL FRAMEWORKS AND STRATEGIES

- **Technology Need Assessment (TNA)** was undertaken by the UNFCCC with the parties for identification and assessment of the efficacy of both mitigation and adaptation technologies
- In 2014, the UNEP has conducted a knowledge gap analysis in relation adaptation technologies in key sectors like agriculture, water and health; The report has identified **potential knowledge gaps and challenges** in the following 3 levels:
  - **Incomplete knowledge production** and dissemination for adaptation technologies
  - **Inadequate linkages and partnership** between and among the institutions and stakeholders for development and transfer of CCAT; and
  - **Limited diffusion and transfer of knowledge** to policy and decision makers and the users for transfer and update (UNEP, 2014 and Klein et al, 2014)

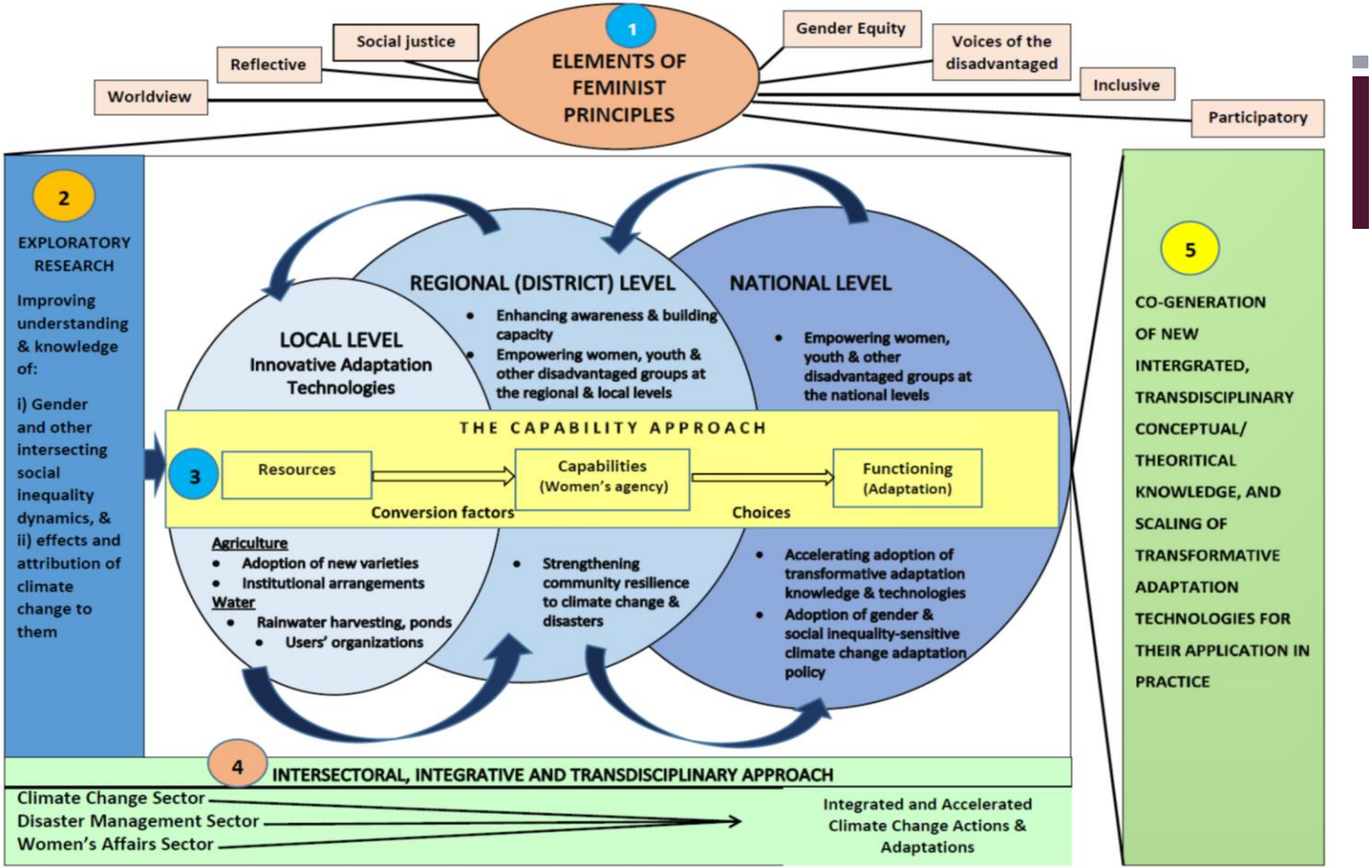
SAKTEE PROJECT: ADAPTATION TECHNOLOGIES

- **The SAKTEE project indented to meet the challenges by taking steps in identification and demonstration of Pro-Poor & Gender Responsive CCAT in**
  - **Agriculture and Water in the two climate affected zones in Bangladesh**
  - **SAKTEE stands for Scaling Climate Change Adaptation Knowledge and Technologies for Empowering Women and to enhance Social Equity and Disaster Resilience in Bangladesh**

Four OBJECTIVES:

- ***OBJECTIVE -1: IMPROVE UNDERSTANDING OF THE DYNAMICS OF VARIOUS FACTORS***
- ***OBJECTIVE -2: IDENTIFY AND EVALUATE INNOVATIVE ADAPTATION TECHNOLOGIES***
- ***OBJECTIVE -3: INTEGRATION THROUGH ENHANCING LOCAL, REGIONAL AND NATIONAL LEVEL STAKEHOLDERS' AWARENESS AND CAPACITY***
- ***OBJECTIVE -4: FACILITATE POLICY DELIBERATIONS AND COORDINATION***

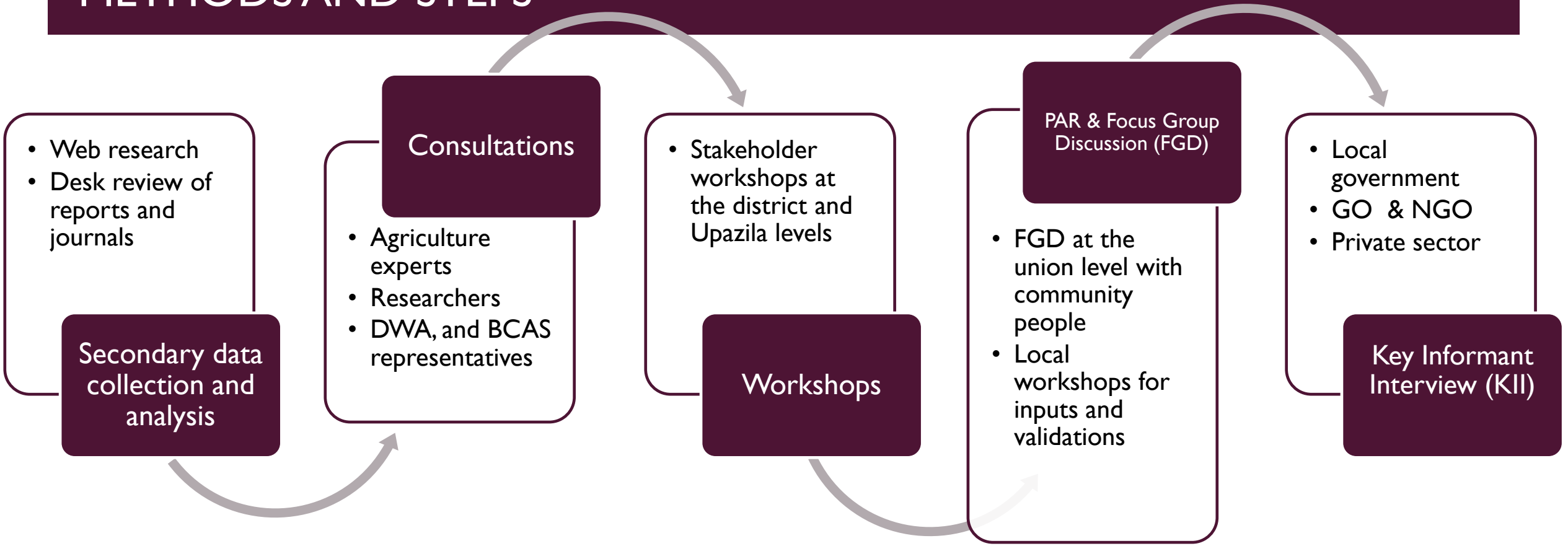
CONCEPTUAL FRAMEWORK



OBJECTIVES OF TECHNOLOGY INVENTORY

- The main purpose of the review and technology inventory is to improve the understanding about the available technologies in water and agriculture as well as to identify the potential adaptation technologies. The specific objectives are:
  - To learn about the current adaptation technologies in agriculture and water sectors in project locations;
  - To identity CCAT and confer how these technologies can benefit vulnerable women, poor and disadvantaged people at the local level; and
  - To know about the challenges and potential opportunities of using innovative adaptation;
    technologies for women and disadvantaged sub-populations

METHODS AND STEPS

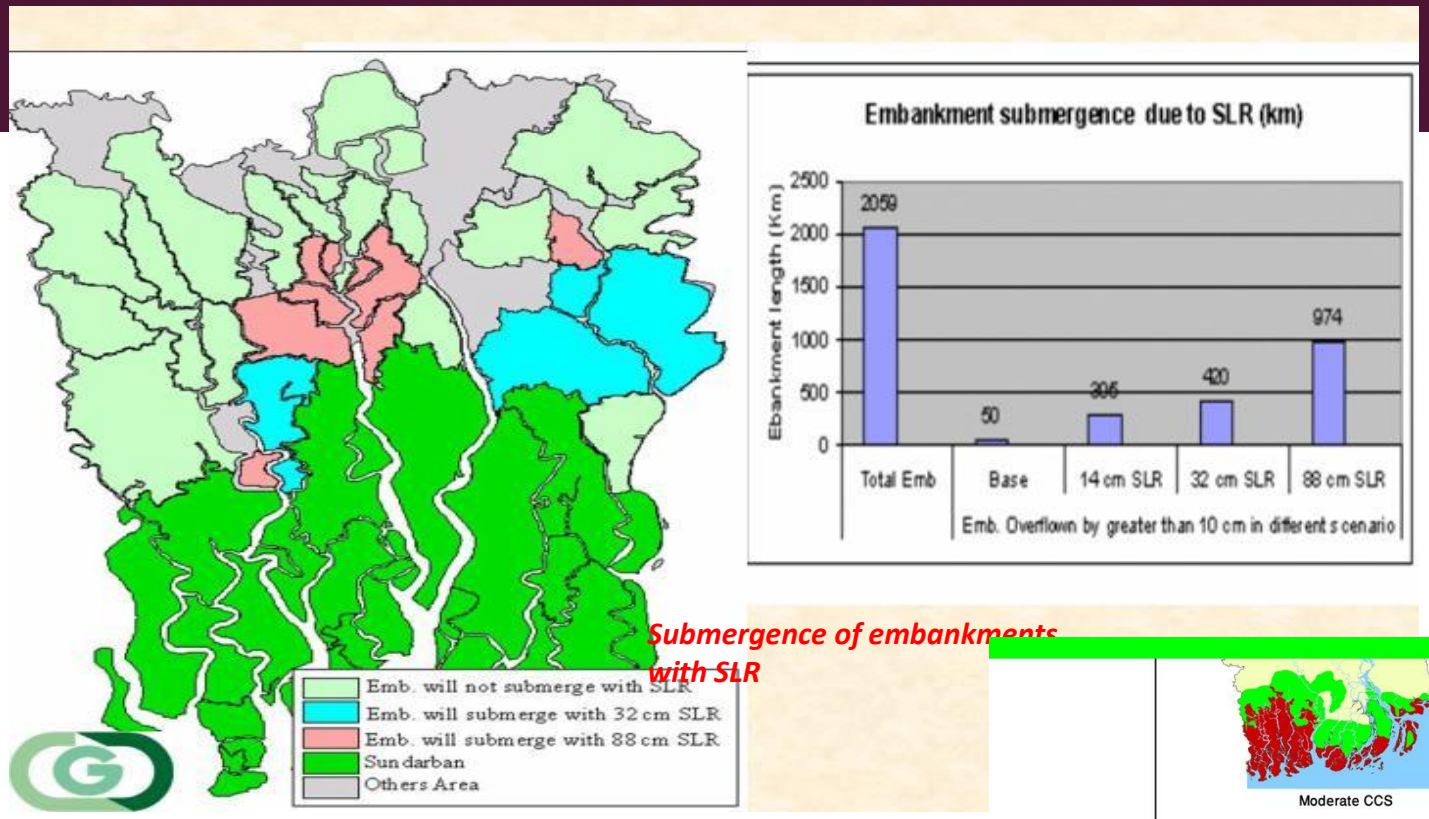


CLIMATE RESILIENT AND ADAPTATION TECHNOLOGY

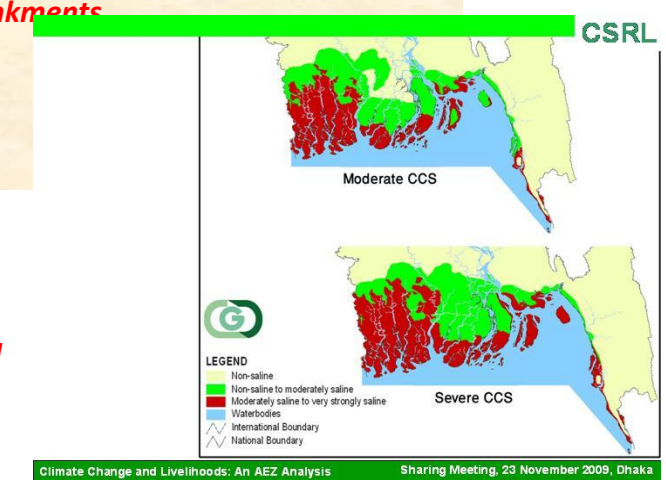
- The climate-resilient technologies mean a new practice that can counter the increased climate risk; the Project has considered the THREE Dimensions of CCTA: to support adaptation, which is a process led action to moderate, cope with, and take advantage of the consequences of climate variability & climatic extreme events

Sector	Hardware	Software	Orgware
Agriculture	Selection of Crop or crop variety	Farming practices research on the new variety	Local Institute: Women's groups, FFS, UP and DAE
Water & WASH	Rain Water Harvesting System, Pond sand filter, Low lift pump, Deep tube well,	Increase availability and use of safe water; skills & efficiency and recycling	Water use groups & associations; UP, DPHE, DWA

LOCAL CONTEXTS OF SATKHIRA, A COASTAL DISTRICT (KALIGANJ & SHYAMNAGAR)



Submergence of embankments with SLR



Coastal belt
Adjacent to Sundarbans
Multiple hazard: Salinity (agriculture and drinking water), Flood, Water logging, Cyclone

Increased intrusion of salinity and water logging

Local Contexts: Sunamganj Haor (Jamalganj & Dowarabazar)

Flash Flood and river erosion prone areas

Major livelihoods: Agriculture(single crop Paddy- December to second week of May) and Fisheries

ADAPTATION TECHNOLOGIES IN AGRICULTURE

- Climate contexts and social conditions are different in the two ecosystems; There are few common, but many local and context specific adaptation measures
- The government of Bangladesh: BARI, BRRI and DAE as well as NGOs have developed and demonstrated various locally appropriate adaptation measures in crop, fisheries and livestock sub-sectors of agriculture
- Key adaptation responses are:
  - **Changes in crop varieties and cropping patterns** (such as salt and draught tolerant varieties, early crops and flood resilient rice varieties)
  - **Floating bed crop farming, raised bed vegetable** and fruits growing, ditch and dyke cultivation, drip irrigation; and *Kanda* farming in Haor
  - **Alternative drying and wetting (ADW), mulching, fresh water storage** in the field for small irrigation in the coastal zone, green & compost manure; agro-forestry etc.

CCAT in Agriculture: Coastal region in Bangladesh

Agricultural production related CCAT
Slab & hanging vegetables garden
Saline tolerant paddy **(BRRI Dhan-40, 41)**
Crab fattening in small saline ponds
Cage fish culture
Saline tolerant (cash) crops

WOMEN FRIENDLY ADAPTATION TECHNOLOGIES: COASTAL REGION

ADAPTATION TECHNOLOGIES: COASTAL REGION

WOMEN FRIENDLY ADAPTATION TECHNOLOGIES: HAOR BASIN

WOMEN FRIENDLY ADAPTATION TECHNOLOGIES: HAOR BASIN

ADAPTATION TECHNOLOGIES IN WATER & SANITATION

- **Physical impacts of climate change** including temperature rise, changes in precipitation, erratic rainfall, drought, increased salinity and climatic extremes have profound impacts on **sources of water, quality, availability and required access to water for drinking, bathing and domestic uses**
- **The affected water, sanitation and hygiene (WASH) systems and services** have huge consequence on human health, nutrition, medical expenditure and livelihoods of common people, particularly on the vast majority poor & women
- These will have huge bearing on the commitment & achievement of SDG-6
  - Hence, the access to safe drinking water and sanitation is the most important adaptation measure for long term resilience and emergency response
- The climate induced multiple risks and growing vulnerability in drinking water, sanitation and health have created greater need for wider and effective adaptation in this sector

ADAPTATION TECHNOLOGIES IN WATER & SANITATION

- The Brief-4 of Technology Executive Committee (TEC) on Adaptation technologies for Bangladesh has prioritized
- Rain Water Harvesting System (RWHS)
- Borehole & tube well, desalinization
- Pond Sand Filters (PSF) and
- Conservation of water for drinking and domestic uses

TNA report of GoB (2012) has identified the following CCAT in water and sanitation

- Rehabilitation of existing embankments and dykes (which protect the live, properties and water sources)
- Management of tidal river systems
- Managed Aquifer Recharge (MAR); and
- Artificial Aquifer Well (AAW)

CCAT in Water Coastal Region

Rainwater harvesters (RWH)

Scarcity of drinking water at any time of the year

response	Shatkhira (%)	Sunamganj (%)
Yes	54.70	23.30
No	45.30	76.70

Drinking water related modalities

Source	Districts	
	Satkhira	Sunamgonj
Deep Tube-Well	30.50%	59.10%
Shallow Tube Well	14.40%	40.90%
Rainwater Harvesting System (RWHS)	22.90%	0.00%
Arsenic iron removal plant	0.10%	0.00%
Desalination plant	1.40%	0.00%
Pond Sand Filter (PSF)	11.40%	0.00%
Reverse osmosis (RO)	2.50%	0.00%
Pond	11.30%	0.00%
Water supply from pipeline	5.30%	0.00%
Total	100.00%	100.00%

ADAPTATION TECHNOLOGIES IN WATER IN HAROS

THE CHALLENGES AHEAD & KEY STRATEGIES

- A combination of hardware, software and org-ware are needed for development and successful application of new and effective adaptation technologies
  - Stand alone technology such as an infrastructure or an equipment is not sufficient for effective adaptation
- Hard-wares are not in the central place to address the vulnerability of the groups and communities
- Rather access to locally available technologies and **knowledge, capacity and skill for use of the new CCAT** and an enabling institutional are the **key elements in advancing gender responsive adaptation**
  - promoting agro-ecological approaches to improve and maintain the productivity, inclusivity, and above all adaptive capacity of farmers & agricultural systems
  - Adaptation capacity largely depends on **social and human capitals such as education, awareness, skill, motivation for adaptation**, income, access to resources, technologies and services
  - **Governance with accountability and responsiveness** of the local government and duty bearers and sectoral actors

THE CHALLENGES AHEAD ……

Key challenges of building long-term resilience to climate change and gender responsive adaptation technology development & transfer are:

- **Identification and development** of climate resilient and women friendly technologies to lessen their burdens and risks
- **Innovation by blending of local knowledge and IK** with external technological knowledge
- Providing **right information about CCAT and services to women & poor** by LIG, NGOs & actors with policy and institutional supports
- **Capacity building of the poor, women and disadvantaged communities**
- Ensuring enabling environment for their **participation & decision making** on adaptation & CCAT; and
- **Collaboration & engagement of actors** for greater supports to the poor women & most vulnerable communities
- **All these may ensure appropriateness (climate resilient, socially accepted, transformative and women friendly) & effectiveness of the use of adaptation technologies**

Thank you

Appendix-5: report on SAKTEE Symposium on

Empowering Women and Enhancing Gender & Social Equity in Bangladesh, 2022

Venue: Blueberry Banquet Hall
Hotel Bengal Blueberry, Gulshan 2, Dhaka

Day 1: October 26, 2022 (Wednesday)

Inauguration: Dr. Saleemul Huq and Dr. Dwijen Mallick.

The event was inaugurated by Dr. Saleemul Huq, Director of the International Centre for Climate Change and Development (ICCCAD), and Dr. Dwijen Mallick Senior fellow of Bangladesh Centre for Advance Studies (BCAS). As part of his inauguration speech, Dr. Saleemul Huq discussed women's empowerment in the context of climate change. The 'Scaling Climate Change Adaptation Knowledge and Technologies for Empowering Women, and to enhance Social Equity and Disaster Resilience in Bangladesh (SAKTEE)' project which aims to empower women who are vulnerable to climate change was given particular attention during the speech. He suggested two roles for the Bangladeshis. Firstly, they must be concerned that they are in one of the most vulnerable positions due to the huge population of climate change and secondly the people of Bangladesh have already known about the problem, now, they must act to solve this not only for personal but also for everyone. He emphasizes enhancing the knowledge from the basic level to the highest level to become a leader in the climate change adaptation process by ensuring women's participation.

In addition, the importance of research and knowledge sharing was highlighted which requires an in-depth understanding of climate change nomenclatures. He urged that Bangladesh should scale up and scale out to attain the position of one of the global leaders as a nation in case of combating climate change. There is no alternative to these so different sectors including Government agencies, NGOs, and private sectors have to work collaboratively. Similarly, such milestones cannot be achieved leaving behind vulnerable women. In order to succeed Bangladesh must include issues regarding gender and climate in the 50% to 60% chapter of the "The Ninth Five-year Plan". He ended his talk by urging the youth to solve climate change problems through research work.

Then Dr. Dwijen Mallick gave his inaugural speech. In his speech, Dr. Mallik explained the background of the SAKTEE projects and a glimpse of their activities. Starting of his speech, he mentioned the importance of the different level stakeholders of the SAKTEE project. According to Dr. Mallick, an emphatical relationship between the local government and marginalized women is necessary. He mentioned Bangladesh is well ahead of making policies like adding making National Adaptation Plan for Action (NAPA), and National Adaptation Plan (NAP) and he added two major problems of the local actors' lack of capacity with less lack of knowledge and adaptive technology. SAKTEE projects work to differentiate vulnerability and build up the capacity of women to ensure Water, Sanitation, and Hygiene (WASH) which is the major problem of women due to climate change. Later he concludes his speech with the importance of agriculture with WASH for women to spread knowledge about where to cultivate and how to build capacity to enhance agricultural productivity.

Session by Mohammod Ariful Haque

The started with the presentation of Mohammod Ariful Haque, Programme Manager, Bangladesh Centre for Advanced Studies. First, he introduced us to SAKTEE project. Scaling Climate Change Adaptation Knowledge and Technologies for Empowering Women, and to enhance Social Equity and Disaster Resilience in Bangladesh (SAKTEE) was initiated by Bangladesh Centre for Advanced Studies (BCAS) in collaboration with ICCCAD, Department of Women Affairs (DWA), Ministry of Women and Children Affairs (MoWCA), Government of the People's Republic of Bangladesh and The University of Manitoba (UM) funded by International Development Research Centre (IDRC). The project is being implemented in two districts of Bangladesh: Sunamganj, which is in the haor basin and is susceptible to flash floods, erosion, drought, heat waves, and tidal surges; and the southern coastal district, which is frequently affected by cyclones and tidal surges, sea level rise, salinity, and waterlogging. or implementation, the SAKTEE project is focusing on four key components: Exploratory research, Capacity building, Participatory Action Research, and Policy-Institute-Practice Integration. Under these components the project aims to: Explore and understand the interrelationships of various environmental, socioeconomic, political, and cultural factors and climate change that may exacerbate social and gender inequity – which is one of the main prevailing knowledge gaps (Exploratory research component); Scale-up innovative, locally-tested adaptation technologies to address worsening climate change impacts, particularly on water and agriculture, through promoting "best practices" in disaster and climate resilience and multi-level institutional coordination and integration (Capacity building component): Support the empowerment of women, students, and poverty-stricken disadvantaged households in the climate-vulnerable regions (Participatory Action Research component); and Engage and inform policy and decision-makers about transformative climate change adaptation technologies and the potential for their integration with social and gender equity programs (Policy-Institute-Practice Integration component).

SAKTEE also has a knowledge-based hub where documents are accessible. The conceptual framework of SAKTEE, which focused on five components, was then further explained by the speaker. SAKTEE aims to explore the issue of climate change from a feminist viewpoint, followed by exploratory research, transdisciplinary methods, intersectoral integrity, and other capacity approaches. Social justice, a reflective worldview, inclusion, and participation were discussed from a feminist viewpoint. Additionally, SAKTEE project advised and oversaw the theses of eight master's students and one Ph.D. student.

The project is based on a well-constructed research framework and a Theory of Change (ToC). The research framework has five key components with clear interlinkages that demonstrate possible outcomes to meet the goal and objectives. The five-point approach consists of elements of feminist research principles, exploratory and participatory research for local actions, the capability approach and scaling of adaptation technologies, inter-sectoral and trans-disciplinary approach, and the co-generation of new knowledge for scaling up of CCAT towards empowerment of women and gender equity. The activities for the project have been designed under the following four outcomes of SAKTEE.

Outcome-1: Improved understanding of the dynamics of various key factors that aggravate differentiated climate change impacts, particularly on women and disadvantaged groups in coastal and wetland districts of Bangladesh. Outcome-2: Innovative climate change adaptation knowledge and technologies in water and agricultural sectors that are locally appropriate and socially transformative, particularly in reducing social and gender inequities, are identified, evaluated and implementation models developed.

Outcome-3: Enhanced awareness and capacity of the stakeholders at multiple institutional levels: to adopt locally appropriate adaptation technologies; to empower women, youth, and disadvantaged groups; and to strengthen community resilience to climate change and disasters.
Outcome-4: Space created in national climate change adaptation policies and programs with a firm commitment to accelerate the adoption of socially accepted and transformative adaptation knowledge and technologies that will empower women and disadvantaged groups.

Open Discussion:

Ques 1: How did you select women-headed households?
Ans: It was difficult to select a women-headed household. There were indicators to select them. A local project officer, female council member, and Department of Women Affairs helped to list down the women-headed household.

Ques 2: What challenges did you face during the project? How did you overcome it?
Ans: The project faced challenges during the Covid-19 pandemic due to limited field activities. SAKTEE shifted to online office activities. Following that, other challenges Dr. Saleemul Haq, and Dr. Atiq Rahman directed us through this challenge. Though we face fewer other challenges. Ques 3: What was the method for such huge research about adaptation? Did you track adaptation?
Ans: SAKTEE used a questionnaire survey as a tool for this research. Additionally, SAKTEE used an adaptation tracking procedure.

Session Moderated by Dr. Atiq Rahman

Dr. Atiq Rahman, Executive Director of Bangladesh Centre for Advance Studies moderated a session on "Initiations and Implementation from Different Sectors". Dr. Atiq stated that women are an integral part of society. But society is yet to accept the concept of women's empowerment to the full extent. Then he gave the floor to a representative from different sectors. Aklima Ahmed, Statistician, Directorate General of Family Planning began by apprising us about the activities her organization has taken. School health programs for teenagers give especially girls and boys who need advice regarding puberty. Furthermore, the provision of iron tablets and folic acid is initiated for their nutrition issues. Besides, services regarding pregnancy such as door-to-door counseling, and message service for providing medical information, etc. initiatives are being taken. Awareness activities including a radio program, and television drama got a good response as well. After that Jannatul Ferdous from the Department of Women's Affairs enlighten us with their contribution. A monthly maternity allowance of for impoverished women in rural areas of Tk800 each for combating poverty with government-to-person (G2P) payments through digitization is one of their best initiatives. To ensure food and nutrition security for destitute rural women provision 30 kilograms of rice, a hostel for working women, establishing a total of 119 child daycare centers, UNFP-funded Kishore Kishori Club, and women training for sewing their remarkable works. In the end, Mohammad Mahashin, Deputy Director, of the Department of Agriculture Extension, mentioned their activities. They provide assistance to the farmers with information to solve their problems at the field level. Furthermore, livelihood adaptation for climate change, initiatives under comprehensive disaster management programs, and different training initiatives are going on. It is always aimed to accommodate at least 30% of women in their training. However, women's participation is relatively low. Although fewer women are participating, they should be educated about climate change. Because they can contribute to reducing global warming through activities such as rooftop gardening, and proper management of livestock feces. He believes that women's engagement in agricultural activities may increase food security, reduce hunger, improve family health and nutrition, and generate new employment.

Dr. Dwijen Mallick

The session started with the presentation of Dr. Dwijen Mallick. He explained the need for climate change adaptation. The Bangladesh government is making every effort to adapt to climate change despite limited resources. Not only the southwestern coastal regions but also the northeastern haor-basin which he mentioned as "The New Hotspot for Flood" should be prioritized for adaptation initiatives. Dr. Mallick also talked about the activities of SAKTEE projects, it's finding, and their challenges. He expressed the importance of building collaboration with knowledge and technology with gender-responsive adaptation and locally led adaption by this project and explains how technology and multicriteria analysis helps to find the effectiveness of the project. He told that Adaptation to climate change involves identification, demonstration and implementation of wide range of technologies with 3 key dimensions: Hard-ware such as sea-wall, improved dykes and irrigation management in the growing salinity and frequent floods, Soft-ware such as change in seeds and cropping patterns, information, skill and knowledge for adaptation; and Org-ware ,which is related to the ownership and institutional arrangement of technology development and dissemination. He admits that adaptive technology will impact 3 types, such as Reducing the risk (salinity, water logging, hygiene, etc.), Protecting the resource of poor people, and protecting the livelihood. In this period of his presentation, he mentioned about 5 types of livelihood- 1) Physical 2) Natural 3) Social 4) Human Capital and 5) Social capital. He also explains how SAKTEE projects overview the different global projects like, UNFCCC Technology Executive Committee, Cancun Agreement on COP 16, the 2015 Paris Climate Agreement and national plans like Technology Needs Assessment (TNA) and GAP analysis in 2014. In his presentation, he suggested finding the problems through women's eyes and finding their vulnerabilities. So, the SAKTEE project connects local union Parishad female members, local-level WDA officers, and agricultural officers to find a way for helping vulnerable women. He finds out some of the challenges of SAKTEE projects which are the collaboration of Hardware, Software, and Org-ware followed by adaptive knowledge to use technology, ecological activities to ensure agricultural production, reach out to the most vulnerable people, a collaboration with local knowledge of science and lack of collaboration with national, regional, and local level. Then, He also mentioned about Government initiatives.

The Brief-4 of Technology Executive Committee (TEC) on Adaptation technologies for Bangladesh has prioritized: Rain Water Harvesting System (RWHS), borehole & tube well, desalinization, Pond Sand Filters (PSF) and conservation of water for drinking and domestic uses. TNA report of GoB (2012) has identified CCAT in water and sanitation are: rehabilitation of existing embankments and dykes (which protect the live, properties and water sources), management of tidal river systems, Managed Aquifer Recharge (MAR); and Artificial Aquifer Well (AAW). After that, he explained key challenges of building long-term resilience to climate change and gender responsive adaptation technology development and transfer which are: identification and development of climate resilient and women friendly technologies to lessen their burdens and risks, innovation by blending of local knowledge with external technological knowledge, providing right information about CCAT and services to women & poor by LIG, NGOs & actors with policy and institutional supports, capacity building of the poor, women and disadvantaged communities, ensuring enabling environment for their participation & decision making on adaptation & CCAT; and collaboration & engagement of actors for greater supports to the poor women & most vulnerable communities. He extended about these challenges that all these may ensure appropriateness (climate resilient, socially accepted, transformative and women friendly) & effectiveness of the use of adaptation technologies. Finally, He concludes his informative session with the suggestion that technology must not be a new burden for women. That should not kill the leisure time of women.

Open Discussion:

After the speech of Dr. Dwijen Mallick, Dr. Atik Rahman, executive Director of BCAS shared his experience on how previously women and men used sanitation in rural areas and their difficulties. He also praised the current situation as it is getting better and better day by day but there is a lot of work to be done. After that, he asked the audience their opinion and question.

Najneen Khan, ICCCAD: - Najneen Khan praised the activities of SAKTEE projects about women empowerment and was also concerned about not only women but also men are also vulnerable to climate change and child marriage. She shares her opinion that why SAKTEE is emphasizing women as over 50% of the population are women so gender equity and equality are needed with the proper connection with the socio-ecological model. Later another opinion was raised from the audience that the stakeholders must focus on Adaptation Tracking and how the technology the Governments and NGOs are providing must need to be monitored so that in the future they could use the data for future advancement and helps to attract donors to solve the problems. The session ended with this opinion.

Session by Mohammad Mahmodul Hasan and Palash Sarker

Mohammad Mahmodul Hasan from Christian Commission for Development in Bangladesh (CCDB) talked in this session and later Palash Sarker joined him during the discussion session to answer the questions from the audience. The session was on "Women in Locally Led Adaptation". Mr. Hasan began by sharing an experience from the survey. Climate Change and Gender Action Plan (CCGAP) was formed in 2013. But during their survey, they found out that most of the ministries did not know about it. He continued his speech by highlighting CCDB. CCDB's goal is to building community resilience through enhancing climate resilience and food security of vulnerable communities. Their working area is Satkhira, Bagherhat and Barguna with 5000 direct beneficiaries. Climate change impact such as salinity intrusion in soil and water, tidal surge, frequent storm, flood causes huge damages in food production like agriculture, fish culture practice. But vulnerable community adapt with climate change, such as: cultivation in adverse situation, climate resilient variety practices, Change in cropping patterns. Christian Commission for Development in Bangladesh analyzes the risk at the household and community level by scoring which villages are at low to high risk and Development of 'Community Climate Resilience Centers' which offers knowledge about the impacts of climate change and how people can adapt. Additionally, training is offered regarding climate change and gender which includes climate change adaptation and mitigation along with disaster preparedness, response, recovery, and evacuation. CCDB is supporting the vulnerable families by planting several Pond Filtering Systems (PSFs) at rural areas, household level rainwater harvesting facilities, community level rainwater harvesting systems for emergency water supply.

He mentioned about youth engagement at resilient building through student-teacher meeting, school session, school-based technology demonstration, youth movement, technology learning and youth volunteering. He emphasized collaboration between NGOs so that they do not provide the same aid in the same location such as planting water harvesting tanks and offering restoration services so that together they can reach more community. He continued appraising that women can take ownership of such activities. Women in coastal regions go great distances to fetch water. Women will be more motivated to assume responsibility for water harvesting tank maintenance if a water collecting tank is planted in an easily accessible location in the neighborhood. Similarly, women will embrace cyclone shelters to evacuate if they feel the ownership of the cyclone shelter through the multifunctionality of shelters such as schools, weekly medical service, seed storage, training center, and other purposes. Likely, through homestead agriculture, women will be able to participate in agriculture.

Before concluding, he shared that “Art Competition on World Environment Day 2022” in Climate Resilient Centre, Poshurbunia, Morelganj, Bagerhat was organized by them and they also have a knowledge hub named as “Climate Portal”.

Open Discussion:

Ques 1: Why most projects are coastal region based?
Ans: Coastal women face difficulties regarding reproductive health, early marriage, and different social issues. Economic damages due to climatic events also increase their susceptibility. That is why they require attention. However, women from the hoar basin are also our concern. Initiatives are being taken by Government and development organizations.
Ques 2: What measures are being taken to reduce the gap in reaching women in extremely remote areas regarding sanitation and hygiene?
Ans: The problem requires to be solved by good governance. Policymakers, academicians, and development workers need to work collaboratively to reduce the gap.
Ques 3: How can we ensure that the adaptation benefits the vulnerable?
It is true that we sometimes find it difficult to help the most vulnerable. However, if we can determine who in the community has low, moderate, and high risk through research and analysis, then our work will be simple. According to the findings, adaptation measures can be taken.
Opinion: Only food, medication, and shelter are recognized forms of help during cyclones. However, women also require dry clothes and a kit for menstruation hygiene. Before providing assistance, development sector professionals and government decision-makers should be aware of this vital aspect.

Shimsad Narmeen: The final session of day one starts with the speech of Shimsad Narmeen from Christian Aid. In her speech, she talks about the activities of Christian Aid (CA) and their journey as it started in 1945 and connected with Bangladesh after the independence. As Christian Aid works for the people who are in the face of the most disadvantaged due to not only physical disabilities, but also social disabilities and it aims to enhance development with every group. Christian Aid believes that any progress must be inclusive in order to be authentic and sustainable. She also explains their two workstreams, Humanitarian, which works during the disaster period, and Development, which is in capacity building and focuses on the most marginalized people. They have 12 running projects across the country. The Christian Aid aims to work for especially young women, Dalit groups, ethnic minorities, transgenders, hijras, and people with social and physical disabilities. She mentioned problems finding minorities during emergency periods, and finding their problems as well, women and disability-facilitated toilets. Christian Aid suggests some general practices with left no one behind, disability-friendly workshops and seminars, access to important materials, and connections with the local and central governments include them in the national policies. At the end of her speech, she shared an experience in Patuakhali that the skin is getting darker of the salinity inclusion, and due to that reason, the child marriage rate is increasing day by day at an alarming rate. After her speech, Sumaiya Binte Selim, Project Coordinator, SAKTEE, ICCCAD shares her experience that people of the northern part of Bangladesh are less aware than the southern part. She also praised the activities of Christian Aid and with this, the Sessions of day one ended.

SAKTEE Student Training Workshop Summary Report, Prepared by ICCCAD onMarch 15th, 2021

Training Workshop on Climate Change, Gender and Social Equity through Adoption of Women Friendly Adaptation Technologies

under *Scaling Climate Change Adaptation Knowledge and Technologies for Empowering Women and to Enhance Social Equity and Disaster Resilience (SAKTEE) Project*

Organized by International Centre for Climate Change and Development(ICCCAD)

Venue: Technical Traiing Center, **Sylhet;** Date: 7thMarch 2021(Sunday) 9:30AM- 4:30 PM
Total number of facilitators (03): Shahrin Mannan, Juel Mahmud, Istiakh Ahmed

ICCCAD has conductedstudent training workshop on adaptation knowledge and technologies that enhance community resilience on differentiated climate change impacts in coastal (Satkhira) and wetland (Sunamganj) under the SAKTEE Project. SAKTEE is a three year long project funded by IDRC, and jointly implemented by Bangladesh Centre for Advanced Studies (BCAS), International Centre for Climate Change and Development (ICCCAD), Department of Women Affairs (DWA), Ministry of Women and Children Affairs (MoWCA), Government of the People's Republic of Bangladesh and The University of Manitoba.

Aim: The training is aimedat capacitating the local university student groups and enhance their knowledge on climate change adaptation. It also focused at improving their understanding on gender and social equity in the face of a changing climate

TARGET GROUP:

20 Undergraduate students from Sylhet region participated in the training (8 Female, 8 Male)

Summary

The day long training consisted of 6 sessions, the following summarizes the proceeding of the training: The **Session 1 and 2** focused on "**Introduction and overview of the training**" and "**Ice Breaking"** respectively. Shahrin Mannan started the introductory session with the goal to; welcome the participants; set objectives of the training and;Juel Mahmud facilitated the Ice Breaking session to create a positive enabling environment in the training room.The two sessions were carried out at the beginning of the training.

Figure 1 During Icebreaking Session

Istiakh Ahmed facilitated the**Session 3** "**Introduction to climate change and relate terminologies"** and he initiated the discussion by describing a few important jargons and definitions namely; Hazard; Vulnerability; Disaster; Risk; Coping Capacity; Climate; Climate Change; Impacts of Climate Change; Adaptation; Mitigation; Loss and Damage. The objective of this session was to ensure that all participants were familiarized with the issues that will be discussed in greater detail in the other session.

Figure 2 Introduction to climate change and relate terminologies

Gender specialist Shahrin Mannan came on the floor again and facilitated **the Session 4 "Unpacking the**

concepts of gender, sex and sexuality" This session comprised of a participatory exercise; breaking the misconception designed to orient students with the right understanding of sex, sexuality and gender roles and break the existing myths around these issues. The session aimed at improving the understanding on gender equity by unpacking the patriarchal norms.

Discussion from the session 4 helped identify that there are existing misconceptions in distinguishing Characteristics "Sex" and "Gender". To demystify the misapprehensions, the following terms "Sex", "Sexuality", "Gender", "Patriarchy","Gender Mainstreaming", "Gender Roles" followed with "Gender Spectrum" was discussedwith relevant example. Through this session the students had gathered an improved understanding of these concepts.

Figure 3 discussing the concepts of gender, sex and sexuality

In the **Session 5: "Understanding differentiated impacts of climate change on women"** the students were taught the different impacts of climate change in coastal reasons, the impacts of these climate induced stresses and how women are differentiated impacted by them. The session facilitator Juel Mahmudrun the session with a participatory exercise; where women based on societal, economic and political reasons. The following

Table 1: represents the cumulative points discussed under the participatory exercise:

Table 1: Gender-differentiated impacts of climate change			
Climate change effects	**Potential Risks**	**Impacts**	**Potential effect on women**
Direct	Increase Drought and Water Shortage	• Lack of Drinking water • Shortage of irrigation • Crop loss • Food Insecurity	• Security • Malnutrition • Chronic diseases
	Increased extreme weather events: Flash Flood	• Crop damage • Loss of shelter and Assets • Lack of Drinking water • Loss of livelihood	• Women responsibility increase • Nutritious food deficiency • Health cost • Acute and Chronic Disease
Indirect	Loss of species	• Ecosystem, Food chain • Economic Loss • Loss of Herbal plants	• Economic loss(crafts sector) • Domestic income loss. • Psychological trauma
	Decreased crop production	• Migration • Food (Malnutrition) • Economic opportunity • Loss of income	• Early marriage • Adverse impact on breast feeding • Increased rate of gender-based violence

Finally in the Session 6: "**Identifying Adaptation technologies in Water and Agriculture Sector**". By disclosing different women specific risks to climate change, the session shed light on existing women-friendly adaptation technologies adopted and practiced in the Hoar regions for the agriculture and water sector.

At the endof this training workshop, the students were sensitized on Gender-responsive transformative approaches of Sylhet region, furthermore they were provided with tools to enhanceresilience and adaptive capacity of persons,

families and communities in their locality. With the successful completion of the training; the student participants were given certificate of completion.

Learning Hub Event on

Disaster management Plan: gender Inclusion and Equity

June 23, 2022 (Thursday)

NEC-1 Committee Room

Planning Commission, Sher-e-Bangla Nagar, Dhaka

Introduction

The event started with welcoming words from Prof. Saleemul Huq. Prof. Huq explained the importance and necessity of a learning hub event (LHE), particularly on SAKTEE project which aims to empower climate-vulnerable women. Learning hub events are mostly organized to have a thorough discussion on a particular topic and to further come up with ideas for research. This presentation is followed by long discussion, comments and ideas on the particular topic. This is under the umbrella of science-policy-dialogue. ICCCAD has done multiple LHE with both government and non-government organizations and will continue to do so in future. The idea is to bring scientists or researchers from different sectors along with actors from policy and planning division and to have a vibrant discussion to know what can help us bring about change or improve the current situation. LHE is more of two-way streamed events which disseminate information and brings about new research ideas to serve as solution for future plans, particularly in national plans like the upcoming 9th Five Year Plan. The LHE on 23rd June 2022 was focused on the role of women in climate change and disaster management. Further he emphasized that this should not remain stagnant on a single LHE but this should be rather an ongoing dialogue which can be used in national planning documents.

This particular LHE aimed to circulate research findings from Scaling Climate Change Adaptation Knowledge and Technologies for Empowering Women, and to enhance Social Equity and Disaster Resilience in Bangladesh (SAKTEE Project). Gender disparity is a preexisting issue in Bangladesh, and climate change just exacerbates such situations, putting women at even worse conditions. With this statement Prof. Huq further explained how SAKTEE project tries to understanding climate change and gendering inequality dynamics and then attempts to come up with solutions to empower such vulnerable communities. Prof. Huq also explained how inclusion of women in national/sub-national/local planning can improve climate change adaptation practices strengthen communities and make them more resilient to climate induced disasters. He ended his welcome remarks by stating that women are often identified as vulnerable group, however a paradigm shift is much required now as women are no more considered as vulnerable rather they are part of the solution and must be defined as future climate change adaptation leaders.

As the session progressed Prof. Mizan explained that this event is not only about discussing the Disaster Management Plan 2021-2025 but rather looking at it through a gender lens. As women are better guardians of nature they must be encouraged to take over the steering. While

explaining women's behavior towards nature, Prof. Mizan stated that the word 'husband' originated from husbandry whose literal meaning is taking care, and women are better caretaker than men both to the family and for nature, therefore must be recognized as so called 'husband.'

Presentation by Dr. Mallick and Ms. Sumaiya

Dr. Malick started his presentation with explaining the inclusion of gender and equity in National Disaster Management Plan (2021-2025). He then explained the position of women in society because of societal norms and patriarchy. When demanding social inclusion it must be ensured that not only women but other vulnerable groups such as indigenous and transgender groups are also taken under consideration. Bangladesh government has ensured that most of the national and sub-national plans are in accordance with Sustainable Development Goal 5, which is concerned with gender equality and end of all discrimination towards women. However, climate change is exacerbating the situation as it is increasing exposure and vulnerability and holding them back in terms of decision making; with keeping all these in mind the project Scaling Climate Change Adaptation Knowledge and Technologies for Empowering Women, and to enhance Social Equity and Disaster Resilience in Bangladesh (SAKTEE) was initiated by Bangladesh Centre for Advanced Studies (BCAS) in collaboration with the International Centre for Climate Change and Development (ICCCAD), Department of Women Affairs (DWA), Ministry of Women and Children Affairs (MoWCA), Government of the People's Republic of Bangladesh and The University of Manitoba (UM) funded by 'International Development Research Centre (IDRC).

This research aimed to improve understanding of the dynamics of various climate change and social factors; identify and evaluate innovative adaptation technologies in agriculture and water; raise awareness and capacity building for scaling gender responsive adaptation technologies; empowerment of women; and to facilitate policy deliberations and institutional integration at all levels. Under this SAKTEE project a framework was also developed using adaptation approaches from local, regional/district level, and national level. The overlapping issues were also identified and how this knowledge can be passed/used and in-turn benefit women and other vulnerable communities is one of the goals of this project. While developing the framework three issues were kept in mind climate change, disasters, and women vulnerability. This framework was developed with the help of Prof. Emdad from Manitoba University and his years of experience in this arena of research.

In order to explain the framework Prof. Emdad, stated that this framework keep women as victims; conceptually. He then explained that women whether she is a minority, belongs to vulnerable community, or indigenous community, there is a hidden strength in them, which can be further strengthen if they receive support from government or NGOs or any other supporting body. To illustrate this fact, the capacity model of Amartya Kumar Sen was used; portraying women who are mostly vulnerable are actually the strongest. Additionally, Prof. Emdad cited multiple researches which stated that in Bangladesh national plans are often successfully implemented but plans in local/district level often remains ineffective and unsustainable; prime reason being lack of localization of plans. Therefore, via this project the research team aims to preserve local knowledge, own, and share those learning among practioners at national or even sub-national level; using a bottom-up approach.

Moving forward in the presentation, Dr. Mallick stated that during this research certain national documents were reviewed which include- Goals and Priorities of NPDM 2021-2025-

National Plan for Disaster Management 2021-2025 is broadly based on Standing orders on Disasters(SOD) 2019 and aligned with the four priorities of Sendai Framework for Disaster Risk Reduction (SFDRR). This alignment also relates to the Asian Regional Plan for Disaster Risk Reduction (ARPDRR), which derives from SFDRR. With climate change on the rise, a changing risk context means new challenges, but also provides opportunities for building resilience. Suffering from a catastrophic pandemic in 2020 has given us perspective, making it possible for us to recognize our strengths and weakness as a nation in tackling future disasters. Aiming towards achieving milestones in disaster risk reduction and building on resilience, the vision of NPDM 2021-2025 is: "Winning resilience against all odds".

In the context of gender, as a determining factor of social life, plays an important role. Patriarchic structures and power imbalance in many countries tend to reduce women's status in society. Their access to resources, opportunities, power and subsequently leads to higher female vulnerability to natural hazards. Engaging and empowering women are beneficial means of strengthening resilience to disaster risks. Just as gender roles and relations shape vulnerability to disaster, conversely they also shape people's capacity to prepare, withstand and recover. Inter-related thematic areas for building resilience from NPDM includes- Disaster risk reduction – activities related to mainstreaming DRR into national and local plans, hazard analysis & risk profiling, early warning etc.; Disaster preparedness- activities related to ensuring – people are prepared and response will be carried out efficiently and effectively; Humanitarian/Emergency response – activities that help restoring lives and livelihoods and basic infrastructure, early recovery; and Rehabilitation, reconstruction and recovery – activities related to long-term recovery – build back better.

NPDM 2021-2025 further focuses on- Bangladesh aligning its DRM strategies and plans with SFDRR, SDG and Climate Agreement. Over the upcoming years in order to expedite the implementation of SFDRR, additional emphasis will need to be given to- promote policy coherence among DRM and development in-country; making disaster risk reduction a development practice to achieve resilient public investment and the SDGs; encouraging private sector engagement towards risk sensitive investments; building capacity and leadership to implement NPDM 2021-2025 at the national and local level. Moreover, social inclusion is a basis for achieving resilience and is an underlying and cross-cutting strategy in all the action plans of NPDM 2021-2025. All DRM initiatives, policies, programs and planning are to be inclusive with emphasis on- ensuring incorporation of gender issues in decision making and ensure participation of women and men, girls and boys in all the priority actions of NPDM 2021-2025. Gender mainstreaming in national policies, relevant laws, plans, and budgets related to disaster risk management will be emphasized during implementation of programs. Key message from NPDM 2021-2025 from a gender perspective is to ensure adequate considerations for people with vulnerabilities (e.g. single marital status, age, disability) in DRM policies and programs and across the implementation of NPDM 2021- 2025; establishment of effective mechanisms and guidelines to collect sex, age and disability disaggregated data at all stages of DRM will be emphasized during implementation of the programme; and meaningful participation, inclusion and leadership of women, men, girls boys

and persons with disabilities and Disabled People's Organizations (DPOs) within disaster risk management at national, district and upazilla level will be ensured during implementation of program.

Dr. Mallick also pointed out the general role for gender inclusiveness and equity: Disaster preparedness at family and community/UDMC, that includes- rescue and recovery- shelter management with gender sensitiveness; social safety and safeguarding the women, children and elderly people; addressing the sensitivity and exposure to disasters (climate induced and man – made) and physical vulnerability, psychological stress and social vulnerability; rehabilitation and humanitarian aids with equity , justice and social inclusiveness (considering inter-sectionality, socially disadvantage and indigenous women and girls); participation in decision making , access to DRR services and resources; raising the voice of the poor women , women actors and women led organization.

Ms. Sumaiya from ICCCAD then proceeded with the research finding from Sunamganj and Sathkhira which were conducted by two Masters Students. The methodology used is called exploratory research and the first research conducted in Sunamganj titled *Analyzing Differentiated Climate Change Impacts on Women in the Wetland Area: A Case Study on Sunamganj District*, by Md. Kazi. Rokonuzzaman, **Department of Disaster Resilience and Engineering, Patuakhali Science and Technology University**. The objective of this research was to measure differentiated climate change impacts on women and to explore the dynamics of numerous factors that aggravate differentiated climate change impacts on women in wetland areas of the Sunamganj district. Ms. Sumaiya then explained the issues which exacerbate the existing challenges that included - impacts on women education, barriers of alternative livelihood skills, compromising in women agency, and climate change and social capitals perspective. Moving on to the results section, Ms. Sumaiya then stated that the most common challenge was barriers towards alternative livelihood for women, as they lack in term of skills and education. Other challenges also included patriarchal norms, lack of support from family, lack of financial resources, lack of awareness, religious conservation, lack of knowledge, and political power. In the reflection part a summary and few recommendations were provided by the researchers which were- social and cultural vulnerabilities and have barriers to taking charge in Disaster Risk Reduction for women; women involvement and inclusiveness need to be ensured; positive attitude to women in climate risk and resiliency need to be incorporated; proper dissemination of scientific early warnings system especially focusing on women; establishment of shelter center focusing women facilities, educational institutions and treatment center; ensuring equal rights on resources acquisition for women; and future in-depth research could find the way of analyzing differentiated impacts and better solutions for women's resiliency.

The second research was conducted in Sathkhira and titled- *Understanding differential climate change impacts among impoverished and disadvantaged households in coastal Bangladesh: A case study on Satkhira District,* by Asma Ul Husna, Assistant professor, **Development Studies Discipline, Khulna University**. The main objective of this research was to assess the differentiated climate change impacts on impoverished and disadvantaged households with exploring the factors of differentiated climate change vulnerability within the coastal sub districts of Bangladesh. The finding included health impacts of climate change due to increasing salinity level in soil and water. Drinking water is often contaminated by high salinity in southern parts of the country. This research identified that the most common health issues in women due to rise in salinity in water used for consumption purpose in five unions, which included- skin disease, water borne disease, cardiac disease, and pregnancy related problem. For recommendation the researchers urged for need of special focus on women group based on segregated data base; integrative planning and development; sustainable livelihood options for both men and women; holistic gender inclusive DRR approaches; women need special focus before during and after the disaster considering sensitivity, exposure and psychological issues; the diversity among the women group is also needed for providing them proper services and inclusivity; and gender inclusive disaster preparedness during before and after disaster are necessary for immediate management during that time.

Open discussion

Followed by the presentation floor for discussion was opened. Participants from praised the framework and suggested for certain changes such as inclusion of transgender group and other groups that are often left behind. Additionally one of the participant expressed that the plans are often well drafted on paper but reality is much different and we must localize solution in order to get the utmost benefits. The point of power dynamics was also raised, where money

and education plays the most important roles. Vulnerability of women in lower socio-economic groups is much higher than women from higher socio-economic groups and we must capacitate women and allow their businesses to sustain. Also women should ensure their part of property and this must come under legal framework.

One of the discussant explained that the model shown here has three thematic areas and how to take this further, however this framework must portray women's unconditional love towards nature and their roles in preserving ecosystem services and how this is different from men taking over. Further theoretically the framework is right but it must propose specific five variables, where government can intervene and how to further incorporate this in 9th FYYP. Indicators should be zone specific for zonal planning in future and incorporation of relevant ministries. One of the participants also raised the point that future research should concern how much time women spend working in field at home and how to convert that into monetary units. If we as researchers can convert this time into monetary units, women will be considered as essential part of the economy in local communities and thus can be empowered.

As the discussion progressed one of the point of Bangladesh aligning most of its national plans such as NDMP with Sendai framework and inclusion of women and other vulnerable groups was mentioned. Additionally, Bangladesh was the first country to sanction Standing Order of Disaster (SOD) and have been updating it in every step and ensures that women are prioritized. Even in Cyclone Preparedness Program (CPP), Bangladesh government ensured that 50% of all the volunteers are female. Despite the country's vulnerability it implemented multiple plans which inclusively talk about women security. One of the participants also raised the concern of sanitation to be taken under consideration specifically during cyclones and floods. It was highlighted that despite all the measures taken even in a city like Dhaka we barely have a proper public toilet for women. Also when speaking of gender equality we must not exclude men, security and justice should be ensured for all.

Finally the chief guest of the session Mr. Pradip Ranjan Chakraborty stated his comments and views on the presentation. He suggested that the research must consider all the government documents eg. Delta Plan, 7th and 8th FYP, Mujib Climate Prosperity Plan, Vision 2021 etc., which ensure inclusion of women and how government has worked along with NGOs and CSOs to ensure women empowerment in the country. Further he emphasized on the point that zone specific recommendations are required as vulnerability differs regionally. Also the differences in percentage that was shown in the slides when portraying diseases in women due to salinity can be a separate research itself and researchers can further identify the reasons behind such differences. And we must admit that Bangladesh has come a long way in terms of women empowerment and security.

Representative from Department of Women Affairs (DWA) also stated that DWA conducted research and did a vulnerability mapping through which most vulnerable areas were identified and multiple need based trainings were organized for women only. Such training ensured that women are capacitated in areas they want to be and later they were given grants of BDT 15000 to start their own businesses or invest in the field they are interested. Additionally, one of the participants argued that government has improved a lot of things in cyclone shelters but still there is room for improvement, specifically for pregnant women and women sanitation systems. In CPP we can bring the gender sensitive issues.

Concluding Remarks

At the end of session the presenters thanked all the participants for their valuable comments and inputs. Prof. Emdad also stated that most of the national and local plans right now are effective but barely considers future projections. Additionally, there is no such thing as magic bullet, nothing changes over night and gender disparity and women particularly being at higher risk, is a pre-existing issues which will require time and effort to improve. Putting all the women from different socio-economic group in the same spectrum is yet another concern, as not all women are equally vulnerable.

Md. Khandaker Ahsan Hossain (Special guest) also stated at the end of LHE, that such events must be organized more often as LHE is a perfect platform to share and gain knowledge on current climate change practices. The session ended with Prof. Mizan's remarks on society

often valuing women for their instrument value which are sheer profit driven, however he urged that intrinsic valuation is much required to empower women in the society.

GOBESHONA
Global Conference 1
Research into Action on Locally - Led Adaptation

Appendix-8: Report on First SAKTEE Session in Gobeshona Confrence in 2020

Rapporteur name and email: Md Shakil Rahman/ICCCAD; *shakilxpcc@gmail.com*

Session Title:*Adaptation Technologies, Gender Equity and Social Inclusion*

Session host/organizer:Global Resilience Partnership (GRP) - ICCCAD, BCAS and Manitoba University, Canada

SessionTheme: Adaptation technology, gender equity, new masculinity, social inclusion

Session speakers and their organizations:

Session Chair: Dr. Atiq Rahman

Co-Chair: Prof. C. Emdad Haque, University of Manitoba, Canada

Moderator: Prof. SharmindNeelormi, Principal Investigator, SAKTEE Project

Presentation Session

Presentation-1:**Challenges of Gender Responsive Adaptation Technologies in Agriculture and Water in Coastal and Haor Regions**,

- Ms.SyedaAmirunNuzhat, BCAS
- Dr. Dwijen Mallick, BCAS

Presentation-2:**On-farm and agricultural sector innovations in times of climate adaptation and resilience building needs**

Dr. AnnemiekeFarenhorst,University of Manitoba, and

Dr. Laura Sims, Université de Saint-Boniface,Canada:

Presentation-3: **Gender equity and new masculinities: Examining a Colombian rural cooperative's approach to development**

Dr. Laura Sims,Université de Saint-Boniface, Canada

Panel discussants

Prof. Dr. Mahbuba Nasreen, Director, IDVS, University of Dhaka

Hawlader Md. Rakibul Bari, Director, DWA, MoWCA, Government of Bangladesh

Dr. Bruce Curri-Alder, Program Head, Climate Change, IDRC, Canada

Dr. Nizamuddin Al-Hussainy, Sr. Fellow of BCAS and Previous Director General (in charge) of the DWA, GOB

Hasin Jahan, Country Director, WaterAid Bangladesh

Coordination and Communication: Shahrin Mannan of ICCCAD and SyedaAmirunNuzhat (Moneesha) of BCAS

Presentation Session

Presentation 1: Dr Dwijen Mallick, BCAS

1. Adaptation to climate change is evolving with a blending of modern and local knowledge, skill and technological innovations.
2. Adaptation technologies in climate change context involve knowledge and skills of vulnerable groups and people.
3. The whole world is in urgent tipping point unless we take any action, for example, increasing population and inequality, who does not get proper access to the adaptation technology.

Presentation 2: Dr. AnnemiekeFarenhorst

1. Women constitute almost 43% of the world's total farmer count, but seldom have access to the resources available.
2. Women and young men are more vulnerable and exposed to the toxicity caused by pesticide application. However, women are more concerned about safety measures than young men groups.
3. To promote women participation, their distinct roles wants and needs to be considered when addressing climate change adaptation.

Presentation 3: Dr Laura Sims

1. Emphasized gender equity, resilience and environmental well being in the context of the climate crisis.
2. Effective sharing and recognition of distinct women roles like household and caring works can also help women participate in other productive activities.
3. A 'new masculinity' can assure women safer environment, gain confidence, become more productive and solve problems like genderinequality.
4. Promoting popular education can effectively approach, enabling transformation in learning.

Panel Discussion

Speaker 1: Prof. C. Emdad Haque (Co-Chair)

1. There are significant changes in women empowerment, but actual change will not be achieved until it happens from the grass-root level.
2. There is no formal institution to scale up the climate change innovations at the local and global level; thus, most of the innovations disappear with time.
3. In developing countries, intersectoral coordination, multi-scale understanding, communication and mainstreaming institutional framework can empower women and increase adaptation technology's reach to grass-root level.

Panelist 1: Prof. Dr. Mahbuba Nasreen

1. The project-based gender empowerment initiatives are not recognized. Without mainstreaming these gender empowering projects, women will have no place in the masculine world.
2. Gender-budget report should be broken in details and sector-wise policy designs, information, and diagnosis of gender in disaster risk reduction approaches should be shared widely.
3. Global responses, knowledge and innovations on gender empowering in climate change adaptation context should be summarized.

Panellist2: Hasin Jahan

1. Focused on WASH elements, as climate change adaptive technologies has a strong connection with WASH elements.
2. Time and labour are directly related to gender empowerment.
3. Climate change adaptive technology should be implemented at the strategic level, not as a project and should be gender inclusive.

Panellist3: Dr Bruce Curri-Alder

1. To empower women, their burden of works and roles are to be recognized. Besides, they must be facilitated with time to utilize the changes and opportunities.
2. If adaptive technologies do not help the poor and promote equity, they are mal-adaptive technologies.

Panellist4: Dr Nizamuddin Al-Hussainy

1. Pointed out the lack of gender analyses on the context of men and women with the same adaptive technologies to promote gender equality, equity and reduce vulnerability.

2. Gender friendly adaptive technologies should be disseminated at grass-root level, and access to service should be ensured.

Key takeaways

1. The grass-root level reach and implementation of climate change adaptation technologies can make them sustainable.
2. Personal time to be ensured for women to empower them.
3. Gender dimension should be acknowledged, centralized and integrated at the strategic level.

Rapporteur summary (500-600 words):

Prof. SharmindNeelormiwelcomed everyone and shared about the SAKTEE project. **Dr Atiq Rahman** shared the opening remarks and added the context of today's session briefly. Dr Atiq stated how the women are more engaged to combat the climate change impacts in Bangladesh amid COVID-9 pandemic.

Dr Dwijen Mallick was the first presenter and presented on "**Challenges of Gender Responsive Adaptation Technologies in Agriculture and Water in Coastal and Haor Regions."** He focused on climate change adaptation technologies, its key dimensions, needs and priorities, and challenges in identifying and demonstrating women-friendly technologies in Bangladesh. He emphasized that the adaptation technologies involve knowledge and skills of vulnerable groups and people. Development and transfer of climate change adaptation knowledge and technologies (CCAT) primarily, e.g., a) reducing risk and vulnerability, b) protecting assets and resources, c) protecting and improving lives of people, and d) enhancing climate-resilient livelihood. He mentioned three key dimensions, e.g., a) hard-ware, b) soft-ware, and c) org-ware, to address a diverse range of technologies in adaptation to climate change. Lastly, he showed the key adaptation responses in Bangladesh's two ecosystems, adaptation technology matrix and key challenges.

Dr AnnemiekeFarenhorst, the second presenter, presented on **"On-farm and agricultural sector innovations in times of climate adaptation and resilience-building needs."** She compared the agricultural context of Canada and Bangladesh briefly. Fourth Agricultural revolution and the 'next food revolution' got special attention in her presentation.

Women constitute almost 43% of world's total farmer count, but seldom have access to the resources available; like, e.g., right over land ownership, less access to loan facilities and less access to technology. Equal access to these resource by women can help to combat global problem hunger. Then she shared the climate change context and agricultural innovations of

Nicaragua and Honduras. Particular emphasis on pesticide application shows that more than half of pesticide application is intentional, and women and young men are more vulnerable and exposed to the toxicity caused by pesticide. Nevertheless, women are more concerned about safety measures than young men groups. A compost-based innovation helped them to reduce the hazard rate and increased production rate. Additionally, she mentioned the extra burden works like collecting drinking water, child care, and household works needed to bring under consideration to promote gender empowerment and address climate change adaptation.

The last presenter, **Dr Laura Sims**, presented the paper **"Gender equity and new masculinities: Examining a Colombian rural cooperative's approach to development."** This paper was done on the context of Colombia rural dairy cooperative. She emphasized gender equity, resilience and environmental well-being in the context of climate crisis through development, poverty alleviation, governance, and gender equity. Effective sharing and recognition of distinct women roles like household and caring works can also help women participate in other productive activities. A 'new masculinity' approach can assure women safer environment, gain confidence, become more productive and solve problems like genderinequality. Lastly, she stated the paper's key learnings, which reflects that women empowerment is backed by women's access to resource and economic opportunity, creating collective solutions.

With this, the panel discussion was started. **Prof. C. Emdad Haque**, the co-chair of the session, pointed out that significant women empowerment changes. However, until it happens from the grass-root level, actual change will not be achieved. Besides, as there is no formal institution to scale up climate change innovations at the local and global level, most of the innovations disappear with time. There is quite a good number of climate change adaptation innovation, knowledge generation and technology sharing. As most of these follow a top-down approach, and there is no institution to manage or scale-up, these innovation, knowledge or technologies does not sustain. Only the grass-root level reach and implementation can make these sustainable. Lastly, he suggested that, in developing countries, intersectoral coordination, multi-scale understanding, communication and mainstreaming institutional framework can help to empower women and increase the reach of adaptation technology to grass-root level.

Prof. Dr Mahbuba Nasreen pointed out that the project-based gender empowerment initiatives are not recognized. Without mainstreaming these gender empowering projects, women will have no place in the masculine world. She also explained the example of a gender-budget report of Bangladesh suggested that such Gender-budget reports should be broken in details and sector-wise policy designs, information, and diagnosis on gender in disaster risk reduction approaches should be shared widely.

Hasin Jahan mainly focused on the WASH elements, as climate change adaptive technologies has a strong connection with WASH elements. She has emphasized the strategic-level implementation of climate change adaptation technologies, not as a project and should be gender inclusive.

Dr Bruce Curri-Alder agreed with **Dr Emdad** and stated that if the adaptive technologies do not help the poor, and promote equity, they are mal-adaptive technologies. He also suggested that for empowering women, their burden of works and roles are to be recognized. Besides, they must be facilitated with time to utilize the changes and opportunities.

Lastly, **Dr Nizamuddin Al-Hussainy** has pointed out the lack of gender analyses on men and women's context with the same adaptive technologies to promote gender equality, equity, and reduce vulnerability. He also agreed with **Dr Emdad**, that is gender-friendly adaptive technologies should be disseminated at grass-root level.

Prof. SharmindNeelormi thanked everyone for participating. **Dr Atiq Rahman** shared the concluding remarks and key takeaways of the session.

Appendix-9: Knowledge Sharing Event of SAKTEE Project with the LDC Countries Universities on Climate Change (LUCCC)
Date: 16th October, 2022 (Sunday)
Kathmandu, Nepal

Introduction: The session was initiated by Mr. Praveen Kumar Regmi, Academic Coordinator, SchEMS with a warm welcome to all. He introduced the organizers of the program along with the Chairperson of the event Mr. Ajay B Mathema, Associate Prof., Principal, SchEMS, and the Chief guests- Prof Dr. Deepak Bahadur Bhandari, Registrar of Pokhara University, Special Guest Dr. Kailash Timilsina, Registrar of Gandaki University, Dr. Radha Wagle, Joint Secretary- Ministry of Forests and Environment, Government of Nepal, Prakash Mathema, Former Secretary, GoN Former Chairman, LDC, Sumaiya Selim Program Officer Researcher at International Center for Climate Change and Development (ICCCAD) and virtually welcomed Dr. Atiq Rahman, Executive Director, BCAS SAKTEE. The inauguration was done by the guests by watering a plant.

Keynote Speaker

Mr. Prakash Mathema, Former Secretary, of GoN, and Former Chairman of the Least Developed Country, expressed how Climate Change is an alarming reality, and one of the greatest challenges of the 21st Century by giving the example of the devastating flood in Pakistan that took place on June 2022 and called it a wake-up call. He made the audience aware on why South Asian nations are more vulnerable to the Climate Crisis. The fragile mountain ecosystem, accelerating glacier melt, and haphazard urbanization affect the population depending on Subsistence agriculture in this part of the World has made the south Asian region vulnerable to climate change. He further added how millions of people have been severely affected by catastrophic events, which results in increased poverty and

jeopardizes development. In addition, he mentioned about vector-borne diseases which are rising.

Mr. Mathema further focused on COP 19: Warsaw International Mechanism on Loss and Damage (L&D) which was back on the agenda at COP 26. He shared how the concept of Loss and Damage is a relatively new topic, making it a frustratingly slow process, and added on how few developed nations have talked about L&D but many nations are yet to come on board. He further mentioned about how the local governments are the center for developing efforts and climate resilience but due to the gaps in knowledge and resources, they are not able to work on it properly. Moving forward, he mentioned Women and children being vulnerable to any kind of climatic disasters and experiencing serious threats to their lives, livelihood as well as health even when they have small footprint. Thus, he ended his speech by emphasizing the need of empowering women and girls to achieve sustainable development. To achieve this public and private sectors need to actively work and more investment is needed for the upliftment of women and vulnerable groups.

Welcome Note: Dr. Atiq Rahman, Executive Director, BCAS joined the session virtually. He communicated that how climate change is affecting lives, economic growth, agriculture, food security and water security in the coast of Bangladesh, flood plain and mountain ecosystems. He further highlighted how climate change is affecting disproportionately the poor and women in the developing countries with high populations, especially those falling on the Himalayan range, and Indo-Gangetic areas. Moreover, the increase of magnitude and intensity of rainfall and temperature have impacted economic growth, agricultural productivity, food security, and water security. He strongly viewed that climate change is not gender-neutral and not recognizing national boundaries. With Climate Change being such a catastrophic event it has also limited access to health care and has a risk to maternal and child care. It has increased Gender-based violence. Despite the small carbon footprint of women, they are more vulnerable to climate change. This makes the empowerment of women crucial for sustainable development. He focused on the intellectual population, intellectual leaders, and scientific communities should come together to address the issue of climate change and to achieve sustainable development.

Technical Session: SAKTEE Project Brief Presentation:

A brief introduction of the SAKTEE project was given with its objectives which were improving understanding and dynamics of Climate Change and social factors and empowering Climate Vulnerable women.

The project focused on innovating technology in agriculture and water along with raising awareness and capacity building. The project's progress and objectives were shared which were the development of two training manuals and modules on CCAT where a total of 3098 women received the training. Awareness raising program was conducted with 15 communities. A total of 1688 people; 70% females and 30% males received the training on Resilient Livelihoods. Similarly, the MUJIB Climate prosperity plan was shared which focuses on shifting Bangladesh's trajectory from vulnerability to resilience to prosperity. Six key points of the MUJIB Climate prosperity plan were discussed which included Business, as usual, Nationally Determined Contribution, Mujib Climate Prosperity Plan, Gender Inclusion, and Equity in National Plan for disaster management. Similarly, the goals and priorities of NPDM 221-2025 were discussed with its focus area and key messages from a gender perspective. Dhaka declaration 2015+ was shared, Bangladesh delta plan integrated and holistic delta development approach was shared. Water security, climate change impact, environmental sustainability, food security and livelihood, economic growth, social development, and national and knowledge development management were also addressed. The strategic development was at 3 levels: National level, hotspot level, and strategic for cross-cutting issues. Similarly, the research carried out by students was shared which focused on Climate change impacts on women living in wetland areas: A case study of Sunamgunj District and another study focused on Climate change impacts among improvised and disadvantaged households living in the coastal area of Satkhira District.

Discussion Session: The presentation session was then followed up by a discussion session.One of the audiences in the discussion session asked if the women empowerment issue still emerging in Bangladesh as the literacy rate of Bangladesh is comparatively higher than in Nepal. Sumaiya Salem addressed the question by saying that it is still an issue. According to her, inclusiveness is mentioned but equity is still an issue. Though women are progressive, they still need to maintain social values and norms and Women are front liners in vulnerable areas. Thus, to achieve equality, they have to go long. Similarly, the audience wanted to know the best innovative approach that their team has found. They replied that several research studies were still going on and the finding would be shared once the studies are completed. Discussions were done on some of the adaptation and innovation technologies that Bangladesh has been following. In response, the government has initiated an early warning system, a 3-day weather forecasting system, installed CCTV, and emphasized youth volunteers, which have been a great relief in the field of risk management. They also shared that sometimes, due to technical errors, the public doesn't receive Early Warning messages, which is a barrier sometimes.

As the SAKTEE project focused more on women, one of the audiences from Prakriti Resources Centre, wanted to know the social norms and values that have been barriers to women and why they couldn't adopt technologies. They replied that attire like a saree, long hair, and bracelets are some barriers to women. During a cyclone, lakhs of people lost their lives, among them more were females and children. Similarly, other discussions were held regarding the authorities in Bangladesh for disaster risk management along with any provision for grants for researchers? Are there any activities regarding localization for the climate change resilience plan? To which they replied that the Ministry of Disaster Management is working in the field of disaster risk management. (Department of disaster), Union disaster management committee, WTMC, wards, etc. have been used as a platform by the locals for any kind of assistance. Similarly, the audience was curious to know the approaches they have been taking for women's inclusiveness and what they have been doing to make women empowered? They addressed the question by saying that BCAS and ICCCAD have been actively working in the field of gender issues of Climate Change. Besides that, awareness-building programs focusing on women and children have been conducted. ICCCAD has also initiated local-led adaptation principles.

Since it is a multiple-partner project, the audience wanted to know if they had any problems in coordination. They shared that they had tackled those issues by properly defining the role of different organizations and bodies involved, keeping the time frame in mind, and having regular coordination meetings. They also added that they had cooperative and interactive partners to make the project more proper.

The discussion session ended by addressing the last question from the audience which was to know the criteria for site selection. They shared that Bangladesh is vulnerable in terms of two major factors, a. Salinity in the southern part and b. Flash flood in the northern part. During the feasibility study, these two factors were identified, based on which the site was selected.

A session for Panel Discussion: Sharing of Global Issues on Gender and Social Equity in Climate Change.

Dr. Radha Wagle, joint secretary of MoFE, as a special guest initiated the panel session with the gender issues of Nepal and how its representation has been taken up by the UNFCCC.
She initiated the discussion with Dr. Ram Asheshwar Mandal, Professor School of Environmental Science and Management (SchEMS): *What are the situation and adaptation measures? A Nepali Perspective*
He mentioned the similarities between Bangladesh and Nepal in terms of climate change and its impacts. How women residing in flood-prone areas are more vulnerable. Climate has started hitting urban areas as well. The Department of Forest and Environment has initiated smart agricultural, smart biodiversity measures to tackle the impact of CC. A country like Nepal has many opportunities. More opportunities come up with more challenges. Due to the altitudinal variation, societal and cultural variation, communities living in different regions have been facing consequences differently.
Sohail the Program Coordinator was asked about "How the study was beneficial for women and the youth and how they can make more inclusive decision-making".
He addressed the questions by saying that *"Problems lead to opportunity"*. As women are the front liners. Clothing and other social norms were the issues among women, but after getting engaged in such projects, they are more aware of them which helped them to grab the opportunities to raise their voices and showcase their talent. During Climate Crisis, youths

are very passionate about volunteering and helping people in shelters. Youths have been actively engaged in risk management, EWS, research, etc. which is beneficial to both society and the youth themselves. He added the project has given knowledge, capacity building training, taking them to the field, and arranged to meet up with the key policymakers, to address this is what the youth and women are talking about.

Dr. Kailash Timilsina, Registrar, of Gandaki University was asked about how a study like this is beneficial. To address these questions he gave a flashback to the audience about the unexpected and excessive rainfall during October 2021 causing billions of losses to the paddy fields. He shared about how women mostly rely on natural resources and are the ones who face high risks and burdens due to climate disasters and why they need to have equal participation in decision-making and policy-making processes. Nepal could learn a lot from the study like good governance, equity, implementation of plans, understanding gaps in localization, and new innovative technology.

Prof. Dr. Sanjay Nath Khanal, SchEMS was asked about the status of Gender issues in the Nepali context. He shared about how Nepal has enough provisions but lacks implementation. And to know about the effect and consequences bear by vulnerable groups have been a challenging issue. He highlighted the importance of incorporating indigenous knowledge and subsistent practices for achieving sustainable development. Lastly, he added how every country needs to learn and follow positive activities, attitudes and bring forward the development process. He further highlighted the need for Academia and government sectors to be stronger and collaborate for research to tackle the Climate Change impacts.

Mr. Ajay Bhakta Mathema, Principal SchEMS was asked to express his view from the academic perspective on gender issues of Climate Change. He expressed, looking at the issue of climate change is both interesting and crucial. With the changing climate, the environment, economic and social fabric, and way of living are going to change and aggravate. Addressing gender issues is not only about equality and equity; the focus should also be on gender sensitivity. He added, talking about women shouldn't be about replacing one over another, but should be about building a synergy. Small topics like this are still missed which actually have a greater impact on Climate Change-related studies and academia has a huge role to play.

Later the panel discussion was ended by the moderator Radha Wagle by giving her concluding remarks. Where she shared how gender perspective on Climate Change should be an important topic of discussion at different national and international platforms. The government has the best provisions but due to the inadequate data, a clearer picture is still missing. Further, she highlighted the role of academia to fill the missing data through research and grants. She added that although the I/NGOs have worked from the gender perspective, both women and men need to join hand in hand to tackle the issue of Climate Change. Both males and females face different challenges and use different strategies and resources to cope with them, thus it is necessary to include every group in the decision-making process. She concluded by seeking more collaboration in the future for learning and knowledge sharing.

Concluding Remarks:

Mr.Ajay Mathema, Associate Professor, Principle, SchEMS, PU gave his concluding remarks by congratulating the Bangladesh team on the "SAKTEE" Project. He further added how Nepal can learn many things from this project and the urgency of Climate Actions to be more inclusive towards gender. Dr. Saleemul Huq, professor at the Independent University of Bangladesh/Chief of ICCAD shared that even though the project is at the end they will still work on the issue of gender more broadly and not only focusing on and analyzing vulnerability but focusing on **WHAT TO DO ABOUT IT**? He further shared that, leaders

are born not created, and expressed the urgency to support young women/girls to become leaders. They need to be given support and should help them in a way that they can become potential leaders. Sheikh Hasina Wazed, Prime Minister of Bangladesh is promoting women's rights and education, hence Bangladesh is progressing in stimulating women's role. He added, while working in the field of CC, effort should be spent on emerging leadership not just on capacity building. Capacitate women in a way that makes the champions of climate change, not just the victims. He ended the program by thanking the organizers and seeking future collaboration in promoting women's leadership.

Appendix-10:

Report of the Learning Hub Event (LHE) on

Gender Inclusion and Equity in Bangladesh Delta Plan 2100

Date: September 28, 2022 (Wednesday)

Venue: NEC-1 Committee Room

Planning Commission, Sher-e-Bangla Nagar, Dhaka

Introduction: The event was moderated by Prof. Saleemul Huq. Prof. Huq explained the importance and necessity of a Learning Hub Event (LHE), particularly on SAKTEE project which aims to empower climate-vulnerable women. Learning hub events are mostly organized to have a thorough discussion on a particular topic and to further come up with ideas for research. This presentation was followed by a long discussion, comments and ideas on the particular topic. This was under the umbrella of science-policy-dialogue. ICCCAD has carried out multiple LHE with both government and non-government organizations and will continue to do so in the future. The idea was to bring scientists or researchers from different sectors along with actors from the policy and planning division and to have a vibrant discussion to know what can help to bring about change or improve the current situation. LHEs were two-way streamed events which helped to disseminate information and brought about new research ideas to serve as a solution for future plans, particularly in national plans like the upcoming Bangladesh Delta Plan.

Dr. Saleemul Huq of ICCCAD was speaking in the opening session of the LHE held on 28 September 2022 at the Planning Commission, Dhaka

The LHE on 28th September, 2022 was focused on the role of women in climate change and disaster management. Further, it was emphasized that this event should not remain stagnant on a single LHE but this should be rather an ongoing dialogue which can be used in national planning documents. Then Dr. Atiq Rahman, Executive Director, Bangladesh Centre for Advance Studies explained the importance and necessity of gender inclusion and understanding of gender issues.

He further emphasized that gender inclusion does not exclusively talk about women rather it should look through a broader perspective and include the male, female, and transgender populations. However, the SAKTEE project tried to shed light on climate-vulnerable women. Further, Dr. Rahman spoke about the inclusion of gender aspects in the Delta Plan.

Presentation by Ms. Maliha Mashfique Malek and Ms. Sumaiya Binte Salim

Ms. Maliha from International Centre for Climate Change and Development (ICCCAD) began her presentation with stating the difference between equity and equality through which she attempted to explain how slight changes in resource allocation can leave bigger impacts on society. While explaining the project, Ms. Maliha also emphasized on how the objectives of the SAKTEE project align with Sustainable Development Goal (SDG) 5, which aims for the inclusion of women. Scaling Climate Change Adaptation Knowledge and Technologies for Empowering Women, and to Enhance Social Equity and Disaster Resilience in Bangladesh (SAKTEE) was initiated by Bangladesh Centre for Advanced Studies (BCAS) in collaboration with ICCCAD, Department of Women Affairs (DWA), Ministry of Women and Children Affairs (MoWCA), Government of the People's Republic of Bangladesh and The University of Manitoba (UM) funded by International Development Research Centre (IDRC).

She then went on to explain the conceptual framework for SAKTEE which aims to view the problem of climate change through a feminist lens. Ms. Maliha then explained the Harvard Analytic Framework which was first introduced in the 1980s to draw details on gender consideration of this project. She then stated the Bangladesh Delta Plan (BDP) 2100 and how its goals align with SDGs and gender being a cross-cutting issue was addressed in multiple chapters, nevertheless, requires a separate section to portray its importance. BDP 2100 has adopted an integrated and holistic delta management approach to formulating the projects which will have to address management of water security, social development, economic growth, climate change

impact and environmental sustainability, institutional and knowledge development, and food security and livelihood; gender was considered as a subsection under social development which must be reviewed. Ms. Maliha then stated how gender responsiveness can be improved through BDP2100.

While explaining she included strengthening the involvement of poor people (women and men) of the locality in the identification, selection, and utilization of khas land, the need for awareness rising by ministries about women's rights, specific programs focused on gender and climate change, gender-friendly legal procedures to rehabilitate displaced population, and recognizing women involvement in farmlands. Additionally, prioritizing investments, particularly for women living in disaster-prone areas is much required. She then explained how many women eat just one meal a day during disasters and gender dynamics clearly manifest that women and girls suffer first and most profoundly during a prolonged food shortage. In line with Ms. Maliha's presentation, Ms. Sumaiya reflected on research findings from the SAKTEE project.

Ms. Sumaiya from ICCCAD then proceeded with the research finding from Sunamganj and Sathkhira which were conducted by two Masters Students. The methodology used is called exploratory research and the first research conducted in Sunamganj titled *Analyzing Differentiated Climate Change Impacts on Women in the Wetland Area: A Case Study on Sunamganj District*, by Md. Kazi. Rokonuzzaman, **Department of Disaster Resilience and Engineering, Patuakhali Science and Technology University**. The objective of this research was to measure differentiated climate change impacts on women and to explore the dynamics of numerous factors that aggravate differentiated climate change impacts on women in wetland areas of the Sunamganj district. Ms. Sumaiya then explained the issues which exacerbate the existing challenges that included - impacts on women's education, barriers to alternative livelihood skills, compromising on women's agency, and climate change and social capital's perspective. Moving on to the results section, Ms. Sumaiya then stated that the most common challenge was barriers towards alternative livelihood for women, as they lack in terms of skills and education. Other challenges also included patriarchal norms, lack of support from family, lack of financial resources, lack of awareness, religious conservation, lack of knowledge, and political power. In the reflection part, a summary and a few recommendations were provided by the researchers which were social and cultural vulnerabilities and barriers to taking charge in Disaster Risk Reduction for women; women's involvement and inclusiveness need to be ensured; positive attitude to women in climate risk and resiliency need to be incorporated; proper dissemination of scientific early warnings system especially focusing on women; establishment of shelter center focusing women facilities, educational institutions and treatment center; ensuring equal rights on resources acquisition for women; and future in-depth research could find the way of analyzing differentiated impacts and better solutions for women's resiliency.

The second research was conducted in Sathkhira and titled- *Understanding differential climate change impacts among impoverished and disadvantaged households in coastal Bangladesh: A case study on Satkhira District,* by Asma Ul Husna, Assistant professor, **Development Studies Discipline, Khulna University**. The main objective of this research was to assess the differentiated climate change impacts on impoverished and disadvantaged households with exploring the factors of differentiated climate change vulnerability within the coastal sub-districts of Bangladesh. The finding included the health impacts of climate change due to increasing salinity level in soil and water. Drinking water is often contaminated by high salinity in southern parts of the country. This research identified the most common health issues in women due to rise in salinity in water used for consumption purpose in five unions, which included- skin disease, water borne disease, cardiac disease, and pregnpregnancy-relatedlems. For recommendation the researchers urged for a special focus on women groups based on segregated data base;

integrative planning and development; sustainable livelihood options for both men and women; holistic gender inclusive DRR approaches; women need special focus before during and after the disaster considering sensitivity, exposure and psychological issues; the diversity among the women group is also needed for providing them proper services and inclusivity; and gender inclusive disaster preparedness during before and after disaster are necessary for immediate management during that time.

Discussion

Prof. Saleemul Huq opened the discussion floor by explaining the importance and necessity of a learning hub event (LHE), particularly on SAKTEE project which aims to empower climate-vulnerable women. This particular LHE is more of two-way streamed event which disseminated information and brought about new research ideas to serve as solution for future plans, particularly in national plans like the upcoming 9th Five Year Plan. It also aims to circulate research findings from SAKTEE Project.

Gender disparity is a preexisting issue in Bangladesh, and climate change just exacerbates such situations, putting women at even worse conditions. With this statement Prof. Huq further explained how SAKTEE project tries to understanding climate change and gendering inequality dynamics and then attempts to come up with solutions to empower such vulnerable communities. Prof. Huq also explained how inclusion of women in national/sub-national/local planning can improve climate change adaptation practices strengthen communities and make them more resilient to climate induced disasters. He ended his welcome remarks by stating that women are often identified as vulnerable group, however a paradigm shift is much required now as women are no more considered as vulnerable rather they are part of the solution and must be defined as future climate change adaptation leaders.

Ms. Farah Kabir from Action Aid, started the discussion by stating that Bangladesh has taken numerous steps to address climate change impacts, most of these steps remained just on documents due ineffective implementation. She then explained that women issues are crucial and must be highlighted and for that we view the national documents through a feminist lens. Convention on the Elimination of All Forms of Discrimination Against Women (CEDAW) is known as a charter for women inclusion and this must be included in Delta Plan. Further she explained about the importance of zonal planning and that one size does not fit all. Ms. Kabir then pointed out how women in the country lack ownership to resources and how this has led to issues in accessing and acquisition of resources. While the presentation highlighted the importance religion and cultural norms, Ms. Kabir critically criticized that and stated that religion is not a problem rather practice is. Further, she went on the lack of monitoring and evaluation of Annual Plans and need for such programs.

Ms Farah Kabir of Action Aid Bangladesh was speaking in the plenary session

Ms. Dilruba Haider from UN Women, stated that it is good to be ambitious and setting a 100 years plan, however, the while formulating such plans inclusivity is much necessary. She then mentioned that Mujib Climate Prosperity Plan is much better in terms of inclusivity. Further Ms. Haider explained the necessity for sex aggregated data and making educational programs climate sensitive. She then went on explaining how small changes in the existing polices can make huge

difference. Lastly, Ms. Haider stated unlike MCPP Delta Plan should also mention about the investment areas.

As the session progressed discussants raised points on the need for change in mindset and derogatory terms used for against women. Moreover, the fact that not all women are equally vulnerable and ensuring equity when allocating resources are much needed currently was raised by some of the participants. Participant from agricultural sector shared an incident where women in rural parts complained about feeling insecure due to the height of plants in corn field when passing by. While discussing about the agriculture field, participants also claimed that early warning systems should be made customized for women as when designing models gender inclusivity is much required for which all department must work together.

The participants from different government agencies were sharing their views on gender equity in planning and development

Representatives from GED, also mentioned that although there are many plans that lack enforcement involve multiple issues including weak decision-making and deprivation of freedom. They also mentioned that while holistic and integrated plans are needed in the country, we must also understand that gender is a cross-cutting area and Delta Plan was mostly focused on particular agendas. Further, the involvement of CSOs, local NGOs, and other small local groups is needed for ensuring security at the ground level. Later, in the session, the representative from disaster management explained that plans and activities must be aligned with the disaster management policies and SDGs. Additionally, they emphasized the fact that Delta Plan is a long-term plan, and we won't be able to experience the benefits, and we cannot compare it with MCPP as it is an investment plan. The Delta plan is quite specific about achievement and there are sections on ownership of land for women and for customizing early warning signals for vulnerable groups. Participants from Planning Ministry also pointed out the importance of ensuring sexual harassment issues in cyclone shelters and this should come up with proper financial planning. One of the participants from the Department of Women Affairs also mentioned the government plan on the inclusion of women and youth in agri-businesses. Further, the necessity of teamwork and the aim of developing women and child action plans were discussed. As the session progressed one of the participants also mentioned missing links between sectors' action plan and national action plan.

Participants also mentioned that we cannot expect rapid improvements as cultural changes require time and proper education. However, the 8th Five Year Plan lacks the gender priorities and we must focus on that for now. Other than keep demanding a separate chapter for gender inclusion customizing technologies for women in all sectors should be taken under consideration.

Concluding remarks: Dr. Saleemul Huq stated that need for follow up for the upcoming plans and to ensure effective integration and implementation of gender issues. Finally, the session ended with concluding remarks from Dr. Md. Kawser Ahmed. Dr. Kawser stated that currently the plan is viewed and made through a patriarchal lens. Additionally, he mentioned that to ensure the implementation of the Delta Plan there are several other steps/plans prepared by the government such as Perspective Plan which is a four-year plan. He then explained that there will be multiple reviews of these plans and activities listed under that. Dr. Kawser also emphasized on the need for non-use value inclusion and scale-up of the activities. The requirement of concrete suggestions for 9th Five Year Plan, down-scale planning, and more suggestions and discussion were also mentioned by Dr. Kawser Ahmed.