



A Case Study on Evaluation of Socio-Economic Consequence of Climate Change in a Project Area in Bangladesh

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Author's contribution

The sole author designed, analysed, interpreted and prepared the manuscript.

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Short Communication

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ABSTRACT

There have been tremendous impacts of climate change on a rural area in their socioeconomic in terms of environmental events. Even though the agriculture sector has been adversely affected and decreased productivity due to climate change. Moreover, rural development and conservation policies have been influenced by climate change likewise natural disasters, migration, poverty, diseases, and food security. Thus, adopt the impact of climate change, stakeholders and experts suggest and develop various practices and solutions. Additionally, they develop integrated problem-solving action and adaptation strategies for the long term which can be directly related to the climate problems. 87 Upazila in 36 districts were selected on the basis of the largest surface areas where tuber crops were cultivated, strong and leading position as crop production. For evaluation the socio-economic condition of the project areas that affected by climate change, it was emphasized on three main point: demographic information of the participants, overall information about climate change, and the planning for climate change to investigate the socioeconomic condition of the project area affected by climate change impact. Poor education level hampered to gather knowledge and awareness about the climate change affects, mitigation and adaptation strategies. However, continue living same place would be a significant term in order to strengthen adaptation and mitigation actions. Both participants underline the common philosophies such as pattern of planning and organizational collaboration to deal with climate change impact which is related to political issues and environmental issues. The study highlights the integrated planning, pattern for crop production, river management for water resources needed to develop the socioeconomic condition of the project area.

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1. INTRODUCTION

It is unpredictable in recent human history that the climate is change and will continue into century at a rate which is highly uncertain the risks related to the climate change [1]. Particularly for those areas of societies that are dependent on resources that are sensitive to changes in temperature, drought, societal sensitivity to the hazards connected with climate change may make already difficult social and economic issues much more difficult [2], (Barua et al., 2020). Risks are evident in agriculture, fisheries, and many other sectors that support rural communities' livelihoods in emerging nations (IPP, 2014). By increasing the country's vulnerability to climate change, climate change is predicted to make Bangladesh more vulnerable to natural disasters [3]. Thus, it is important to evaluation the socio-economic scenarios of the climate change impact for the long term and available options to response. Integrated viewpoints on mitigation, adaptation and resilience climate change remains vital for combat the problems in socio-economic status [4]. Moreover, food security, food shortage, and demand increase for food are arisen in affected areas of the impact of the climate change in agriculture sector and rural life [5]. The modern and progressive practice and solution in order to adaptation to the adverse impact of the climate change can mitigation [6]. Moreover, policy and the implementation process implemented by comprehensive adaptation planning frameworks, policy engagement or forming as well as changing in institutional arrangement [7]. For the combat the solution for the climate change impact, farmers tend to focus on short term process, while experts want long term sustainable policies. Adaptation techniques may be closely tied to the climate challenge if short-term remedies are included into long-term problem-solving tactics.

1.1 Aim of the Study and Problems Questions

On the basis of environmental view of the problems statements are, climate change has detrimental impact on soil, water resources and so on. Also, it poses a danger to socioeconomic issues like sickness, migration, and poverty. Education and technology, perception and experiences are all linked to these socioeconomic situations. The socioeconomic

and environmental impacts of the climate change both progressively worsen. The goal of the investigation is to determine participants' perception on the effects of the climate change on local farming and rural areas in Project areas based on the personal experiences. Moreover, aims to look different farmers' and expert views and experiences of climate hazards, the result of mitigation activities, strategies, and predicted repercussions are. The purpose of this investigation is to minimized the gap by presenting the perspectives, experiences, and predictions of the expert and farmers about the outcomes of the climate change. This research offers five viewpoints such as observable impact, hazard, the result of mitigation activities, methodologies, and predicted implications in the diverse rural area of farmers and experts on the basis of the weather conditions. In Bangladesh, farmers are intimately tied to the farming industries, and the change in weather seems to have an impact on crops dependent on the agriculture sector. Consequently, socioeconomic issues in the rural area might be brought on by climate change. However, institutional cooperation is also a topic of interest when it comes to agricultural policies. There are three theories underline the investigation. The research initial premise state that the agricultural industries face socioeconomic risks, environmental risks based on climate change, and hazards. The second one is that as a result of forthcoming socioeconomic situations, farmers would experience unfavorable effects of the climate change. The social network and collaboration with all stakeholders are reinforced the mitigation of the negative impact of the climate change in rural area. According to the third point of the study, although professionals place more emphasis on planned adaptation on large scale than farmers' do on autonomous adaptation on small scale. Also planning discipline works on it. On the basis of the research the following problem questions are within the purview of the study; (i) What is the micro and macro socioeconomic hazards resulting from the climate change in the project areas? (ii). What are the effects do social networks and cooperation have on all stakeholders? (iii). What functions do plan at the micro and macro level serve?

2. METHODOLOGY OF THE STUDY

The intention of the study is to ascertain the climate change impact, finding the hazards may

poses in the project areas, the mitigation outcome as well as techniques and perception and experience of the farmers' and agriculture experts. According to the AEZ (Agro-Ecological Zones) classification (Appendix B), the 36 districts and 87 Upazila from project areas (Appendix A) were selected on the basis of the largest surface areas where tuber crops were cultivated, strong and leading position as crop production. Moreover, according to the AEZ classification, 17 zones were selected where tubers crops cultivated in following 36 districts (AEZ). However, the areas are also confronted of threads from drought, soil leaching, flood, and water scarcity due to climate change. Thus, the research works needed big data and empirical evidence. Data were collected by two steps: primary data was collected as structure questionnaires and misstructure questionnaires and secondary data was gathered from institutional and e-sources reports of both local and internationally. Additionally, information from official website of FAO and United Nation (UN) as international sources and locally from DAE, Bangladesh Ministry of Environment, Forest and Climate Change, Bangladesh Meteorological Department in Ministry of Defense of the Government of Bangladesh, Soil Research Development Institute, Ministry of Agriculture, Bangladesh Bureau of Statistics. Tables, graphs, statical data and mapping were represented for the resulting data as documentation.

The variable of the research regarding the climate change were examined by extreme or unexpected weather conditions. Also, secondary data was utilized in order to analyze the climate change situation. All represented 36 districts including 800 villages linked with 17 AEZs by using ArcMap-10 software. The questionnaires were carried out according to the determining the study areas. There were eight variable such as land categorized by AEZs, whether farming, good agricultural practices, livelihood of production, the amount of wetland, average of

the own land for cultivation, cooperative and organic agricultural practices. 800 villages in 36 districts in project areas were reviewed and ranked 4 and above.

Observing the selected areas map and according to the 8 criteria the districts were categorized in 8 based on geographical similarity and zone site and size. The case study evaluation participants' perceptions and experiences about the adaptation strategies which was heterogenous or not source of primary data. Consequently, there were five group were determined. The semi-structured questionnaires were arranged from November, 2021 to April, 2022. Simultaneously, climate experts' perception and experiences, structural questionnaires were conducted for the farmers. The questionnaires consisted three parts as community information, general information about climate change linked with agriculture and the relationship between climate change and organizational planning. The case study was evaluated using the data from random sample 160 farmers and 40 experts. First step, 160 structured questionnaires evaluated by filling the information from farmers from the 36 districts (Appendix A). After that, semi-structured questions were collected the information from the 40 experts (Appendix C and D). The experts included from public organization, Research Institute, local government and village leaders in terms of agricultural practices. All questionnaires carried out face-to-face interviews from five groups of geographical areas in project area. Table 2 shown the number of participants from 5 groups of area.

3-point Likert type scale were included in questionnaires and open-ended questions were designed for data collection. These data were recorded on SPSS (Statistical Package for Social Science) software package (IBM SPSS Statistics 24.0) and 'analyze/descriptive statistics' were used to describe the data. All the findings were visualized via Microsoft Excel Worksheet 2010.

Table 1. Variable according to the criteria

Rural areas	Criteria	Subjects
Variable 1	50%	land categorized by AEZs
Variable 2	2 points	wetland
Variable 3	2 points	average of the own land
Variable 4	75%	cooperative
Variable 5	16-20%	good agricultural practices
Variable 6	50%	Organizational advice
Variable 7	25-50%	Certified organic agriculture
Variable 8	3 points	Livelihood crop production

Table 2. Selection of participant (Farmers and experts)

AEZ Group	Districts (36)	No of Farmers	No of Experts	Total
Zone 1, 3, 4, 7,8	17 Upazila	32	8	40
Zone 9, 15, 16, 17	15 Upazila	28	7	35
Zone 19, 22, 23	19 Upazila	34	8	42
Zone 25, 26	17 Upazila	36	10	46
Zone 27, 28,29	19 Upazila	30	7	37

3. DATA ANALYSIS

According to the AEZ (Appendix B) most of the project area are medium to high level of fertility. However, most of Barisal, Jhalkati, Pirojpur, Patuakhali, Bagerhat, Barhuna, Khulna and Satkhira, Sunamganj, Habiganj, Kishoreganj and Brahmanbaria have high level of fertility due to the high organic matters. Though, paddy is the common crops in most of the AEZ area [8] with jute, pulse, wheat, vegetable, tuber crops are not grown everywhere. About 54 million tons of rice produce in 2019 which was ranked as 4th largest producer country [9]. The project areas (Appendix A) have different kinds of climate diversity and geographical perspectives. Few districts are in hilly area, few are near to the sea level, few are plain land and near the river basin. But southwest districts in Bangladesh are expected and more prone to climate change effects Flood, drought, cyclone are common in Bangladesh which can cause extensive damage of the agriculture and insecure for food security, health hazard, socioeconomic loss and so on [10]. About 42 Upazillas’ in 8 coastal districts were affected by pre-monsoon type cyclone Mahasen where 14,828 house were damage [11]. The tropical cyclone of Ayla occurred in During May 22, 2009 in southwest monsoon areas of Bangladesh and lost economically 89.46 billion taka (US\$1 billion) [12]. On the other hands, extreme storm cyclone sidr in 2007 which

causing large scale evacuation [13]. Progressive development of the climate change impact damage the agriculture mainly which is result of 16% agriculture GDP [14]. Thus, it is solely necessary adaptive strategies apply in irrigation system, crop diversity and harvest time change due to the adverse impact of the climate change.

This study is based on farmers’ and experts’ responses to the impacts of climate change. The dataset contains 160 farmers’ and 40 experts’ observations in thirty-six districts in project areas by using SPSS software package (IBM SPSS Statistics 24.0) which were findings were visualized via Microsoft Excel Worksheet 2016. The following Fig. 1 shown the survey consisted three main point: demographic information of the participants, overall information about climate change, and the planning for climate change [15,16].

3.1 Participants Information about Demographic

It can be stated that about more than half of participants were male, while about more than quarter were female participants for both farmers and experts. According to the result of the data 70% and 80% were male and 30% and 20% female for farmers and experts respectively attending the research.

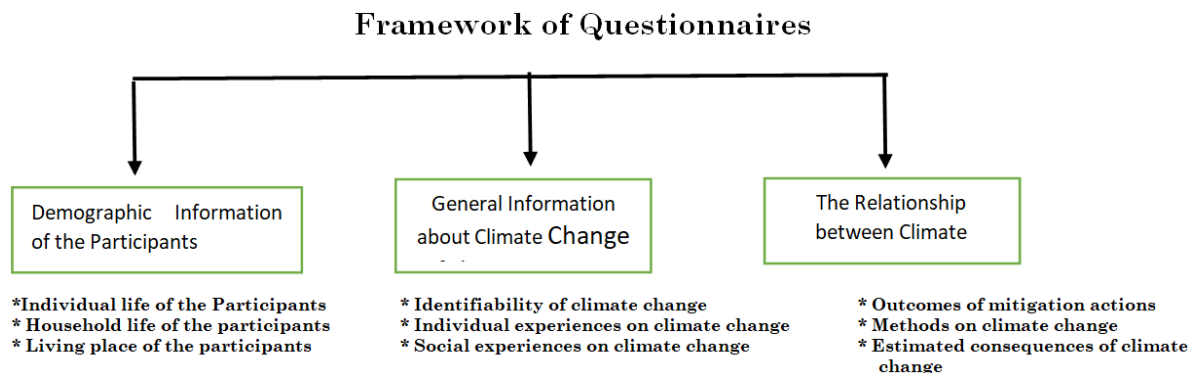


Fig. 1. The Framework of questionnaires

The base role of the participants in this research was educational background of the participants. The finding displayed that there were majority farmers completed their primary school. About 72% primary, 1% farmers were doing Masters. On the other hand, more than half of the experts (70%) were Bachelor's, 25% high school and 1% were primary educated experts. This result stated that the education level was different between farmers and experts. Consequently, more farmers used to traditional methods, especially for adaptation strategies. But educated person can understand the climate change problems and to help to increase the crop production.

There were five categories household size where 75% of the farmers shown 3-4 household size. Additionally, while 21% of them had a household size 5-6 persons and 1-2 person had in 7% of farmers household. The household size categorized as medium, large or small. The finding represented that farm size ranged from <50 to 200> acr. Although 12.6 % of them had more than 200 acr farm areas. The size of the farms as small, medium or large. However, the farm size differs for each village due to the geographical reason.

According to the result demonstrated that largest proportion, 90% farmer willing to stay their present residence and the largest number of experts also willingness to continue to living their present place. However, the production of the crops hampered in that place, but they still love to live their village. As a result, it can be said that farmers did not migrant. Thus, the results are crucial in order to sustain mitigation and adaptation of climate change. Moreover, while the participants, who wanted to migrate to urban areas, underlined economic concerns due to lack of monetary acquisitions, the experts highlighted insufficient social activities. The results are directly related to socio-spatial planning based on social and economic balance.

According the result stated that the rate of ownership (58%) was higher than the rate of tenancy (16%) which was define by the proximity between residential and agricultural lands in case of farmers. The proximity between residential and agricultural lands was defined by farmers' perceptions, while 45% of the farmers stated close proximity, 28% of them perceived it as middle proximity. The findings supported some rural planning studies in terms of several perspectives such as transportation,

sustainability of agricultural areas, and food security on macroeconomic conditions. According to the results, even though approximately 58% of the farmers had close and middle proximity from their residential areas to agricultural areas, it was remarkable that the rate of vehicle use is high in/ outside of villages. On the other hand, the ownership is a significant determinant of adaptation and mitigation actions due to the sense of belonging. There is an inverse proportion between belonging and migration. Thus, the results should be considered as a remarkable advantage at macro economy in terms of food security and agricultural sustainability.

3.2 General Information about Climate Change of the Participants

In this section consisted that the general information of participant's perception of climate change, observation, methods and risks. These results were connected with the adaptation of alleged climate change which was calculated by statistical methods. The participants observations were investigated where they mentioned that climate change is extreme. The research also evaluation the participants understanding about the environment, social, economic and political context as long or short duration.

It is important to understand the perceptions of the participants about the climate change as a fundamental to adapt to climate adverse impacts. It is observed from the finding of the research that, perceptions were highly influenced by the communication systems. According to the findings the 43% farmers focus on global warming, where 22% on unexpected change in weather, 20% depletion. On the other hands the experts expressed that 53% global warming, 32% and 28% emphasized on greenhouse and CO₂ emission. The result specified that the participant rely on traditional past process and information. The scholar think that temperature and rainfall pattern affected the growth and production of the crops more than the mention events in result.

Regarding the importance of farmers' and experts' perceptions, the components of the climate change were categorized into five groups: the existing reasons of climate change, the future impacts of climate change, climate change adaptation process, action plans and intervention tools or methods and nothing. According to the graph (Fig. 2) farmers

expressed that “nothing” (50%) where (60%) experts thought that ‘the existing reason of climate change. So, it can be said that most participant do not know about adaptation, action plan and intervention methods of the climate change.

Thus, it is stated that the information was inadequate in order to take action on climate change. Therefore, there were inconsistency between participant’s perception and the process of the climate change. So, it suggested that education, planning is essential in order to combat the negative consequences of the climate change.

Sufficient water in time and knowledge about the climate change is important in agricultural sector. According to the outcome the farmers shown 42% medium level and 55% was high level of climate change while, experts expressed that (55%) more than half experts in medium and 41% was high level. As farmers emphasized as high and medium of climate change means that severity drought and water depletion were utmost imperative problem in project area. Summarized the point that public support, awareness and collaboration with all stakeholders combat the problems in project area.

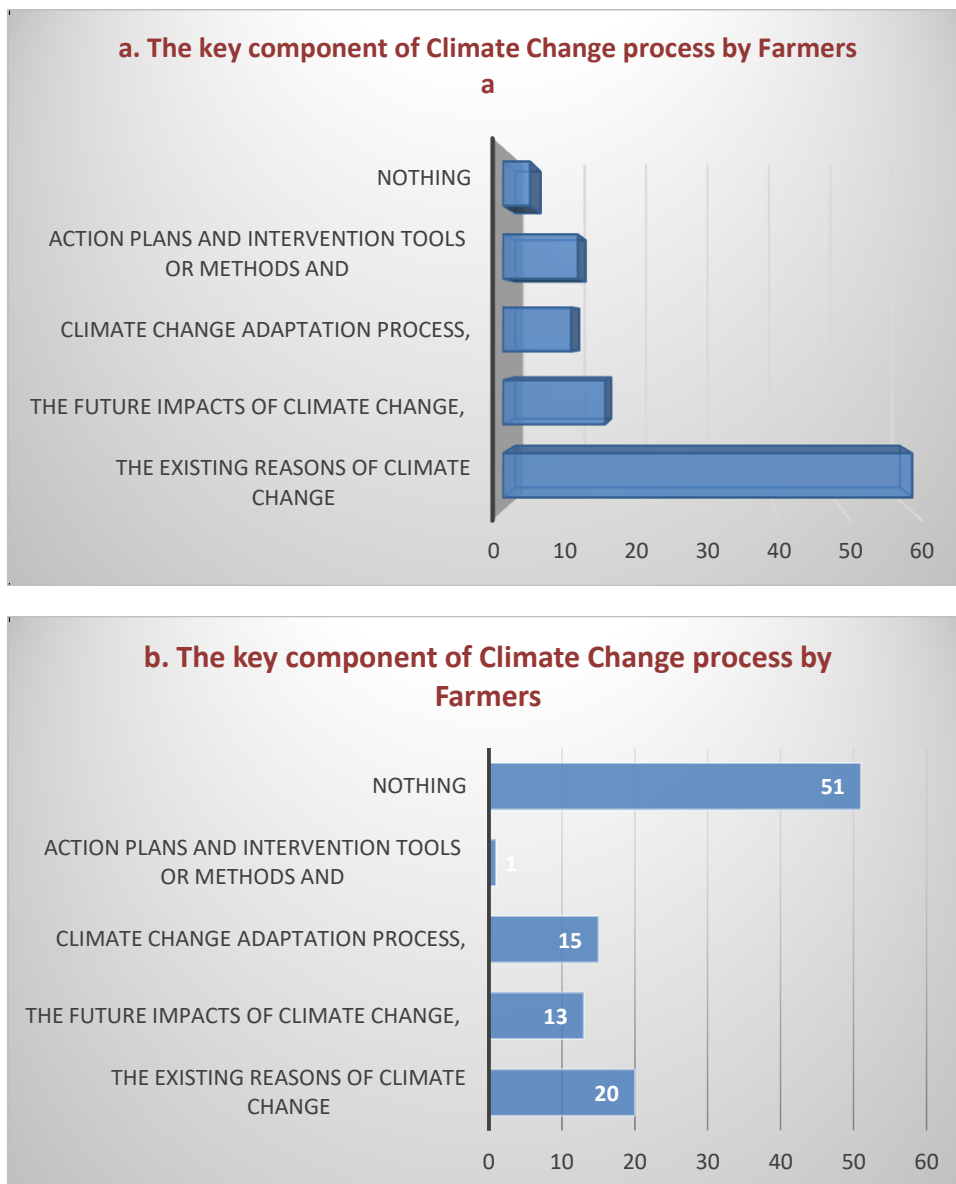


Fig. 2. The key component of the climate change process by farmers (a) and experts(b)

The results proceeded (Fig. 3.) with an analysis of participants' observations about climate change. The observations of farmers on climate change were in line with the climatic variables. About 32% farmers said that unexpected change in weather, majority (61%) said that increased the annual temperature. Contrary, 43% experts observed season shift, 40% of the experts emphasized on increased the annual temperature. It is evidenced that temperatures increase in the globe, however, the seasonal shift and unexpected change weather were defined under 'other' option, and there was a differentiation between farmers' and experts' views was linked with environmental, socioeconomic perspectives likewise drought, water depletion, and decrease the crops production. Consequently, both participants shown their individual and social experiences to reduce the impact of the climate change.

It is established by scientists by their research that human impacts on climate change conditions have been vital in recent age. As observed that 65% of the farmers said to high level of human impacts, while, 93% of the experts referred to high level of human impact on climate change. It is obvious that human mostly linked with climate change related events.

Also observed that the farmers and experts emphasized that human has impact on climate change which were differed from each other as per the open questionnaires. Though more than quarter (21.5%) the farmers were marked on uses of water, 25.1% experts emphasized on

unawareness and inadequate reforestation-destroying nature, accordingly. Unnecessary usage of water stated the vital problem in environmental and socio-ecology. Moreover, 9.8% for farmers and 7.2% of the experts mentioned the urbanization-population growth. Similarly, the data represented that, 8.4% farmers said that extreme electricity used and machineries while 18% of the expert expressed same statistics. The human impacts had the most negative influence on adaptation and mitigation decisions against climate change. All these impacts might bring about adverse environmental and socio-economic consequences such as drought, decreased income, decreased crop yields; thus, an integrated planning focuses on all of these variables.

Concern level of participant and the climate change has intimate connection demonstrated in the findings. Although, 55% of farmers said that they were concerned it highly but it was too late for everything, 32% was concerned but said it needed to developed. Similarly, 50% of expert concerned but said it can be developed and 20% of experts said that "I am concern, but next generation could be improved it". It is clearly stated that farmers were concerned about the future generation since going to face the economic suffering. Contrary, experts suggested for new methods and solution to combat the negative concern of the climate change. According to the statistics, increase in awareness and education may be more affective in order to deal with their concerns.

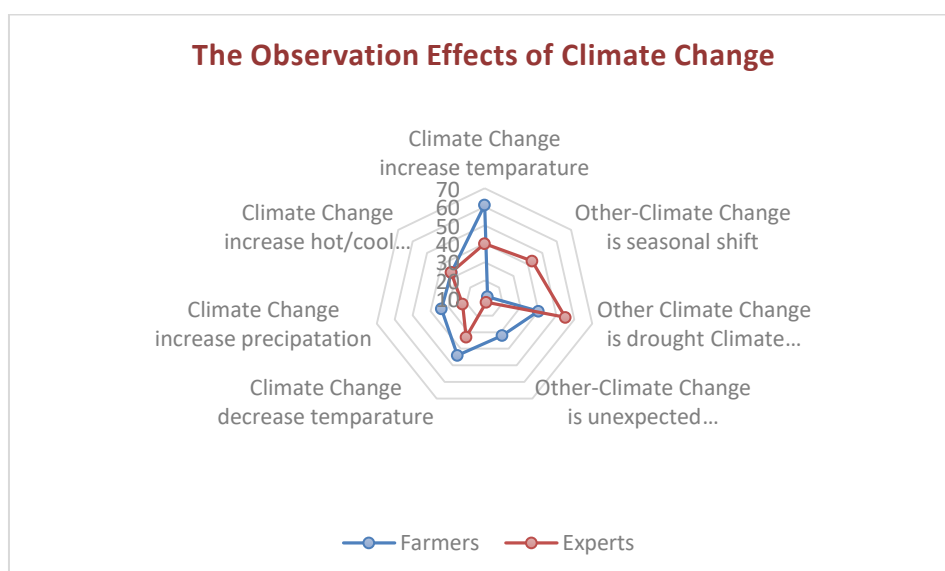


Fig. 3. The observed of the climate change of farmers and experts

As observed the outcome, 54%, 50% and 47% were for annual reports and informative programs, increasing cooperation among institutions, and developing the modern irrigation systems shown respectively mentioned by farmers. They also expressed that 12% reforestation, 9% education, 7% product pattern systems were mentioned by farmers. According to the report, the policy support is compulsory in order to reduce the adverse effects of the climate change.

A loss in crop diversity, a fall in crop yields, product pattern alterations, economic harm, and drought were among the significant outcomes. According to the comments, almost 37% of the experts claimed that agricultural yield had decreased. In addition, 30% of the experts predicted that project's area agricultural fields will suffer increased economic damage. Another forecast made by 8% of the experts is drought. There was general agreement that as unfavorable effects of climate change on agricultural areas rise, economic circumstances will suffer as a result of climate change and these issues might be seen as relating to food security.

In addition to this, over half of the experts (66%) said that raising awareness and promoting education are essential steps in reducing the negative effects of climate change on agricultural areas. In addition to this, over half of the experts (66%) said that raising awareness and promoting education are necessary aspects in reducing the negative effects of climate change on agricultural areas. The specialists next concentrated on afforestation (17.9%), administrative interactions (3%), irrigation, and excessive water-using plants

(13%), in that order. Given these reactions, environmental initiatives are essential for lowering climate change-related incidents. This study demonstrated the effectiveness of expert-recommended progressive strategies for raising participants' awareness. In addition, 13% of respondents underlined the value of contemporary irrigation systems, while 5% of respondents cited the significance of administrative interactions.

The strategies recommended by the experts produced statistically favorable results for socio-spatial planning. For instance, families might use less subterranean water if they were more aware of climate change-related occurrences. Additionally, these techniques might aid in reducing and adapting to the consequences of climate change on agricultural land, which would reinforce the favorable effects on food security. An integrated strategy might strengthen both awareness and education.

The results of the study's participant perspectives revealed that 50% of farmers and experts thought project area's resilience level was insufficient to deal with the detrimental effects of climate change (Fig. 4). The majority of participants indicated in their replies that the negative effects of climate change will worsen in the future. Awareness among participants might be raised by a variety of communication techniques to assist deal with these negative effects. According to the findings, of the farmers, 72.2%, 37.5%, and 19.4% learnt about climate change through media (TV/radio), social media/the internet, and neighbors/family.

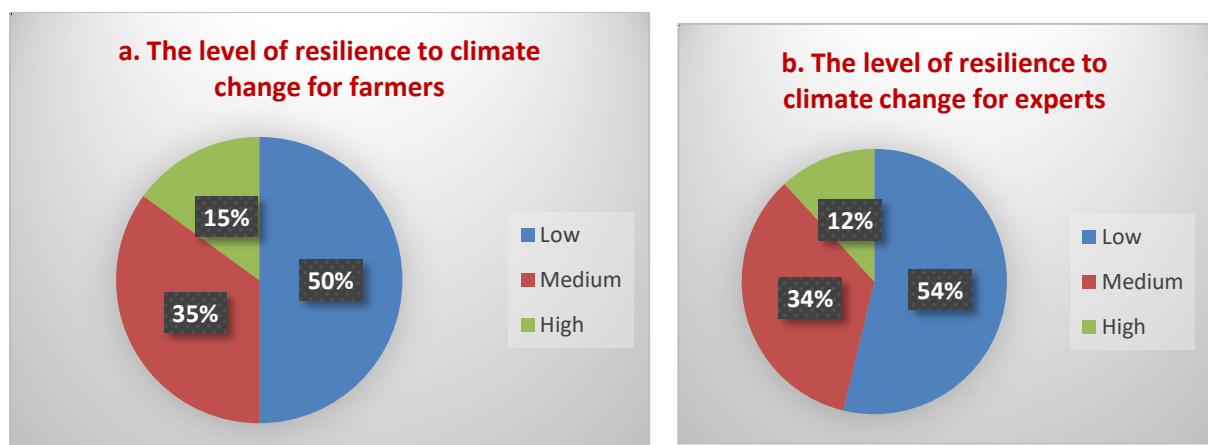


Fig. 4. The level of resilience to climate change for farmers and experts

The findings (Fig. 5) showed that farmers (88.9%) and experts (75%) had a strong belief in the financial threats posed by climate change. According to the comments, farmers were more concerned than specialists. Weather has a direct impact on crop quality and yields, therefore these changes in agriculture might have an impact on farmers' incomes. The majority of interviewees were worried about their fundamental living situations.

The findings (Fig. 6) showed what would happen to study area's food production and marketing if mitigation and adaptation measures were not taken on agricultural areas. While 29.2% of farmers emphasized the serious effects of climate change, 42.9% of the experts claimed that project area had a comparable degree. According to the comments, the unavoidable effects of climate change may have an impact on food production and marketing. The participants, however, did not focus on a single response. The effects of climate change on food production and marketing were thus not well understood in study area.

3.3 The relation between Climate Change and Planning

The questionnaire developed on evaluations of mitigation actions ensure to the agriculture sector where it represented by low, medium and high (Fig. 7). According to the Fig. 7. farmers emphasized 45% urban sprawl, 45% migration and 22% food dependency, whereas experts 29% and 45% respective events. Not only experts but also farmers emphasized that actions were not only connected with impact of climate change. Contrary, they were alleged that were

affected by environmental, social, economic and political conditions affected the actions. Moreover, farmers mentioned that 45% reduce poverty, 63% reduce drought, and 69% reduce efficiency product which reflected the environmental and socio-economic condition of the project area. Analyzing the finding, it can be said that, farmers emphasized socio-economic acquisition with migration actions while experts stressed on adaptation process research actions of the climate change terms of the environment background.

Adaptation of climate change were categorized by tree resulted from the farmers' practices the techniques in agriculture field in various districts to adjust to climate change according to the AEZ. The finding shown that farmers mentioned land consolidation 44.5%, 41% organic farming, 43.1% improved machineries and public transport system which were lower impact. Likewise, 35% Improved machineries and public transport system and 22% land consolidation ranked low by the experts. Good Agriculture Practices (60%) as high impact level shown by the farmers whereas, experts focus on highly (74%) Good Agriculture Practices, (60%) organic farming, 60% decrease waste generation and (60%) having information for planning. These findings showed a significant correlation between farmers' practices and socioeconomic factors like education, as well as a link between environmental and policy factors and agricultural practices. As a result, there exist connections between the recommendations made by the participants, and the development process for adaptation planning should systematize these techniques.

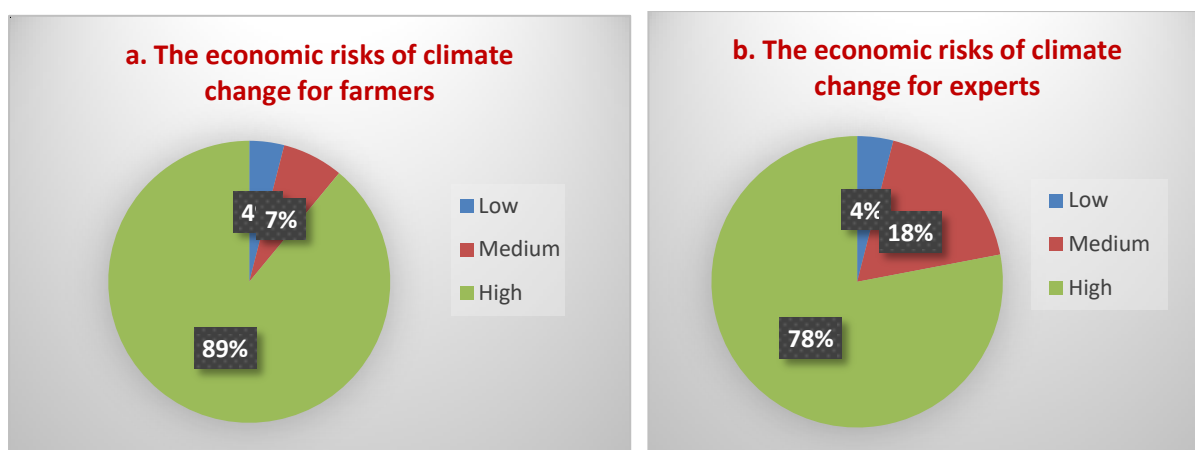


Fig. 5. The economic risks of climate change for farmers and experts

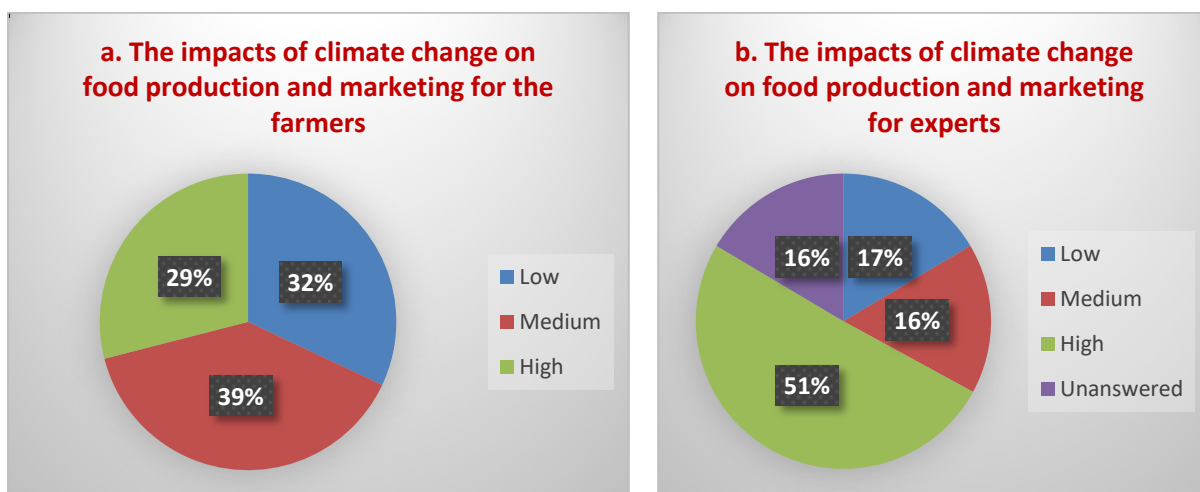


Fig. 6. The impact of climate change on food production and marketing for the farmers and experts

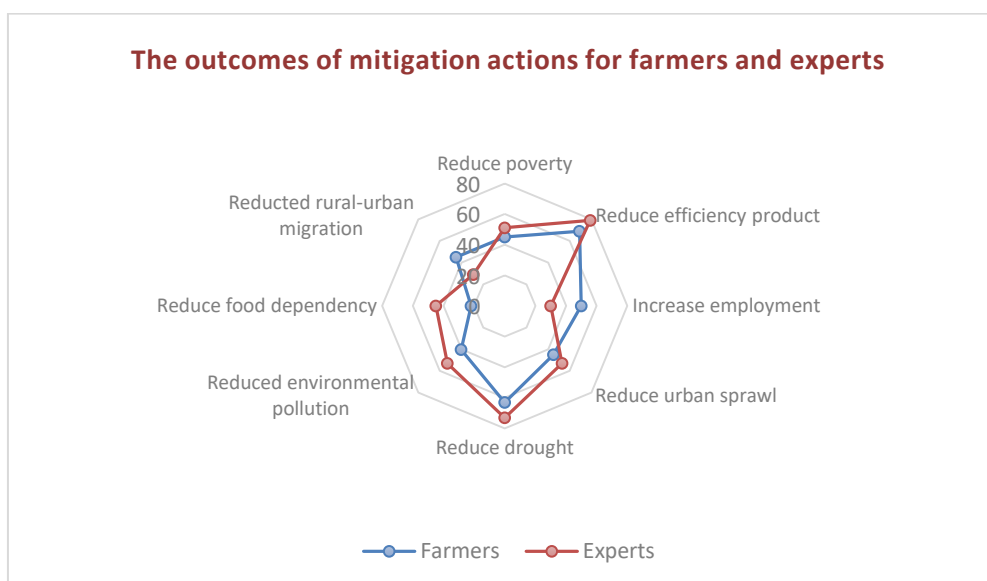


Fig. 7. The outcome of the mitigation actions for Farmers and experts

4. DISCUSSION

The purpose of the study is to investigate how climate change would affect the project areas, as well as the risks may present, the outcome of the mitigation activities and anticipated effects in contrast to farmers' and experts' perspectives and experiences. In concern of the demographic aspect, the result shown that male participants of both framers' and experts were common. In this research, most of the farmers had primary level education while experts had bachelor's level. It can be said that lack of proper information can affect adaptation and mitigation action in the study areas. Also, it is assured that due to the

poor education level hampered to gather knowledge and awareness about the climate change affects, mitigation and adaptation strategies. Moreover, the house hold size was 3-4 people for about half of the farmers in the research areas where there was no balance tern of their land size, however, most of the farmers had own property. As per family tradition of the farming, most of the farmers want to continue living in their place as well experts also want to live here. Similarly, there were a strong linkage between farmers to continue living their place and sense of belonging. That point has arisen a positive influence for planning organization or institute to make a long terms project in order to

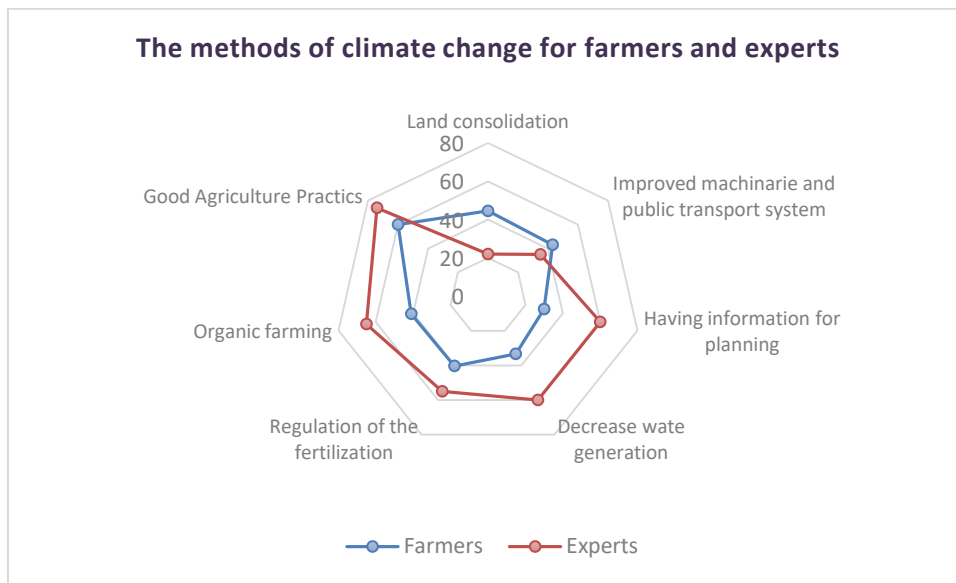


Fig. 8. The methods of the climate change for farmers and experts

agricultural sustainability. Thus, it would be a significant term in order to strengthen adaptation and mitigation actions.

According to the farmers and experts “global warming” was the leading concept of the climate change. Most of the expert had knowledge about existing reasons of the climate change, while the majority farmers had no idea about the climate change cause, its impact in their crops. Certainly, it is true that both participants had no actual knowledge about adaptation, mitigation process and action plan. In this circumstance, bring result in serious hindrances for adaptation and mitigation process. But they observed the changes happened in their areas like temperature increase, duration long for raining, seasonal shifting which is noteworthy issue to increase their activities regarding the climate change impact.

It is stated that, the expert impressions were higher than the farmers’ overviews about the human impacts on climate change. Farmers’ experiences stressed the usage of water, inadequate reforestation and destroying nature; furthermore, experts’ experiences highlighted inadequate reforestation and destroying nature, unawareness, and the extreme usage of electricity and vehicles. So, it is obvious to said that the concept or viewpoints about the climate change were differed between farmers and experts. Analyzed the data, it is observed that, about 30% of farmers had significant knowledge about the climate change, while, 70% of the

experts had It meant that farmers were more pessimistic about the climate change and less concern due to the proper information. To minimized the negative impact of climate change, it is recommended that educational program, training, workshops, strong administrative and integrated planning are the fundamental issues to cope the issues. Main risk issues in agriculture were water depletion and desertification mentioned by both farmers and experts for the research areas. Thus, it is certainly important to determine of protected areas and an integrated planning system and policy strategies need strengthening. Both participants underline the common philosophies such as pattern of planning and organizational collaboration to deal with climate change impact which is related to political issues and environmental issues. They also improved numerous applications related to the climate change. The study resulted those farmers experienced mostly focus on irrigation system change, involvement of expert to demonstrate technologies and experts’ suggestion was also change of the pattern of planning, institutional involvement, irrigation system change, good agriculture practices, irrigation system development. So, this finding concluded that both participants had synchronization. This circumstance provides positive benefits to mitigation and adaptation to climate change. On the other hands the strong institutional and among all stakeholders’ farmers and expert network improve in the study areas by public support and awareness. In other words, increased strong networks among stakeholders

are facilitated by public backing. Farmers emphasized annual reports and educational programs, as well as institutional collaboration, in accordance with social standards, whereas specialists emphasized an improvement in educational and awareness initiatives, as well as administrative cooperation. So, in order to combat climate change, both farmers and scientists emphasize two key ideas: administration cooperation and education and awareness efforts. These ideas have implications for socioeconomic and political issues from a planning perspective. Majority expressed that they were poor in resilient to climate change. Despite the fact that they both find out that climate change posed an economic danger, however, there were no agreement for crop production and supply chain or marketing. Farmers mentioned that it is crucial to having market places, other social and cultural amenities in their area. As a result, for the sustainable agriculture needs to protect the climate change risk which is the most viable issue for the sector. Farmers use agriculture machineries in their field which may cause pollution and they have no idea the linkage of the machineries uses to the climate change.

Seasonal shift, rapid weather change, the alteration of product patterns, product pattern planning, and crop diversification are a few of the key problems with climate change. Farmers and experts rely on public institutions and organizations as the top administrative priority when discussing institutional collaborations to lessen the effects of climate change. Additionally, farmers emphasized the value of universities, experts stating that co-organization for all stakeholders. Thus, the significance of public backing was once again emphasized. Farmers highlighted socioeconomic and environmental challenges when questioned about mitigation and adaptation measures. The majority of farmers place little emphasis on disaster risk reduction. Because of this, it might be assumed that farmers tend to see the effects of their activities firsthand. programs and administrative cooperation, it might be said.

In the issue between climate change and planning, they have suggested that the mitigation improved by improve the planning, decisionmakers views, production will also increase. Therefore, despite the fact that the climate change mitigation dealings assist rural economies and they also account the urbanization in various aspect of climate change.

Farmers admitted that they need extensive knowledge of the crops cultivation during the adverse impact of climate change, whereas specialist emphasized to effective agriculture operation and agriculture good practice (GAP) at high level. Other side there were less noticeable effects of different agriculture methods on climate change and adaptation strategies where agriculture methods should be improved in light of regional dynamics. Moreover, farmers strongly emphasized on production pattern planning in consideration of the projection consequences of climate change, while the experts draw attention on potential water resources in near future. Both of farmers and experts stressed on to improve the fertile level of the agriculture land in present which may offered to development in near future. In case of mitigation approaches, farmers and experts given similar statement that, there are various factors that intimately related to the urbanization and that effects of climate change on urban extension were negligible. Plans for river basin management, on the other hand, are crucial for safeguarding water supplies. Along with these plans, the estimations and determination of farmers' socioeconomic conditions may present a chance for integrated planning. It is recommendation for further research that include more research area in Bangladesh. Also giving more emphasize on planning, environmental cropping pattern by examine in details. Last but not least, planning related policy regarding the climate change will be developed by analyzing the farmers', all stakeholders interlink with experts and administration.

5. CONCLUSION

The study suggests that the socio-economic development is slow due to the impact of the climate change in the project areas. Moreover, agriculture sector is another vital that has been adversely affected and decreased productivity due to climate change. Natural disasters, migration, poverty, diseases, and food security resulted from the climate change impact, influenced the rural development and conservation policies. The interviews used could form part of the methodology to link demographic information of the participants, overall information about climate change, and the planning for climate change for analyzing the socio-economic condition. The negative impact of climate change can be minimized by demonstrate educational program, training, workshops, strong administrative and integrated planning. Also,

giving more emphasize on planning, environmental cropping pattern by examine in details. Last but not least, planning related policy regarding the climate change will be developed by analyzing the farmers', all stakeholders interlink with experts and administration.

COMPETING INTERESTS

Author has declared that no competing interests exist.

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APPENDIXS

Appendix A. Research area (Project area):							
Name of the region	Name of the district	Name of the Upazila	Name of the region	Name of the district	Name of the Upazila		
Dhaka	1. Manikganj 2. Munshiganj 3.Narsingdi 4.Kishoreganj	Singair	Dinajpur	21.Dinajpur	Birganj		
		Srinagar			Parbatipur		
		Belabo			Butler		
		Hossainpur			Pirganj		
Faridpur	5.Faridpur 6.Madaripur	Pakundiya	Mymensingh	22.Thakurgaon 23.Panchagarh 24.Mymensingh	Ranisangkail		
		Culiarchar			Debiganj		
		Charabhadrasana			Dumar		
		Sadar			Sadar		
Jessore	7.Jessore	Kalkini	Rajshahi	25.Netrokona 26.Jamalpur 27.Rajshahi 28.Natore 29.Chapainawabganj 30.Naogaon	Gafargaon		
		Sadar			Gauripur		
		Monirampur			Trishal		
	8.Narail	Sadar			Rajshahi	25.Netrokona 26.Jamalpur	Phulbaria
		Lohagarh					Ishwarganj
		Sadar					Purbadhala
	9.Magura	Sadar			Rajshahi	27.Rajshahi	Madarganj
		Sreepur					Islampur
		Sadar					Bagha
	10.Jhenaidah	Sadar			Rajshahi	28.Natore	Mohanpur
		Kaliganj					Lalpur
		Shailkupa					Baraigram
11.Chuadanga	Sadar	Rajshahi	29.Chapainawabganj 30.Naogaon	Shibganj			
	Alamdanga			Mahadevpur			
	Sadar			Raninagar			
Rangpur	12.Meherpur 13.Rangpur 14.Gaibandha 15.Kurigram 16.Lalmonirhat 17.Feni	Mujibnagar	Bogra	31.Joypurhat 32.Pabna 33.Sirajganj 34.Bogra	Manda		
		Sweet pond			Badalgachi		
		Pirganj			Sadar		
		Pirgachha			Panchbibi		
		Gangachara			Aestragram		
		Fulbaria			Chatmohar		
		Saghata			Ishwardi		
Gobindganj	Shahjadpur						
Rangpur	18.Nilphamari	Ulipur	Comilla	35.Comilla	Kazipur		
		Phulbari			Ullapara		
		Hatibandha			Shajahanpur		
Sylhet	19.Habiganj	Aditmari	Comilla	36.B , Baria	Sherpur		
		Sonagazi			Sonatala		
		Syedpur			Sariakandi		
Chittagong	20.Chittagong	Dimla	Comilla	36.B , Baria	Titus		
		Domar			Baruda		
		Nabiganj			Chandina		
Chittagong	20.Chittagong	Baniachang	Comilla	36.B , Baria	Nabinagar		
		Madhabpur			Banjarampur		
		Boalkhali					
		Patiya					

Appendix: B. AEZ (Agroecological Zone) in Bangladesh where Potato cultivation						
Name of the AEZs	Location	Extent	Land type	Organic matter content	Fertility level	Suitable crops
1. Old Himalayan Piedmont Plain	Most of Panchagarh and Thakurgaon districts and north-western parts of Dinajpur districts	4008 km ²	<i>High:</i> 58% <i>Medium high:</i> 34% <i>Others:</i> 8%	Low	Low to medium	Kharif: B. Aus, T. Aman, Jute, Summer vegetables, Summer pulse, Sesame Rabi: Pulses, Potato, Vegetables, Wheat, Mustard
3. Tista Meander Floodplain	Most of greater Rangpur, eastern part of Panchagarh and Dinajpur; northern Bogra and part of Jaipurhat, Noagaon and Rajshahi districts.	9468 km ²	<i>High:</i> 35% <i>Medium high:</i> 51% <i>Others:</i> 14%	Medium	Medium	Kharif: B. Aus, T. Aus, Jute, T. Aman, GM, Kaon Rabi: Wheat, Sugarcane, Potato, Mustard, Blackgram, Tobacco
4. Karatoya-Bangali Floodplain	Eastern half of Bogra district and most of Sirajganj district.	2572 km ²	<i>High:</i> 23% <i>Medium high:</i> 44% <i>Medium low:</i> 14% <i>Others:</i> 19%	Medium to high	Medium	Kharif: Jute, B. Aus, T. Aman, Kaon, GM Rabi: Wheat, Vegetables, Pulses, Mustard, Potato, Boro
7. Active Brahmaputra-Jamuna Floodplain	Eastern part of Kurigram, Gaibandha, Bogra, Sirajganj and Pabna districts. Minor areas also occur in Dhaka, Munshiganj, Narayanganj and Chandpur districts.	3190 km ²	<i>Medium high:</i> 37% <i>Medium low:</i> 20% <i>Others:</i> 43%	Low	Low to medium	Kharif: Jute, B. Aus, B. Aman, T. Aman, Kaon Rabi: Wheat, Mustard, Sweet Potato, Groundnut, Cheena.
8. Young Brahmaputra and Jamuna Floodplain	Western parts of Sherpur, Jamalpur and Tangail districts, parts of Manikganj, Dhaka, Munshiganj and Gazipur districts and a belt of adjoining and old Brahmaputra channel Kishoreganj and Narsingdi districts.	5924 km ²	<i>High:</i> 18% <i>Medium high:</i> 42% <i>Medium low:</i> 19% <i>Others:</i> 9%	Low to medium	Low	Kharif: B. Aus, T. Aman, T. Aus, Jute, Green manures, Fox tail millet Rabi: Wheat, Potato, Tobacco, Mustard, Boro

Name of the AEZs	Location	Extent	Land type	Organic matter content	Fertility level	Suitable crops
9. Old Brahmaputra Floodplain	Large areas in Sherpur, Jamalpur, Tangail, Mymensingh, Netrokona, Kishoreganj, Narsingdi and Narayanganj districts. Small areas in the east of Dhaka and Gazipur districts.	7230 km ²	<i>High:</i> 28% <i>Medium high:</i> 35% <i>Medium low:</i> 18% <i>Others:</i> 17%	Low to Medium	Low	Kharif: B. Aus, T. Aman, T. Aus, Jute, Green manures Rabi: Mustard, Wheat, Pulses, Onion, Potato, Grasspea
15. Arial Beel	Munshiganj and Dhaka district.	144 km ²	<i>Medium high:</i> 13% <i>Low:</i> 73% <i>Others:</i> 14%	Medium	Medium to high	Kharif: Aus rice, Jute Rabi: Pulses, Mustard, Potato, Boro rice
16. Middle Meghna River Floodplain	Parts of Kishoreganj, Brahmanbaria, Comilla, Chandpur, Narsingdi and Narayanganj	1555 km ²	<i>Medium high:</i> 8% <i>Medium low:</i> 29% <i>Low:</i> 25% <i>Very low:</i> 11% <i>Others:</i> 27%	Low	Medium	Kharif: B. Aus+B. Aman, Jute Rabi: Boro rice, potato, wheat, mustard
17. Lower Meghna River Floodplain	Chandpur, Lakshimpur and Noakhali.	909 km ²	<i>High:</i> 14 <i>Medium high:</i> 28 <i>Medium low:</i> 31 <i>Others:</i> 27	Medium	Medium to high	Kharif: T. aman, jute Rabi: Boro rice, Potato, Wheat, Mustard, Groundnut, Lentil, Chickpea, Soybean, Chilli
19. Old Meghna Estuarine Floodplain	Kishoreganj, Habiganj, Brahmanbaria, Comilla, Chadpur, Feni, Noakhali, Laksmipur, Narsingdi, Narayanganj, Dhaka, Shariatpur, Madaripur, Gopalganj and Barisal.	7740 km ²	<i>Medium high:</i> 24% <i>Medium low:</i> 33% <i>Low:</i> 21% <i>Others:</i> 27%	Medium	Medium	Kharif: B. Aus+B. Aman, T. Aman, Jute Rabi: Boro rice, Wheat, Potato, Mustard, Grasspea, Chickpea, Winter vegetables
22. Northern and Eastern Piedmont Plains	Sherpur, Netrokona, Sunamganj, Sylhet, Moulivibazar, Habiganj, Brahmanbaria and Comilla	4038 km ²	<i>High:</i> 33% <i>Medium high:</i> 31% <i>Medium low:</i> 16% <i>Others:</i> 80%	Medium	Low to medium	Kharif: T. Aus, T. Aman, Jute Rabi: Boro rice, Wheat, Mustard, Potato, Grasspea, Black gram
23. Chittagong Coastal Plains	Feni, Chittagong and Cox's Bazar	3720 km ²	<i>High:</i> 17% <i>Medium high:</i> 43% <i>Medium low:</i> 13% <i>Others:</i> 27%	Low	Medium	Kharif: T. Aus, T. Aman, Taro Rabi: Boro rice, Potato, Mustard, Tomato, Cowpea, Brinjal, Radish, Country bean, Yard long bean

Name of the AEZs	Location	Extent	Land type	Organic matter content	Fertility level	Suitable crops
25. Level Barind Tract	Dinajpur, Gaibandha, Joypurhat, Bogra, Naogaon, Sirajganj and Natore	5049 km ²	High: 30% Medium high: 55% Others: 15%	Low	Low	Kharif: T. Aman, Sugarcane, Maize Rabi: Sugarcane + Potato, Maize, Mustard, Wheat, Tomato, Onion, Cabbage
26. High Barind Tract	Rajshahi, Nawabganj and Naogaon	1600 km ²	High: 93% Others: 7%	Low	Low	Kharif: T. Aus, T. Aman, Sugarcane, Maize Rabi: Boro rice, Wheat, Sugarcane + Cabbage/Cauliflower, Maize, Mustard, Potato, Chickpea, Black gram, Lentil, Ladies Finger.
27. North Eastern Barind Tract	Dinajpur, Rangpur, Gaibandha, Joypurhat and Bogra	1079 km ²	High: 36% Medium high: 56% Others: 8%	Low	Low	Kharif: T. Aus, T. Aman, Sugarcane, Jute, Sesame Rabi: Boro rice, Wheat, Sugarcane + Potato, Maize, Mustard, Black gram, Cabbage, Cauliflower
29. Northern and Eastern Hills	Khagrachhari, Chittagong Hill Tracts, Bandarban, Chittagong, Cox's Bazar, Habiganj and Moulivibazar	18172 km ²	High: 92% Others: 8%	Low	Low	Kharif: B. Aus, T. Aman, Jhum cultivation Rabi: Boro rice, Potato, Sweet potato, Cucumber, Sweet gourd, Snake gourd, Bitter gourd, Ridge gourd, Brinjal, Country bean, Coriander
30. Akhaura Terrace	Brahmanbaria district and minor areas in Habiganj district	113 km ²	High: 11% Medium high: 10% Medium low: 15% Others: 64%	Low	Low	Kharif: T. Aus, T. Aman, Jute, Sugarcane + Turmeric Rabi: Boro Rice, Wheat, Mustard, Potato

T. — Transplanting; B. — Broadcasting

APPENDIX C

A. Questionnaire Form for Farmers

Questionnaire Number:

Farmers' Spatial Information

Village/ Neighborhood:

District:

A. DEMOGRAPHIC INFORMATION

Personal Information

A.1. Gender?	<input type="checkbox"/> (1) Female	<input type="checkbox"/> (2) Male
A.2. Age?		
A.3. Birthplace?		
A.4. Education Background?		
<input type="checkbox"/> (1) analphabetic	<input type="checkbox"/> (3) Primary education	
<input type="checkbox"/> (2) Lettered	<input type="checkbox"/> (5) Bachelor's degree	<input type="checkbox"/> (6) Master's and Doctoral Degree
<input type="checkbox"/> (4) High School		
A.5. Do you work in different sector?		
<input type="checkbox"/> (1) Yes	<input type="checkbox"/> (2) No	
A.5. 1. If it is "yes", which sector do you work?		
<input type="checkbox"/> (1) Public Sector	<input type="checkbox"/> (2) Private Sector	<input type="checkbox"/> (3) University
<input type="checkbox"/> (4) self-employed	<input type="checkbox"/> (5) Cooperative/unity	<input type="checkbox"/> (6) Other.....

Household Information

A.6. Number of people in household?

1.	2.	3.	4.	5.
A.6.1. Relationship status				
A.6.2. Gender				
A.6.3. Age				
A.6.4. Birthplace				
A.6.5. Education				
A.6.6. Working Status				
A.6.7. Job				
A.6.8. Sector				

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A.6.1. (1) Mother, (2) Father, (3) Wife/Husband, (4) Child, (5) Brother/Sister, (6) kin, (7) friend, (8) other

A.6.2. (1) Female (2) Male

A.6.5. (1) analphabetic (2) Lettered (3) Primary education (4) High School (5) Bachelor's degree (6) Master's and Doctoral Degree

A.6.6. (1) working (2) not-working (3) Housewife (4) Student (5) Retired (6) Other

A.6.8. (1) Public (2) Private (3) Other

A.7. How much does your family's income in a month?

<input type="checkbox"/> (1) Less than 10000	<input type="checkbox"/> TK (2) 10000-15000BDT	<input type="checkbox"/> (3) 15000-20000BDT
<input type="checkbox"/> (4) 20000-22000 BDT	<input type="checkbox"/> (5) 22000 above	<input type="checkbox"/> (6) More than 5000 TL

A.8. How many years are you doing farming?....., Farming size.....

General Information about Living Place

- A.9. How many years have you lived in current place?
- A.10. How many years have you lived in this neighborhood/ village in place?.....
- A.10.1. If you have not lives, where have you lives before?
- (1) In another village/neighborhood in place,
 - (2) In a village/neighborhood outside in place,
 - (3) Abroad,
- A.11. Do you want to continue living in your place of residence in this village/neighborhood? Why?
- (1) Yes..... (2) No
- A.11.1. If your answer is “no”, where would you like to migrate? Why?
- A.12. What is the ownership status of the agricultural lands?

-
- (1) tenancy (2) property owner (3) other.....
- A.13. What is the proximity between residential and agricultural areas?
- (1) close distance (2) middle (3) long distance
- A.13.1. If your answer is “long distance”, where do you live?
.....
- A.14. What kind of housing do you live in? (2) Multi-storey building
- (1) Single Family House
-

B. KNOWLEDGE ABOUT CLIMATE CHANGE AND ASSESSMENTS

Identifiability of Climate Change

- B.1. Which options are associated with perception of climate change all the world?
- (1) Climate change is global warming
 - (2) Climate change is depletion of the ozone layer
 - (3) Climate change is the increase in greenhouse effect
 - (4) Climate change is the increase in CO₂ emissions
 - (5) Climate change is global economic system
 - (6) Nothing
 - (7) Other.....
- B.2. Which issues do you have knowledge about the general process of climate change?
- (1) The existing reasons of climate change
 - (2) The future impacts of climate change
 - (3) Climate change adaptation process
 - (4) Action plans and intervention tools/methods
 - (5) Nothing
- B.3. Which level of climate change do you experience in place?
- (1) less (2) medium (3) more
- B.4. What are the observed effects of climate change in place?
- (1) Climate change increases temperature
 - (2) Climate change decreases temperature
 - (3) Climate change increases precipitation
 - (4) Climate change decreases precipitation
 - (5) Climate change increases frost cases
 - (6) Other
- B.5. What is the level of human impact in climate change in place?
- (1) low (2) medium (3) high
- B.5.1. Why?.....

Individual Experiences on Climate Change

B.6. What is level of concern about climate change for future?

- (1) I am concerned highly, and I think it is late for everything.
- (2) I am concerned, but new methods can be developed.
- (3) I am concerned lowly because future generation can be improved solutions.
- (3) I am not concerned since future generation will not be affected.

B.7. In your place, which risks based on climate change will occur in the future?

- | | | |
|---|---|--|
| <input type="checkbox"/> (1) Desertification | <input type="checkbox"/> (2) Famine | <input type="checkbox"/> (3) Water depletion |
| <input type="checkbox"/> (4) Biodiversity reduction | <input type="checkbox"/> (5) Air pollution | <input type="checkbox"/> (6) Land pollution |
| <input type="checkbox"/> (7) Water pollution | <input type="checkbox"/> (8) Food wars | <input type="checkbox"/> (9) Water wars |
| <input type="checkbox"/> (10) Increased acid rains | <input type="checkbox"/> (11) Decreased in food production (12) Migration | |
| <input type="checkbox"/> (13) Epidemic Diseases | <input type="checkbox"/> (14) Pothole Formation | <input type="checkbox"/> (15) Sandstorm |
| <input type="checkbox"/> (16) Nothing | <input type="checkbox"/> (17) Other..... | |

B.8. Which methods based on climate change should be developed in the future?

- (1) I do not believe in climate change.
- (2) Population growth should be balanced.
- (3) New technological developments should be increased.
- (4) Renewable energy sources should be increased.
- (5) Other

B.9. What are your individual efforts and experiences to reduce the impact of climate change in your place?

- | | |
|---|---|
| <input type="checkbox"/> (1) The changed of the product pattern | <input type="checkbox"/> (2) The changed of the irrigation system |
| <input type="checkbox"/> (3) Usage of good agricultural practices | <input type="checkbox"/> (4) Usage of organic farming |
| <input type="checkbox"/> (5) Reforestation | <input type="checkbox"/> (6) Usage of renewable energy systems |
| <input type="checkbox"/> (7) Disposal of waste | <input type="checkbox"/> (8) Usage of recyclable products |
| <input type="checkbox"/> (9) Not use of chemical fertilizer | <input type="checkbox"/> (10) Usage of heat insulation systems |
| <input type="checkbox"/> (11) Consulting experts | <input type="checkbox"/> (12) Reduced of the usage of vehicles |
| <input type="checkbox"/> (13) Nothing | <input type="checkbox"/> (14) Other..... |

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Social Experiences on Climate Change

B.10. What are the social efforts and experiences that can reduce the impact of climate change on rural areas?

- (1) Usage of good agricultural practices
- (2) Usage of organic farming practices
- (3) The developed the modern irrigation systems
- (4) The increased the crop diversity
- (5) Promotion of environmental-friendly products
- (6) Making soil analyzes
- (7) Preparation of annual reports and informative programs
- (8) The increased cooperation among institutions
- (9) Other.....

B.11. Which tools do you use to get information about climate change?

- | | | |
|--|--|--|
| <input type="checkbox"/> (1) Media (TV/Radio) | <input type="checkbox"/> (2) Internet/Social Media | <input type="checkbox"/> (3) Family/Neighbor Relations |
| <input type="checkbox"/> (4) University | <input type="checkbox"/> (5) Public Institutions and Organizations | <input type="checkbox"/> (6) Private Sector |
| <input type="checkbox"/> (7) Local Governments | <input type="checkbox"/> (8) Neighborhood representative | <input type="checkbox"/> (9) NGOs |
| <input type="checkbox"/> (10) Other | | |

(1) Low	(2) Medium	(3) High
C.1.a. Reduced poverty		
C.1.b. Reduced rural urban migration		
C.1.c. Reduce food dependency		
C.1.d. Reduced environmental pollution(water, land, air)		
C.1.e. Reduced drought		
C.1.f. Reduced urban sprawl		
C.1.g. Increased employment		
C.1.h. Increased efficiency product		

C.2. Which methods will mitigate the adverse impacts of climate change?

(1)Low	(2)Medium	(3)High
C.2.a.Land Consolidation		
C.2.b. Good Agricultural Practice		
C.2.c. Organic farming		
C.2.d. Regulation of the fertilization system		
C.2.e. Decreased waste generation		
C.2.f. Having detailed information about the products that are planned to be plant		
C.2.g.Improved public transportation system		

C.3. If the measures are not taken, what are your estimations based on climate change?

(1) Low	(2) Medium	(3) High
C.3.a. Seasonal effects will be more severe.		
C.3.b. Seasonal effects will be more mild.		
C.3.c. Seasonal abrupt change will occur		
C.3.d. Agriculture production will not be done in many areas.		
C.3.e. Product pattern plans will be needed.		
C.3.f. Agricultural areas, which will be fertile lands in the		

(1) Low	(2) Medium	(3) High
future, may be opened to development in the present.		
C.3.g. Water crises among sectors will rise.		
C.3.h. New technological developments will enable to adaptations		
C.3.i. The negative impacts of climate change will reduce with planning and modern education.		
C.3.j. There will be no change		

APPENDIX D

B. Questionnaire Form for Experts

Questionnaire Number:

Experts' Spatial Information

Institution:

Village/ Neighborhood:

District:

A. DEMOGRAPHIC INFORMATION

Personal Information

A.1. Gender? (1) Female (2) Male

A.2. Age?

A.3. Birthplace?
.....

A.4. Education

Background?

(1) analphabetic

(2) Lettered

(4) High School

(3) Primary education

(5) Bachelor's degree (6) Master's and

Doctoral Degree

A.5. Job?

A.6. Profesional Issues?

General Information about Living Place

A.7. How many years have you lived in posted place?

A.8. How many years have you lived in this neighborhood/ village current position?.....

A.8.1. If you have not lives, where have you lives before?

(1) In another village/neighborhood in posted place,

(2) In a village/neighborhood outside in posted place,

(3) Abroad,

A.9. Do you want to continue living in your place of residence in this village/neighborhood? Why?

(1) Yes..... (2) No

A.9.1. If your answer is "no", where would you like to migrate? Why?

B. KNOWLEDGE ABOUT CLIMATE CHANGE AND ASSESSMENTS

Identifiability of Climate Change

B.1. Which options are associated with perception of climate change all the world?

(1) Climate change is global warming

(2) Climate change is depletion of the ozone layer

(3) Climate change is the increase in greenhouse effect

(4) Climate change is the increase in CO₂ emissions

(5) Climate change is global economic system

(6) Nothing

(7) Other.....

B.2. Which issues do you have knowledge about the general process of climate change?

(1) The existing reasons of climate change

(2) The future impacts of climate change

(3) Climate change adaptation process

(4) Action plans and intervention tools/methods

(5) Nothing

B.3. Which level of climate change do you experience in current place?

(1) less (2) medium (3) more

B.4. What are the observed effects of climate change in current place?

- (1) Climate change increases temperature
- (2) Climate change decreases temperature
- (3) Climate change increases precipitation
- (4) Climate change decreases precipitation
- (5) Climate change increases frost cases
- (6) Other

B.5. What is the level of human impact in climate change in current place?

- (1) low (2) medium (3) high

B.5.1. Why?.....

Individual Experiences on Climate Change

B.6. What is level of concern about climate change for future?

- (1) I am concerned highly, and I think it is late for everything.
- (2) I am concerned, but new methods can be developed.
- (3) I am concerned lowly because future generation can be improved solutions.
- (3) I am not concerned since future generation will not be affected.

B.7. In your current place, which risks based on climate change will occur in the future?

- | | | |
|---|--|--|
| <input type="checkbox"/> (1) Desertification | <input type="checkbox"/> (2) Famine | <input type="checkbox"/> (3) Water depletion |
| <input type="checkbox"/> (4) Biodiversity reduction | <input type="checkbox"/> (5) Air pollution | <input type="checkbox"/> (6) Land pollution |
| <input type="checkbox"/> (7) Water pollution | <input type="checkbox"/> (8) Food wars | <input type="checkbox"/> (9) Water wars |
| <input type="checkbox"/> (10) Increased acid rains | <input type="checkbox"/> (11) Decreased in food production | <input type="checkbox"/> (12) Migration |
| <input type="checkbox"/> (13) Epidemic Diseases | <input type="checkbox"/> (14) Pothole Formation | <input type="checkbox"/> (15) Sandstorm |
| <input type="checkbox"/> (16) Nothing | <input type="checkbox"/> (17) Other..... | |

B.8. Which methods based on climate change should be developed in the future?

- (1) I do not believe in climate change.
- (2) Population growth should be balanced.
- (3) New technological developments should be increased.
- (4) Renewable energy sources should be increased.
- (5) Other

B.9. What are your institutional efforts and experiences to reduce the impact of climate change in Konya?

- | | |
|---|---|
| <input type="checkbox"/> (1) The changed of the product pattern | <input type="checkbox"/> (2) The changed of the irrigation system |
| <input type="checkbox"/> (3) Usage of good agricultural practices | <input type="checkbox"/> (4) Usage of organic farming |
| <input type="checkbox"/> (5) Reforestation | <input type="checkbox"/> (6) Usage of renewable energy systems |
| <input type="checkbox"/> (7) Disposal of waste | <input type="checkbox"/> (8) Usage of recyclable products |
| <input type="checkbox"/> (9) Not use of chemical fertilizer | <input type="checkbox"/> (10) Usage of heat insulation systems |
| <input type="checkbox"/> (11) Consulting experts | <input type="checkbox"/> (12) Reduced of the usage of vehicles |
| <input type="checkbox"/> (13) Nothing | <input type="checkbox"/> (14) Other..... |

Social Experiences on Climate Change

B.10. Which international activities are you influencing about climate change? Which level are you affected by these studies?

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B.11. Which national activities are you influencing about climate change? Which level are you affected by these studies?

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B.12. What are the activities carried out on a local scale with regard to climate change?

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B.13. How do you evaluate the effects of climate change on agriculture?

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B.14. What are the social efforts and experiences that can reduce the impact of climate change on rural areas?

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B.15. Which methods should be applied in order to increase awareness?

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B.16. What is the level of resilience to climate change?

<input type="checkbox"/> (1) low	<input type="checkbox"/> (2) medium	<input type="checkbox"/> (3) high
B.17. What is the risk of economic livelihood of climate change?		
<input type="checkbox"/> (1) low	<input type="checkbox"/> (2) medium	<input type="checkbox"/> (3) high
B.8 What is the opportunity of economic livelihood of climate change?		
<input type="checkbox"/> (1) low	<input type="checkbox"/> (2) medium	<input type="checkbox"/> (3) high
B.19. In Konya, what is the impacts of climate change on food production and marketing?		
<input type="checkbox"/> (1) low	<input type="checkbox"/> (2) medium	<input type="checkbox"/> (3) high
B.20. Which institutions should take an active role in order to mitigate the negative effects?		
<input type="checkbox"/> (1) Public Institutions and Organizations	<input type="checkbox"/> (2) Local Government	<input type="checkbox"/> (3) Media
<input type="checkbox"/> (4) University	<input type="checkbox"/> (5) NGOs	<input type="checkbox"/> (6) Private Sector
<input type="checkbox"/> (7) Neighborhood representative	<input type="checkbox"/> (8) Other.....	

C. THE RELATIONSHIP BETWEEN PLANNING AND CLIMATE CHANGE

C.1. To what extent do you think the climate change measure, will ensure the following?

(7) Low	(8) Medium	(9) High
C.1.a. Reduced poverty		
C.1.b. Reduced rural urban migration		
C.1.c. Reduce food dependency		
C.1.d. Reduced environmental pollution(water, land, air)		
C.1.e. Reduced drought		
C.1.f. Reduced urban sprawl		
C.1.g. Increased employment		
C.1.h. Increased efficiency product		

C.2. Which methods will mitigate the adverse impacts of climate change?

(1)Low	(2)Medium	(3)High
C.2.a.Land Consolidation		
C.2.b. Good Agricultural Practice		
C.2.c. Organic farming		
C.2.d. Regulation of the fertilization system		
C.2.e. Decreased waste generation		
C.2.f. Having detailed information about the products		

(1)Low	(2)Medium	(3)High
that are planned to be plant		
C.2.g.Improved public transportation system		

C.3. If the measures are not taken, what are your estimations based on climate change?

(7) Low	(8) Medium	(9) High
C.3.a. Seasonal effects will be more severe.		
C.3.b. Seasonal effects will be more mild.		
C.3.c. Seasonal abrupt change will occur		
C.3.d. Agriculture production will not be done in many areas.		
C.3.e. Product pattern plans will be needed.		
C.3.f. Agricultural areas, which will be fertile lands in the future, may be opened to development in the present.		
C.3.g. Water crises among sectors will rise.		
C.3.h. New technological developments will enable to adaptations		
C.3.i. The negative impacts of climate change will reduce with planning and modern education.		
C.3.j. There will be no change.		

THANK YOU FOR YOUR CONTRIBUTION

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