Research

A RESEARCH REPORT

Climate-smart agriculture technology and food security: Role of agricultural policy in Bangladesh

AUTHORS
AVIJIT BISWAS
Assistant Professor
Department of Agriculture
Bangabandhu Sheikh Mujibur Rahman Science and Technology University
Gopalganj-8100, Bangladesh

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Leading University, Sylhet

Content

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The Author

Ethical Consideration

Ethical concerns are a set of guidelines that explain how to strategically plan out our research. Ethics in research are essential for the integrity of science, the rights and dignity of the individual, and the ability of science and society to collaborate together. We want to ensure that individuals who take part in this research are doing so voluntarily, with complete understanding, and in a secure environment. Before participants agreed to or rejected the study, they were informed about its goal, benefits, risks, and funding. There is no plagiarism or other illegal acts in this research paper and the results are presented in a scientific manner.

I promise that the research report I'm submitting to the British Council is my own effort and hasn't been submitted to any other organization for any reason before.

Keywords:
Challenges, COVID-19, Design perspectives, Socio-economic, Urban environment.

List of tables

List of figures

Abstract

Bangladesh is very vulnerable to climate change, so it needs to use a lot of Climate-Smart Agricultural Technologies (CSATs) to make sure that everyone has access to food. Different economic factors, personality traits, and ways of communicating can make it hard for CSATs to be adopted on farms. With the aim of exploring the determinants of farmers' perceived adoption of CSATs, this research adopted a cross-sectional, face-to-face, structured interview-based survey and collected data from 203 randomly selected farmers residing in a selected coastal upazila of Khulna district. Descriptive statistics, difference testing statistics, and regressions were used to analyze the data. Through the study, we try to find out farmers' extent of understanding of agricultural policy to adopt CSATs at the farm level. The regression analysis showed that the impact of agriculture policy is a function of age (β=0.306), service experience (β=-0.291), use of information sources (β=0.288), the impact of climate change on agriculture (β=-0.292), adoption of CSATs (β =0.281), barriers to using CSATs (β= -0.405) and age (β =0.306) which has the strongest contribution to the impact of agriculture policy. Findings revealed that farmers believed the purpose of the agricultural policy was to only enhance the income and production of farmers. This study also found the food security status of the study area through the "Food Insecurity Experience Scale," and the result showed that most of the respondents (53%) were from this area and were mildly food insecure), and consequently, 21.33%, 1% of the respondents were moderately and severely food insecure. The farmers also faced some barriers to adopting CSATs on the personal, organizational, economic, technological, and social scales, and the result showed that the economic barrier was the main factor hindering their adoption rate of CSATs. The agriculture policy needs to be updated so that farmers can learn how to become more resilient to climate change. Policymakers should indeed collaborate with producers to reduce the impact agriculture has on climate change. The study's findings could help policymakers and extefaced some barriers to adopting CSATs on the personal, organizational, economic, technological, and social scales, and the result showed that the economic barrier was the main factor hindering their adoption rate of CSATs. The agriculture policy needs to be updated so that farmers can learn how to become more resilient to climate change. Policymakers should indeed collaborate with producers to reduce the impact agriculture has on climate change. The study's findings could help policymakers and extension service providers understand the drivers and types of CSAT adoption, allowing them to develop effective agricultural policies to increase CSAT adoption in Bangladesh.

Keywords: Adoption, Agricultural Policy, Climate Smart Agricultural Technologies, Determinants, Farmer, Food Security etc.

1.1 Introduction:

Climate change is defined as a significant and lasting change in the statistical patterns of precipitation, temperature, wind, humidity, and seasons over periods ranging from decades to millions of years (James B. et al., 2015). The average global temperature is increasing continuously and is predicted to rise by 20C by 2100, which would cause substantial economic losses at the global level. But poorer countries are more often hurt by the bad effects of climate change because their infrastructure isn't as good and they can't adapt as well (Pachauri, R. K., et al., 2014).

The sustainability of rural livelihoods and the battle against poverty are both made more difficult by climate change (Morgon C. et al., 2015). It has been named one of the major issues facing small-scale farmers worldwide (IFAD, 2011). Due to its enormous scale and susceptibility to weather variables, agriculture is one of the most vulnerable to climate change and has significant economic repercussions (Thornton et al., 2019) . Significant crop yield losses due to climate change are projected to have a negative impact on smallholder livelihoods (Lobell, D.B., et al., 2011). As a result, the agricultural households most dependent on agriculture may face threats to their food security and prospects for earning an income (Morgon C. et al., 2015). The world's food and nutritional security are currently under threat on a worldwide scale (Malhi, G.S. et al., 2021). Food security and climate change are two of the most urgent issues facing the world community today (Gitz, 2016) Issahaku G. and Abdulai A. (2019) say that over the past four decades, climate change has made farming in many developing countries riskier. This is because the weather has become more unpredictable.

A crucial component of an effective response to the dangers posed by climate change to sustainable agricultural output and food security is the use of climate-smart agriculture (CSA) practices (Tiamiyu S. A. et al., 2018).). A method to implement new agricultural techniques for boosting output, adaptability, and mitigation in the face of climate change was originally described in 2009. (Lipper et al., 2014). According to the FAO, CSA refers to any strategy that addresses the three pillars of food security: (sustainable productivity growth; adaptation (improving climate change resilience), and mitigation (removal of greenhouse gas emissions). The agriculture industry is crucial to global economic growth and the eradication of poverty (Cervantes-Godoy & Dewbre, 2010). Out of the 6 billion people living around the globe today, nearly 1 billion suffer from chronic hunger (Bruinsma, J., 2009). According to a 2009 study by Lobell et al., climate change could have a considerable influence on agricultural production and food security up to 2030, especially in Sub-Saharan Africa and South Asia, because of changes in mean temperatures and rainfall as increasing variability linked to both. If community-supported agriculture (CSA) proves to be a promising method of securing food for the expanding global population under the effects of climate change, the spread of CSA will depend on a shift in mentality that allows for novel techniques and technologies that boost agricultural productivity while also promoting climate change resilience and greenhouse gas emission reduction (Karlsson, L. et al., 2018). A strategy for agricultural growth called "climate-smart agriculture" (CSA) seeks to solve the interrelated problems of food security and climate change (Lipper, L. et al., 2014). Due to lowered climate-related risks, households in northwest Ethiopia that adopted and maintained CSA technologies between 2015 and 2017 increased farm-level production by 22% above non-adopters (Asrat, P., and Simane, B. 2017). So, using CSA technology on a large scale could make it much easier to get food while reducing the effects of climate change (Kurgat B.K. et al., 2020).

At all decision-making levels, including local, regional, national, and international levels, adaptation measures are required. According to (Stringer et al., 2020), to promote the adoption of adaptation techniques, farmers' coping mechanisms must be supported by appropriate public policy, investment, and collective action. A technique for reforming and reorienting agricultural systems to ensure food security in light of the new realities of climate change is known as climate-smart agriculture (CSA) (Lipper L. et al. 2014). Climate-smart agriculture (CSA) promotes the sustainable development of agricultural systems through methods and procedures that enhance food security, boost resilience, and, when possible and suitable, lead to the production of low emissions (FAO, 2010). Policy is an important part of the larger context in which adaptive decisions are made (Climato F., Mullan M. 2010). The process of agricultural economic growth is significantly influenced by agricultural policies. In particular, agricultural productivity enhancement raises farmers' actual earnings and ensures a reliable supply of food at affordable prices, and technological progress has been regarded as the main source of productivity growth (OECD 2012; Morris et al. 2007). Existing policies and new policies make up the two main components of the policy context (Urwin K., Jordan A. 2008).

Some policies and projects that are already in place make it easier for people to adapt at lower levels, even if they do not explicitly address climate change (Urwin K., Jordan A. 2008). On the other hand, new policies, both climatic and non-climatic, need to be designed in ways that facilitate adaptive decisions. Building enabling legislative and regulatory frameworks through improved coordination of agricultural, environmental, and food system policies is an active area for CSA (Lipper L. et al. 2014). The Bangladeshi government, NGOs, and scholars are working to spread and promote CSA practices in an effort to lessen the negative effects of climate change (Ahmad and Rahman 2011; FAO 2014). The Bangladesh Climate Change Strategy Action Plan focuses extensively on food security and comprehensive disaster management. (Mallik et al. 2012). For a policy environment to be helpful, all policy areas must be in sync, and communication between the relevant ministries is key to dealing with trade-offs, gaps, and overlaps.

1.2 Justification of the study

According to the Global Climate Risk Index 2021, Bangladesh is the sixth most vulnerable country to climate change and the one most affected by extreme weather (Eckstein et al., 2018). It is anticipated that climate change will have severe effects on various sectors of Bangladesh's economy, particularly agriculture. Agriculture is the primary source of income for over sixty per cent of the country's population; this sector has been identified as the key to reducing hunger and all forms of malnutrition as well as alleviating poverty. FAO (2014) estimates that the worldwide population will increase by one-third by 2050, while climate change is estimated to have decreased global maize and wheat yields by 3.8% and 5.5%, respectively. This scenario puts pressure on farmers to cultivate sufficient and sustainable food production; it puts pressure on researchers to innovate improved technologies and develop stress tolerance in high-yielding varieties of crops and animal breeds, and it puts pressure on policymakers to create an environment that is conducive to the development of sustainable agriculture. Many coastal parts of Bangladesh have suffered a rise in soil salinity and tidal cyclones, which may have an effect on coastal agriculture (Dasgupta et al., 2014). As the coastal zone of Bangladesh comprises 32%of the country's land area and is home to 29% of the population (Ahmad, 2019), decreased food production in coastal areas would also have significant effects on food security throughout the rest of Bangladesh. This study wants to find out if the CSA approach is used to change and reorient agricultural systems to support food security in the face of the new realities of climate change. It also wants to find out what role policymakers should play in bringing CSAT into the agriculture sector so that agriculture production is sustainable.

1.3 Justification of the study

The present study is designed with the following objectives:

- To determine and describe the adoption status of climate-smart agriculture technologies (CSATs) in Bangladesh.
- To explore the role of agricultural policy in facilitating to adoption CSATs for ensuring food security.

1.4 Limitations of the study

The present study was undertaken with a view to determining the role of agricultural policy in facilitating the adoption of CSATs for ensuring food security. Considering the time, money, labor, and other necessary resources available to the researcher, the following limitations have been observed throughout the study:

- Due to the limitations of resource availability and time constraints, the study was confined to only an upazila in the Khulna district of Bangladesh. So, the findings of the research have some limitations for replication in other regions of Bangladesh.
- The demographic characteristics of the respondent are many and varied; however, only nine characteristics were selected for this study.
- Finally, for the collection of information, the researcher had to depend on the data furnished by the respondents during their interviews with him or her. The majority of farmers do not keep detailed records of their activities; they provided information to the various questions by a recall.

2 Literature review

Climate-Smart Agriculture (CSA) is a framework for establishing farm and policy-level decision support systems. It seeks to identify technologies, management tools, and policies that will enable farmers to adapt to climate change challenges while maintaining and enhancing societal well-being (FAO 2018, L. Lipper et al.). CSA is an approach that includes actions at scales beyond the farm, such as within communities, wider landscapes, and national policy frameworks (FAO 2013; Lipper et al. 2013; CCAFS 2019). Agriculture can adapt to climate change in a variety of ways (Climate Change Impacts and Adaptation Options in the Agrifood System A Summary of the Recent Intergovernmental Panel on Climate Change Sixth Assesment Report, 2022), and the implementation of any of these adaptation strategies is contingent on a variety of conditions .Age, education, family size, farm size, family income, and participation in cooperatives were substantially connected to adaptation by adopting CSATs, according to Uddin M. N. et al. (2014). Issahaku G. and Abdulai A. (2019) found that household heads are more likely to do these things if they are educated, have access to extension services, and know about the weather. According to Fosu-Mensah et al. (2012), the degree of education of farmers, farm size, land tenure, improved access to markets, extension and credit services, technology, farm assets (labor, land, and capital), and knowledge about climate change all influence adaptation to climate change. According to Saha M. et al. (2019), a farmer's level of education, occupation, family size, cultivated farm size, farming experience, cattle ownership, annual income, market difficulty, access to farm information, training experience, organization affiliation, and perception of climate change all influence their choice of adaptation strategies. A study discovered that farm holding size, expertise, access to information sources, and annual household income were positively correlated with the adoption of crop diversity as a climate-smart agricultural approach in Bangladesh (Nasim F. A. et al., 2019). The adoption of CSA techniques could increase food security by boosting food output, income, and annual food expenditure per capita. Hasan et al. (2014) found that farmers who joined CSAs more often were more likely to be food secure because they spent more on food per person each year, which meant they ate more food.

In addition to highly educated farmers, having large ponds, owning cattle, having fewer children, and experiencing less market trouble were all factors that were more likely to encourage the establishment of CSAs to increase food security (Hasan K. M. et al., 2018). Only 46% of smallholder farmers reported using climate-smart irrigation technology, and it has been proposed that adoption is favorably influenced by parameters like gender, age, district, farm size, production of staple foods, and CSIT awareness. Improving extension services, training, adopting robust crop varieties, promoting underutilized and nutrient-dense crops adapted to challenging local conditions, and other interventions are urgently needed by relevant stakeholders to reform the smallholder farmer subsector (Srote et al., 2021). According to Luu Tien Dung 2020, farmers' adoption of CSA is favorably influenced by formal education, field size, credit availability, and access to extension services. So, the successful adoption and spread of CSA technical advances is a very important topic that needs to be looked at the policy, research, and practice levels. Policies in agriculture that focus on adapting to and reducing the effects of climate change need to be improved, and it is very important that climate-smart agriculture is put into place well. The CSA method is the best way for Bangladesh to fight the effects of climate change on agriculture in a sustainable way. It is essential to have effective implementation methods and a defined road map in order to promote CSA. As a part of the science-policy interface, it is important to provide capacity building, technology transfer demonstrations, and strengthened knowledge dissemination in order to hasten the adoption of the CSAT among smallholder farmers (Srote et al., 2021). Brüssow et al. (2017) discovered that people who participated in CSAs were more likely to have food security than those who did not. CSA is an integrated, evidence-based, and transformative approach to addressing food and climate security at all levels. This approach requires coordinated actions from the global to the local levels, from research to policies and investments, and across the private, public, and civil society sectors in order to achieve the indicator and rate of change that are required (Lipper L., 2014).

2 Methodology

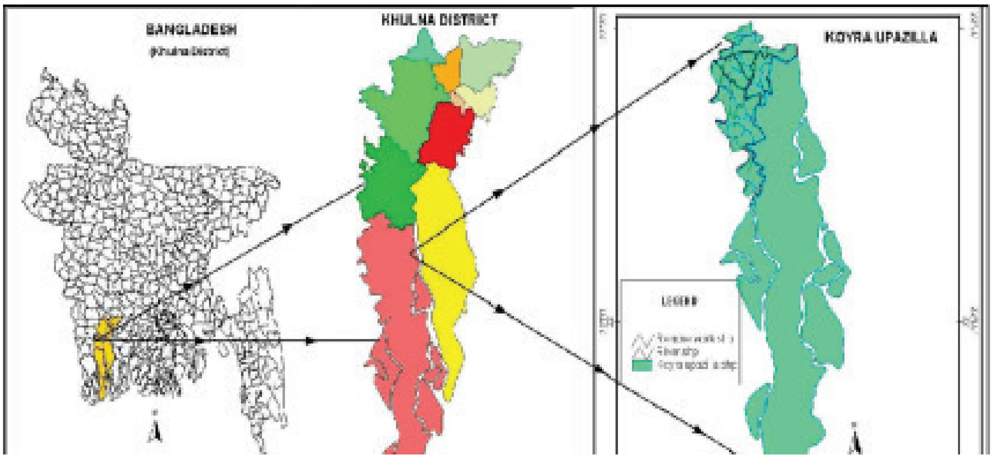
Research methodology is the description, explanation and justification of various methods of conducting research. It is considered the foundation of the research process. Broadly speaking, a methodology is the underlying principles and rules of the organization of a philosophical system or inquiry procedure (Urdong, 1968). Thus, a methodology is the systematic and logical study of the principles guiding scientific investigations (Gould and William, 1964). The selection and adoption of appropriate research methodology are related to the nature of the problem to be solved and the study objectives (Mahmood, 2019). The methods and procedures used in this present study have been discussed sequentially.

3.1 Locale of the study

The study was conducted in the Khulna district which consists of nine upazilas. Of nine upazilas, two upazilas (Dacope and Koyra upazillas) were purposively selected as the locale of the study. The reasons behind the selection of this district were as follows:

- The upazilas are situated in the coastal region of Bangladesh.
- There are significant changes in the environment including weather and climate.
- These upazilas have a high level of extension activities to adopt climate change impact.

Fig 1. Location map of the study area



3.2 Research design

For the purpose of this study, a convergent parallel mixed method was used which comprises both quantitative and qualitative components. In a convergent parallel design, the researchers performed the quantitative and qualitative elements of the research at the same period, giving each approach equal weight, distinguishing the two parts for evaluation, and integrating the findings (Creswell & Pablo-Clark, 2011). Hence, this study will examine the current practice of Climate Smart Agriculture Technology through survey questionnaires, interviews and observations (small scale). The quantitative approach includes coastal farmers' survey questionnaires whereas the qualitative approach is comprised of observations, document analysis and interviews with early adopters and agricultural extension workers. It is important to note that all these personnel play a pivotal role in technology adoption and policy implementation in Bangladesh.

3.3 Population and sampling

The study will be conducted in selected Koyra upazila under the Khulna district, which is one of the most vulnerable coastal regions of Bangladesh. The study comprised the population from Koyra upazila. A stratified sampling method was used to select farmers from selected upazila. For the purpose of the survey, coastal farmers were selected because they are primary victims of different kinds of adverse climatic conditions. This study considered early adopters, Sub Assistant Agriculture Officer (SAAO) and Agricultural Extension Officer (AEO) as the participants for interviewing purposes in order to get purposeful qualitative data. To determine the sample size, a list of 450 coastal farmers was prepared obtaining information from the concerned Upazilla Parishad. An internet-based sample size calculator was used to determine samples from the population. At a 90% level of confidence and a 5% margin of error the required sample size was 208, hence this research selected 208 smallholder farmers proportionately from the selected villages. It is important to note that due to the inconsistency in the information given 5 respondents were dropped from the final analysis.

3.4 Data Collection and Analysis

To collect the data, different data collection instruments were used. Primary and secondary data were collected. Primary data focused on a structured interview schedule to gather quantitative information from the farmers. The interview schedule was broadly divided into several sections such as descriptive characteristics of the farmers, factors influencing CSATs adoption and CSATs adopted by respondents. The interview schedule was developed through a discussion with the smallholder farmers in the study area. The interview schedule was developed in Bengali to encourage better participation and confidence of the respondents in providing accurate and unbiased information. Following the data collection process, data were transferred into a spreadsheet for the purpose of coding to put them in the appropriate format for analysis using the Statistical Package for Social Sciences (SPSS). For the pre-test 20 randomly selected similar kinds of farmers were considered. However, the measurement of the dependent and independent variables of this research is indicated in Table 1.

Table 1: Measurement procedure of dependent and independent variables

Independent Variables	Measurement
Age of the respondents	Score 1 for each completed year
Education of the respondents	Can't read and write=0; Primary=1; Secondary=2; Higher Secondary=3; Graduate=4; Postgraduate=5
Service Experience	Score 1 for each year of experience
Gender of the respondents	Male= 0, Female=1
Marital status of the respondents	1= Married; 0= Unmarried
Farm size of the respondents	Score 1 for each decimal
Training Experience in ICT	Score 1 for each day of experience
Job satisfaction	Highly satisfied=4; satisfied=3; moderately satisfied=2; least satisfied=1; dissatisfied=0
Use of Information Sources	3-4 time/week=3; 2-3 time/15 days=2; Once/ month=1; Don't use=0
Impact of Climate Change on Agriculture	Strongly Agree= +2; Agree= +1; Undecided= 0; Disagree= -1; Strongly Disagree= -2
Barriers to use CSATs	Strongly Agree= +2; Agree= +1; Undecided= 0; Disagree= -1; Strongly Disagree= -2
Adoption of CSATs	
To Increase Agricultural Productivity and Income	Always = every season or year = 4
To Boost Resiliency Against Climate Change	Frequently = 1 times/two seasons or years = 3
To Decline Agricultural Contribution to Climate Change	Occasionally = 1 times/ three seasons or year = 2
Role of Agricultural Policy (Source: National Agriculture Policy 2018)	Rarely = 1 times/ Six seasons or years = 1
To Increase Agricultural Production and Income To Help Agricultural Communities to Adapt Climate Change To Decline Agricultural Contribution to Climate Change	Do not Use = Never use = 0 Highly Effective = 3 Moderately Effective = 2 Low Effective = 1 Not Effective = 0

3.5 Measurement of Food Insecurity Experience Scale

The FIES was developed by the Food and Agriculture Organization (FAO) through the Voices of the Hungry (VoH) project, building on the pioneering work of the Household Food Insecurity Access Scale (HFIAS) and the Latin American and Caribbean Food Security Scale (ELCSA). Experience-based food insecurity scales can measure by following eight questions in table 2.

Table 2: Measurement procedure of Food Insecurity Experience Scale

During the past 12 months, was there any time when:

SI No.		Question	Measurement	
			Yes=1	No=0
1	Mild	You were worried you would not have enough food to eat because of a lack of money or other resources?		
2		You were unable to eat healthy and nutritious food because of a lack of money or other resources?		
3		You ate only a few kinds of foods because of a lack of money or other resources?		
4	Moderate	You had to skip a meal because there was not enough money or other resources to get food?		
5		You ate less than you thought you should because of a lack of money or other resources?		
6		Your household ran out of food because of a lack of money or other resources?		
7	Severe	You were hungry but did not eat because there was not enough money or other resources for food?		
8		You went without eating for a whole day because of a lack of money or other resources?		

Sources: Ballard et al. 2013; Hendriks 2015

3.6 Statistical analysis

For describing the general characteristics of the respondents this study used descriptive statistics such as mean, median, mode, standard deviation, frequency, etc. To reveal the role of agricultural policy in CSATs adoption, this study deployed linear regression analysis. The linear regression model was deployed to explore the effect of the independent variables on the dependent variable. In this research, three linear regression models were used to find the determinant of CSATs adoption based on agricultural policies to increase agricultural production and Income, to help agricultural communities to adapt climate change and to decline agricultural contribution to climate change.

4 Results and Discussions

4.1 Socio-demographic characteristics

Information furnished in table 1 showed that the majority of respondents were 40, ranging from 75 -18 years, where the average was 46.44years. This indicates that youth are less engaged in farming activities (Brown et al, 2018) proved that because of this reason they showed more interest in off-farm activities. Most of the respondents were marginal or poor farmers (83.7%) and only about 0.49% of farmers have a high income. Less income of the farmers is a sign of higher vulnerability to climate change and less ability to adapt (Jamshidi et al, 2019).

Table 3: Measurement of Socio-demographic characteristics of the respondents

Variable	x	s	Mode	Median	OR	PR
1. Age						
2. Annual Income						
3. Education						
4. Service Experience						
5. Training Experience in Climate Change Adaptation						
6. Job Satisfaction						
7. Use of Information Source						
8. Impact of Climate						

Information furnished in table 1 showed that the majority of respondents were 40, ranging from 75 -18 years, where the average was 46.44years. This indicates that youth are less engaged in farming activities (Brown et al, 2018) proved that because of this reason they showed more interest in off-farm activities. Most of the respondents were marginal or poor farmers (83.7%) and only about 0.49% of farmers have a high income. Less income of the farmers is a sign of higher vulnerability to climate change and less ability to adapt (Jamshidi et al, 2019).

On the other hand, people with a poor income had small farms and they desire to work with new agricultural technology because of the fewer risk factor. Here, most of the farmers were educated to the secondary level (42.6%). Whereas very few farmers completed the graduate level (6.80%). Also, a good percentage of farmers were illiterate16.26% and at the primary and higher secondary level, the percentage is 14.29% and 7.88% respectively. Moreover, the education level of the farmers may not be helpful when searching for a solution to changing climate, response-ability, and adaptation strategies. Also, they may not have sufficient knowledge about modern cultivation techniques. With increasing education qualifications, farmers' future is more dispersed to the government, and they showed more interest in the off-farm activity. Graduates rarely choose farming operations (Mochizuki and Bryan, 2015). Service experience of the respondents, scores ranges from 2-60 with an average of (23.67). So, in the study area farmer had diversification in service experience but the biggest percentage of farmers didn't get any training (66%). With this poor training experience, it is quite hard to understand the changing climatic situation and adapt to it. The average job satisfaction of the respondent was recorded at 7.66, in the range of high (9.36%), medium (49.75%), and low (41.38%).On the other side, the highest proportion (75.37%) of the respondents used information sources to a very little extent compared to 20.1% in medium and only 4.43% in high use of information source categories with a mean of 5.81. The last and most concerning topic is the impact of climate change on agriculture. The impact of climate change on agriculture respondents ranged from 5 to 20, with an average being 13.83. Maximum (55.7%) respondents of the study area felt the medium level impact of climate change on agriculture compared to 20.7 per cent in low and 23.6 per cent in the high impact of climate change on agriculture. The cumulative percentage of medium and high impact of climate change in agriculture categories constituted the huge majority of respondents (79.3%).

4.2 Relationship between the Role of Agriculture policy and some pre-determined variables

An analysis was carried out to find out the relation between some pre-determined variables and the role of agricultural policy engaged in a changing climate (Tables 2 & 3). Some variables like the use of information sources, the Impact of climate change on agriculture, the Adoptions of CSATS, and barriers to CSATS, bear a high significance statistically($p=0.000$) with the role of agricultural policy. Significant negative correlations were observed for households with a higher impact of climate change and barriers to adopting CSATS. Households that were less vulnerable to climate change and face fewer barriers to using CSATs get better implementation and benefit from the agricultural policy.

Results furnished in Table 2 showed that the R2 value is 0.466 and the corresponding F value is 15.147 which were significant at 0.001 levels. The R2 value showed that the five factors used in the regression analysis explained 46.6% of the total variance in the impact of agriculture policy. The findings indicated that age (β=0.306), service experience (β=-0.291), usage of Information Sources (β =0.288), the impact of climate change on agriculture (β= -0.292), adoption of CSATs (β=0.281) and barriers to use CSATs (β= -0.405) all play a role in the influence of agriculture policy. The age factor (β=0.306) was the most important contributor to the influence of the agriculture policy. It is consequently explained that the influence of agriculture policy to adopt CSAT by the respondents will be 1.546 if age increases by one unit.

That means when the present farmers are getting older than they will become more enthusiastic to apply CSAT on their land, considering the value of such methods in the aspect of agricultural policy. The results also indicated that service experience had a negative contribution. Old, aged farmers are more experienced in the climatic plus cultivation process, but they showed unwillingness to adopt new technology in their farmland. The more experienced farmers choose the traditional agricultural methods over the new ones because they were not found enough motivation to adopt new technologies as they are feared that they might have to bear a great loss which they cannot afford and become comfortable with the regular activity. Old, aged farmers were believed to transfer their farming responsibility towards their younger ones.

On the other hand, the use of information sources had a positive relationship with the impact of agriculture policy. That means, if the use of information sources increases by 1 unit, the impact of agriculture policy will be 1.288. In this digital era information source is like media through which anyone can keep aware own-self about any kind of matter, so if farmers are used more and more information media then it will be bigger support for them to know about inner and outer cities' weather conditions and in what way they manage their adverse situation, like- in southern coastal farmers of Bangladesh used many CSA strategies like floating vegetable gardens, traditional gher -farming, fresh water harvesting etc. as a technique for managing climate risk against the increasing frequency of natural disasters. The surjon technique was also employed by farmers in the low-lying, swampy area. Utilizing possible information sources like local institutes, local extension programs, the DAE website, and Government and expert help may assist farmers in adopting new technology to expand productivity. Besides, the climate change effect on agriculture (β= -0.292) had a negative contribution to the impact of agriculture policy. The effect of climate change on agriculture will decrease by 1 unit if the impact of agriculture policy increases by 1.292.

Table 4: Relationship between the role of agriculture policy and some pre-determined variables

	B	SE	β	t	P	VIF
Constant	34.360	3.745		9.174	.000	
Age	.171	.053	.306	3.219	.002	3.241
Income	.013	.009	.118	1.558	.121	2.035
Service experience	-.146	.047	-.291	-3.118	.002	3.112
Education	-.289	.105	-.166	-2.742	.007	1.311
Training exposure	.086	.041	.121	2.111	.036	1.173
Farm Size	-4.075	1.459	-.201	-2.794	.006	1.849
Job satisfaction	-.115	.130	-.053	-.885	.377	1.284
Use of Information Sources	.728	.152	.288	4.792	.000	1.292
Impact of Climate Change on Agriculture	-.718	.140	-.292	-5.129	.000	1.157
Adoption of CSATs	.162	.033	.281	4.931	.000	1.462
Barriers to Use CSATs	-.435	.069	-.405	-6.329	.000	.000
R^2 =.466			Adj. R^2 =.435		F=15.147	P<0.000

Day-by-day research on climate-changing patterns is done by different groups and simultaneously they also give solutions to get rid of those situations. So that such recommendations are added to our policy, it becomes more effective to control the negative effect of climate change on agriculture. Furthermore, the adoption of CSATs (β=0.281) positively contributes to the impact of agriculture policy. Because if the agricultural policy is updated continuously according to changing situations, then the importance of CSATs will be emphasized in policy and the farmer feel safe to adopt such technology as the Govt. recommended. Barriers to using CSATs (β= -0.405) negatively contribute to the impact of agriculture policy. When farmers faced obstacles to applying CSATs in their farming land, then they lost faith in Govt. recommended agriculture policy and showed less interest in adopting such technology.

4.3 Adoption of CSATs

The adoption of Climate Smart Agricultural Technologies is a systematic approach to managing crops, farmland, and other agricultural activities to maintain food security in the context of climate change. Here we can adopt Climate Smart Agricultural Technologies described in three ways, firstly agricultural productivity and income, secondly boosting up resiliency against climate change, and finally declining agricultural contribution to climate change. The furnished data are described in table 4:

Table 5: Adoption of climate-smart agriculture technologies.

Sl No	Name of CSAT	AL	FR	OC	RR	DU	WM	
To Increase Agricultural Productivity and Income								
1	HYVs of oil seed	2	20	11	37	133	0.63	
2	HYVs of chili	108	11	3	3	78	2.33	
3	HYVs of vegetables	166	5	4	2	26	3.3	
4	HYVs of pulse crops	6	17	15	8	157	0.56	1.52
5	HYVs of Maize	10	12	6	20	155	0.53	
6	HYVs of fruits	61	33	8	16	85	1.85	
7	Livestock fattening	46	19	21	5	112	1.42	
To Boost up Resiliency Against Climate Change								
1	Submergence-resistant HYVs of Aman rice	6	8	0	0	189	0.24	
2	Short-duration HYVs of Aman rice	143	9	1	23	27	3.07	
3	Salinity-resistant HYVs of Boro rice	23	0	11	15	154	0.66	
4	Growing creeping vegetables on nets over ponds	72	27	12	17	75	2.02	
5	Salinity-resistant varieties of Jute	2	0	3	7	191	0.1	
6	Salinity-resistant varieties of oil seeds	2	5	13	21	162	0.34	

SI No	Name of CSAT	AL	FR	OC	RR	DU	WM	
7	Salinity-resistant varieties of chili	68	25	2	10	98	1.78	1.20
8	Conservation agriculture in pulse	32	8	16	10	137	0.96	
9	Intercropping	68	33	20	13	69	2.09	
10	Fodder crop production	24	19	2	11	147	0.83	
11	Rice cum fish culture	33	13	26	2	129	1.11	
12	Year-round fish culture	76	27	0	12	88	1.96	
13	Indigenous fish culture	130	5	0	3	65	2.65	
To Decline Agricultural Contribution to Climate Change								
1	Use of solar-powered irrigation pump in Boro rice cultivation	16	0	0	0	187	2.64	
2	Proper use of fertilizer e.g. amount, dose, application, etc. in Boro rice	45	103	17	22	16	0.22	
3	Direct sowing of Aus rice	0	11	11	15	154	0.66	
4	Ribbon ratting method of Jute	0	0	12	17	75	2.02	
5	Zero tillage sowing of oil seeds	0	0	3	7	191	0.1	0.1
6	Surjon cultivation method of vegetables	100	13	13	21	162	0.34	
7	Floating bed cultivation of vegetables	3	4	1	23	27	3.07	
8	Use of mulch in vegetables	67	62	11	15	154	0.66	
9	Use of crop residues as organic manure in pulse	52	14	12	17	75	2.02	
10	Compost/Biogas	97	39	13	16	38	2.64	

The result showed that in the "Increase Agricultural Productivity and Income" category, the highest number of respondents use HYVs for vegetables, 166 respondents always use them, and the least number of respondents use HYVs for oil seed, where only 2 respondents were using them. During the FGD, the majority of farmers stated that many vegetable varieties had since been created, ensuring better productivity and a favorable return on their investment. In our country, HYVs oil seed is unavailable, and its price is extremely high; nevertheless, HYVs vegetable seed is accessible, and farmers can purchase it at a reasonable price. The second most used seed is HYVs of chilli, 166 respondents are using this. The total mean of “Increase Agricultural Productivity and Income” is 1.52. The majority of farmers in the research area adopt CSATs to increase their yields and secure their financial well-being. The majority of farmers are vulnerable, so they don't know how to deal with uncertainty.

In the category of “Boost up Resiliency against Climate Change”, 143 respondents are always using short-duration HYVs of Aman rice. The farmers become vulnerable during the rainy season because this region is among the most prone to natural disasters. There is a risk of yield loss due to the frequency of flash flooding in this area. This is why local farmers choose to cultivate short-season rice varieties during the aman season.

The second most popular technology was the indigenous fish culture which was used by 130 respondents regularly. This occurrence might be due to the popularity, higher demand and benefit to the farmers. And the least popular technologies are salinity-resistant varieties of jute and oil seed. Only 2 respondents are always using this technology regularly. But salinity-resistant varieties of chilli and pulse are more popular than salinity-resistant jute and oil seeds. The total mean of “Boost up resiliency Against Climate Change” is 1.20.

In the "Decline Agricultural Contribution to Climate change" category, the surjon cultivation method of vegetables is very popular among the respondents, 100 respondents are using this technology always. Most farmers employ this method in an effort to lessen their exposure to salt. The direct showing of aus rice, ribbon ratting method of jute, and zero tillage sowing of oil seeds are the less prevalent technologies. No respondents want to use these technologies most of the time. A large proportion of respondents (187 respondents) did not employ solar power irrigation pumps in boro rice farming. This is due to a lack of adequate knowledge of modern cultivation practices. They are unfamiliar with solar power irrigation technology. However, it has a high setup cost. In terms of compost/biogas use, 97 respondents use it always, 39 respondents use it frequently, and 38 respondents do not use it. This higher adoption rate might be due to the availability and low-cost techniques, as well as farmer respondents, are properly trained by the Department of Agricultural Extension (DAE). The average adoption rate of CSATs to "Decrease Agricultural Contribution to Climate Change" is 1.19.

4.4 Role of Agricultural Policy

Agriculture is the driving force of the economy of Bangladesh and where rural farmers play a dominant economic role. Because of their high dependency on agriculture for livelihoods, they are frequently exposed to extreme climatic events. It results in significant crop and income losses and exacerbates food insecurity. Climate-smart agriculture is a sustainable option to work on it. Which, Government of Bangladesh is developing many plans and strategies for adaptation to climate change under National Action Policy to ensure food security and improve the socioeconomic conditions of people by increasing productivity, better-adopting capacity, and reducing climate vulnerability. As a result, national rules for calculating the impact on the CSAT system must be revised and rejudged, as it is time sensitive and crucial for a larger population in a changing climate. (Rahman 2020; Harvey et al 2018; Mustafi & Islam 2008). In table 5 three comparative structures are focused on.

The results of the survey indicate that the policy appears to be highly effective in boosting agricultural productivity as well as profitability. Farmers noted that agricultural policy had a significant impact on the empowerment of women, the encouragement of youth to work in agriculture, and the research and development of agricultural crops.

Nearly 70% said it has a significant impact on women's empowerment. Different extension programs are currently being introduced in Bangladesh by the Department of Agriculture Extension to include women in agriculture. While 63.5% mentioned that it supports youth involvement in agricultural pursuits. The percentage is 59.1% for agricultural development research. In recent years, farmers have introduced different saline-tolerant varieties of crops. Now they are highly satisfied with getting more production against salinity. The price support policy in the study is not up to the mark because most of the farmers highlighted that there is a syndicate to manage the price support policy. A farmer cannot do anything against this syndicate. They asked the government to do something about this group because if nothing was done, they wouldn't get the right price for their crops. Farmers recommend revising credit policies and introducing mechanized agriculture as additional impacting elements. Farmers have stated that the supply of agricultural inputs and labor resources is sufficient to meet demand.

According to farmers, the policies work well in encouraging the agricultural community to adapt to climate change using CSATs technology. Specifically, by focusing on the coastal zones and generating stress-tolerant cultivars based on these places. 64.5% and 70.9% of farmers mentioned being highly impacted by these terms. However, just 32% of respondents identified agricultural subsidies, 16.7% infrastructure development, and 3% technology transfer initiatives as having a significant influence. However, agriculture policy did not have a significant impact on credit facilities, which have a 1.5% high impact response.

Agriculture policy is significantly impacted (58.1%) in order to enhance farmer knowledge and skill development on CSATs, which will reduce agriculture's contribution to climate change. Agriculture policies that focus on environmental and resource management, specialist agriculture, and cooperative agriculture programs that promote cooperation can all fulfills their objectives on average. One of the policy's weaknesses is that 75.4% of farmers are not affected in any way by e-agriculture, which is a significant number. The agricultural policy did not succeed in generating chances for e-agriculture, which plays an important role across the majority of the country.

Table 6: Role of agricultural policy

	Statements	High Impact	Medium Impact	Low Impact	No Impact	Weight Mean	Mean
	To Increase Agricultural Production and Income						
1	Research on Agricultural Development	120 (59.1%)	40 (19.7%)	34 (16.7%)	9 (4.4%)	2.33	1.62
2	Price Support and Stabilization Policy	12 (5.9 %)	42 (20.7%)	44 (21.7%)	105 (51.7%)	0.81	
3	Agricultural Marketing Chain	2 (1%)	24 (11.8%)	53 (26.1%)	124 (61.1%)	0.53	
4	Labors in Agricultural Sector	80 (39.4%)	60 (29.6%)	42 (20.7%)	21 (10.3%)	1.98	
5	Mechanized Agriculture	4 (2%)	29 (14.3%)	89 (43.8%)	81 (39.9%)	0.78	
6	Availability of Agro-Inputs	32(15.8%)	80(39.4%)	67(33%)	24 (11.8%)	1.59	
7	Women Empowerment	142 (70%)	41(20.2%)	6 (3%)	14 (6.9%)	2.53	
8	Youth in Agriculture	129 (63.5%)	39(19.2%)	18 (8.9%)	17(8.4%)	2.38	
	To Help Agricultural Communities to Adapt Climate Change						
9	Technical Support	32(15.8%)	56(27.8%)	33(16.3%)	82(40.4%)	1.19	1.41
10	Agriculture for Special Area (Salinity, Flood, Coastal)	131(64.5%)	55(27.1%)	13(6.4%)	4(2%)	2.54	

11	Stress-Tolerant Variety of Different Crops	144(70.9%)	26(12.8%)	30(14.8%)	3(1.5%)	2.53	
12	Infrastructure Development (Irrigation Facility)	34(16.7%)	29 (14.3%)	58(28.6%)	82 (40.4%)	1.07	
13	Credit Facility	3(1.5%)	25(12.3%)	60(29.6%)	115(56.7%)	0.57	
14	Technology Transfer Program	6(3%)	19(9.4%	42(20.7%)	136(67%)	0.48	
15	Subsidies for Agriculture	65(32%)	41(20.2%)	20(9.9%)	77(37.9%)	1.46	
To Help Agricultural Communities to Adapt Climate Change							
16	Knowledge and Skill Development	118(58.1%)	56(27.8%)	33(16.3%)	82(40.4%)	1.19	1.55
17	Agricultural Environment & Natural Resource Management	56(27.8%)	100(49.3%)	17(8.4%)	30(14.8%)	2.54	
17	Specialized Agriculture	68(33.5%)	56(27.6%)	47(23.2%)	32(15.8%)	2.54	
17	Cooperative Agricultural System	47(23.2%)	43(21.2%)	60(29.6%)	53(26.1%)	1.41	
17	e-Agriculture (use of ICTs)	25(12.3%)	7(3.4%)	18(8.9%)	153(75.4%)	0.53	

4.5 Food insecurity measurement

Food insecurity is the inability to constantly obtain enough food for each household member to maintain an active and healthy lifestyle. In this study, we measure food insecurity using the FIES, which generates a population-level estimation of food insecurity that can be compared across nations, cultures, and subpopulations. Saint Ville et al., (2019) stated that this scenario consists of 8 questions, and sample households were divided into mild, moderate, and severe categories. Each FIES question pertains to a unique experience and reflects the severity of food insecurity at varying levels. The response is set to either yes or no. The results of the survey are shown in table 6:.

Table 7: Measurement of food insecurity experience scaley

Sl No		Question	Mean	Average Percentage (%)
1	Mild	You were worried you would not have enough food to eat because of a lack of money or other resources?	0.52	53%
2		You were unable to eat healthy and nutritious food because of a lack of money or other resources?	0.57	
3		You ate only a few kinds of foods because of a lack of money or other resources?	0.50	
4	Moderate	You had to skip a meal because there was not enough money or other resources to get food?	0.09	21.33%
5		You ate less than you thought you should because of a lack of money or other resources?	0.50	
6		Your household ran out of food because of a lack of money or other resources?	0.05	
7	Severe	You were hungry but did not eat because there was not enough money or other resources for food?	0.01	1%
8		You went without eating for a whole day because of a lack of money or other resources?	0.01	

It was found that roughly 22.33 per cent of respondents had suffered moderate to severe FI, whereas just 1 per cent had experienced severe FI. On the other hand, 53% of people were facing mild food insecurity issues. In the mild FI category, 53% of respondents were concerned that they wouldn't have enough food to eat, where 57% claimed that they are unable to consume good and nutritious food, and 50% only ate a limited variety of meals due to a lack of money and resources. Nine per cent of those with moderate food insecurity reported skipping meals, while fifty per cent said they ate less than they believed they should and five per cent claimed their household ran out of food due to a lack of funds. One per cent of participants claimed they were starving but did not eat, and one per cent claimed they went without food for an entire day due to a lack of finances and are currently experiencing severe FI. Rural farmers may be experiencing food insecurity as a result of landlessness and related issues including climate change, market imperfections, a lack of purchasing power, natural disasters, high food costs, etc (Islam M. and Abdul, M. 2014). Most of the respondents in this region decided on a different field of work to satisfy their needs.

4.6 Barriers to Use CSATs

Barriers to adaptation to the CSAT technology can be defined as factors or conditions that create difficulties in adoption opportunities and hindered the opportunity to reduce vulnerability mostly caused by a lack of information and communication on adaptive measures, and lack of support. Such barriers can be overcome with proper identification, changed thinking, and concerted effort (Schoepp. K. 2015). But identifying the barriers properly on the various scales is the primary and most important consideration. So, our study is designed under a proper framework to identify the barriers on the personal, organizational, economical, technological, and social scales. As most of the farmers are illiterate and literate farmers are less engaged in farming, it was difficult to accurately find the barriers without giving them proper guidelines or structure. Farmers were asked to state the factors that hinder them from adopting available CSTAs technology.

Table 8: Barriers to adopting CSATs

	Statements	SA	A	UD	DA	SDA	WM	Mean
	Personal Barriers							
1	Require new Knowledge to adopt CSATs	97(47.5%)	84(41.4%)	0	7(3.4%)	15(7.4%)	1.19	0.39
2	Lack of Skill to adopt CSATs	72(35.5%)	66(32.5%)	9(4.4%)	28(13.8%)	28(13.8%)	0.62	
3	Observe the effect/ results of CSATs are difficult	10(4.9%)	54(26.6%)	79(38.9%)	45(22.2%)	15(7.4%)	-.0049	
4	Negative presumed assumptions on CSATs	3(1.5%)	39(19.2%)	68(33.5%)	89(43.8%)	4(2%)	-0.26	
	Organizational Barriers							
1	Lack of Technical Support from GO and NGOs	116(57.1%)	67(33%)	0	19(9.4%)	1(0.5%)	1.37	1.09
2	Government policies and Strategies are shaky	109(53.7%)	58(28.6%)	3(1.5%)	9(4.4%)	24(11.8%)	1.08	
3	Inability to assess technologies	119(58.6%)	44(21.7%)	25(12.3%)	10(4.9%)	5(2.5%)	1.3	
4	Farmer's knowledge not considered in R&D	79(38.9%)	45(22.2%)	18(8.9%)	48(23.6%)	13(6.4%)	0.64	
	Economic Barriers							
1	High initial investment cost	153(75.4%)	50(24.6%)	0	0	0	1.8	1.24
2	Lack of Credit facility	76(37.4%)	84(41.4%)	10(4.9%)	33(16.3%)	0	1	
3	Uncertain results and returns	48(23.6%)	83(40.9%)	48(23.6%)	24(11.8%)	0	0.76	
4	The price is too low in relation to the cost	132(65%)	43(21.2%)	0	26(12.6%)	2(1%)	1.4	

	Technological Barriers							
1	Poor infrastructure of the embankment	147(72.4%)	11(5.4%)	0	41(20.2%)	4(2%)	1.3	0.81
2	Unavailability of stress-tolerant variety of crops	5(2.5%)	54(26.6%)	10(4.9%)	103(50.7%)	31(15.3%)	-0.4	
3	Weak telecommunication and internet facility	51(25.1%)	86(42.4%)	48(23.6%)	18(8.9%)	0	0.84	
4	Unavailability of solar-powered Irrigation system	143(70.4%)	33(16.3%)	16(7.9%)	0	11(65.4%)	1.5	
	Social Barriers							
1	Trends in migration from rural to urban	32(15.8%)	40(19.7%)	13(6.4%)	57(28.1%)	61(30%)	-0.37	0.16
2	Change in occupational status	6(3%)	49(24.1%)	11(5.4%)	64(31.5%)	73(36%)	-0.73	
3	The unfavorable land tenure system	50(24.6%)	66(32.5%)	25(12.3%)	42(20.7%)	20(9.9%)	0.41	
4	Low marketing facilities	131(64.5 %)	42(20.7%)	9(4.4%)	7(3.4%)	14(6.9%)	1.32	

A=Strongly Agree, A=Agree, UD=Undecided, DA=Disagree, SDA=Strongly Disagree

In table 8, farmers argued that Economic condition was the first hindrance with a weighted mean of 1.24, as they were poor. Surprisingly all of the Farmers agreed (75.4% strongly agree, 24.6%agree) that most of the adaptations require high initial investment costs that hinder most as they have limited capital. With lack of credit access, along with insufficient prices besides high-cost investment also significantly hindered their adaptation capacity.

The second most hindrance was found in organization activities with a weighted mean of 1.09. Almost 57.1% of respondents strongly agree and 33% agree that they find little technical support from governmental and non-governmental organizations. They addressed governmental policies and strategies that are too old-fashioned and less sensitive to cope with the new frequency of disasters. As farmers' knowledge and experience are not taken seriously, as well as farmers have few options to assess technology properly. Farmers have some personal barriers to adopting new technology. Besides current functional technologies also failed to fulfill the fundamental needs as they are too weak. 68% of the farmers lack skills but most importantly farmers are quite sure (88.9%) that they need new knowledge to adopt CSTA first. While farmers mostly disagree that CSATs results are difficult and they presumed negative on CSATs. Moreover, farmers mention that poor infrastructure, weak telecommunication, and unavailability of solar power irrigation facilities are the reasons that hindered them most technologically. Though farmers have diversified perceptions about the stress-tolerant variety of crops majority of them addressed that there is sufficient availability of stress-tolerant variety (50.7% disagreed, and 15.3% strongly disagreed)

Farmers are comparatively less affected socially to adopt CSATs. Even if they managed all the barriers to adopting CSTAs technology in the end low marketing facilities hit them mostly (64.5% strongly agreed, 20.7% agreed). Farmers have diversified perceptions about other social barriers. Among them, farmers are not ready to agree that migration and change in occupation create barriers to adopting technology. For the majority of them, it creates opportunity, not a hindrance. Farmers also positively addressed the Unfavorable land tenure system as a barrier.

Conclusion and recommendations

Bangladesh is a climate-vulnerable country, and agriculture is its most income-generating source. So that both factors are equally influencing each other by way of a vice versa process. According to the findings of this study, climate-smart agriculture technologies are now a viable and reliable option for farmers to protect their farms from any type of adverse situation, and this type of climate change adaptation process is heavily influenced by the policy frameworks in place. A policy framework established by the government is an essential component in convincing farmers of the need to implement CSATs. According to the findings of this study, the majority of farmers who adopted such technology were middle-aged age. Since the researchers found a link between this kind of adoption and the policy framework, this means those as farmers get older, they will become more dependent, have more faith, and be better able to understand the agricultural policy. On the other hand, the service experience of farmers showed a negative relationship with the impact of agricultural policy, which indicates that the present farmers with more experience were less interested in obeying the government-certified policy and adopting CSATs because they were more comfortable with their traditional methods. Our ageing farmers should be included in agricultural development programs, and the government should take the necessary steps to ensure this happens. If it is possible to teach scientific knowledge to more seasoned farmers, then they will be able to apply their years of experience to produce much improved results. The use of information sources and adoption of CSATs showed a positive relationship with the role of agricultural policy in motivating farmers to adopt CSATs for adaptation. Communication exposure of farmers towards e-Agriculture was found to vary with their age. Hence, it is recommended that the DAE and other NGOs can carry out motivational programs and training on e-Agriculture especially targeting the old aged farmers to make frequent communication with e-Agricultural media.

Alongside climate change effect and barriers to adopting CSATs showed a negative relationship with the role of agricultural policy. Because if the climate change effect increases day by day then the farmers who followed the agricultural policy to adapt to the adverse situation will don’t work effectively because the pattern of climate change is changed frequently, so the policy must be updated to adjust to the impact. Maximum farmers said that the established policy played an important role in agricultural production and income generation so the adopted technologies also supported the enhancement of agricultural production and income generation.

The fact that farmers are emphasizing the adoption of CSATs to increase agricultural production and income is important to take into consideration. The agriculture policy should be updated so that farmers are able to understand how to increase climate change resilience. To reduce agricultural contributions to climate change, policymakers must engage with farmers. It is strongly suggested that nepotism should be avoided when different types of agricultural extension programs are taking place at the farmer level. Farmers in this region have expressed their dissatisfaction with the extension workers here, claiming that they do not have adequate knowledge of climate change and CSA technology. Therefore, in addition to the farmers, they too need to undergo training.

This study also tried to find out the food security condition of this area and it seemed that the respondents were mildly food insecure. According to the findings of this study, the majority of educated farmers have abandoned farming to pursue other opportunities in nearby cities in order to maintain their food security. This is a horrible sign for our agricultural industry. As a result, the government should develop the policies required to engage educated people in agriculture.

Farmers are suffering greatly due to poor dam construction in the study area. It is highly recommended that policies on the construction of dams in coastal areas be formulated by coordinating various departments. On the other hand, economic constraints were the biggest factor that hindered the farmer’s capacity to adapt to the adverse situation. Moreover, because our country's farmers are impoverished, there must be a zero-interest loan policy to assist farmers in launching their own farming operations by using CSATs as a climate change measure. As the policy framework influences farmers' interest in taking the initiative against climate change by adopting CSATs, the government of Bangladesh should be cognizant of climate change and continually update its policy framework to adapt to CSATs.

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