DETERMINANTS OF THE ADOPTION OF CLIMATE SMART AGRICULTURE

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DETERMINANTS OF THE ADOPTION OF CLIMATE SMART AGRICULTURE

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CERTIFICATE

This is to certify that the thesis entitled **"DETERMINANTS OF THE ADOPTION OF CLIMATE SMART AGRICULTURE"** submitted to the department of Agricultural Extension and Information System, Faculty of Agriculture, Sher-e-Bangla Agricultural University, Sher-e-Bangla Nagar, Dhaka in partial fulfillment of the requirements for the degree of Master of Science (M.S.) in Agricultural Extension, embodies the result of a piece of bona fide research work carried out by **Md. IMDADUL HAQUE, Registration No. 11-04358** under my supervision and guidance. No part of the thesis has been submitted for any other degree or diploma.

I further certify that any help or source of information, as has been availed of during the course of this investigation has been duly acknowledged by the Author.

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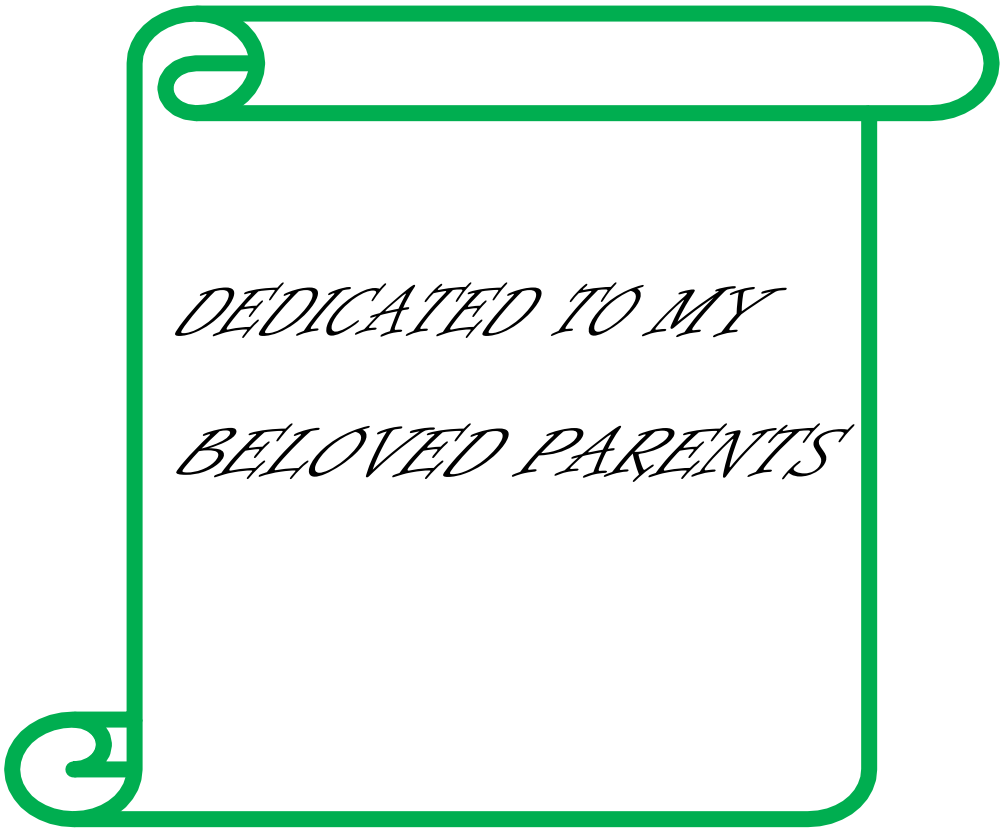
DEDICATED TO MY
BELOVED PARENTS

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The Author

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Acronyms

BBS	Bangladesh Bureau of Statistics
UNFPA	United Nations Population Fund
GDP	Gross Domestic Product
CSA	Climate-smart agriculture
GHG	greenhouse gas emissions
FAO	Food and Agriculture Organization
CCAFS	Climate Change Agriculture and Food Security
RDRS	Rangpur Dinajpur Rural Service
ITK	Indigenous Technical Knowledge
HYV	High Yielding Variety
IPM	Integrated Pest Management
ICT	Information and Communication Technology
SPSS	Statistical Package for Social Sciences
BNFE	Bureau of Non-formal Education

DETERMINANTS OF THE ADOPTION OF CLIMATE SMART AGRICULTURE

MD. IMDADUL HAQUE

ABSTRACT

Climate-smart agriculture (CSA) is an effective approach of transforming and reorienting agricultural development under in the context of climate change. The objectives of the study were to determine and describe some characteristics of the farmers, to estimate the extent of adoption of CSA, and to determine the determinants of the adoption of CSA. Data was collected from 105 farmers of 4 villages of two unions. The farmers who used CSA were the population of the study. These Unions namely Dauki and Jamjami in Alamdanga Upazilla under chuadanga district were purposefully selected due to easy communication as well as easy contact with the farmers. Data were collected during the period from February 20 to March 20, 2018. Descriptive statistics, multiple regressions (Y) were employed for analysis. 58.1% farmers partially adopted the CSA, while 23.8 and 18.1 percent of them had not and fully adopted the CSA, respectively. Education, organizational participation, access to ICT and farmers perceptions on the effects of CSA were key determinant of the adoption of CSA and all variables collectively explained 47.7% variation in the adoption of CSA. It is concluded that farmers' learning, training, knowledge development and skills improvement are crucial to CSA adoption. To increase the adoption of CSA, the policy makers could invest on improving capacity of farmers organizations (e.g. farmers field schools) and enhancing farmers' access to ICTs such as mobile phones and television with a view to get oriented to the latest CSA practices and technologies like alternative wetting and dry methods.

CHAPTER I

INTRODUCTION

1.1 General Background

Bangladesh is a South Asian developing country. It is the fifth most populous country in Asia and the seventh in the world. Its population growth rate is 1.36 percent and now its population is 150,790,000 (BBS, 2003) and according to UNFPA (2009) the population of Bangladesh at 2050 will be 254,100,000. So this increasing population requires more food as a result dependence over agricultural sector is increasing day by day. Agriculture is the single largest producing sector of the economy and it contributes about 14.79 percent to the total Gross Domestic Product (GDP) of the country. This sector accommodates around 45.1 percent labor force (BBS, 2017). GDP growth rate of Bangladesh mainly depends on the performance of the agricultural sector.

When it comes to the adoption of a new technology, farmers are faced with choices and trade-offs. Differences in adoption decisions are often due to the fact that farmers have different cultures, different resource endowments, different objectives, different preferences, and different socio-economic backgrounds. It follows that some farmers adopt the new technology while others do not. Rogers defined the rate of adoption as "the relative speed with which an innovation is adopted by members of a social system". In such a context, farmers decisions regarding the adoption of innovation can be explained using the theory of the maximization of expected utility. Following this theory, a farmer will adopt a given new technology if the expected utility obtained from the technology exceeds that of the old one.

Farmers do adopt a mix of technologies to deal with a multitude of agricultural production constraints. This implies that the adoption decision is inherently multivariate, and attempting univariate modeling would exclude useful economic information about interdependent and simultaneous adoption decisions. When farmers face multiple innovations, they consider the way these different technologies interact and take these interdependencies into account in their

adoption decisions. Ignoring these interdependencies can lead to inconsistent policy recommendations. Adoption of CSA technologies has become a major consideration to most farmers in Chuadanga district. Adoption in this respect is defined as a process of implementing CSA techniques after being aware of the presence of the technologies in one's environment which is heavily affected by climate variability. The study applied a multivariate model to investigate determinants of CSA technology.

A diverse set of potential household-level determinants of adaptive capacity such as family size, age, gender and education level of the family head are considered. For example family size in terms of adult equivalent units is a potential indicator of labour supply for production and if considered in investments, and maintenance of soil and water conservation which are particularly labour demanding and may be too expensive to undertake in family with limited access to labour. Considering the inconsistent estimates culminating from single equation statistical model, where information on a farmers adoption of one CSA does not alter the likelihood of the farmer adopting another CSA. The multiple regression model approach simultaneously models the influence of the set of explanatory variables on each of the different practices, while allowing for the potential regression between unobserved disturbances, as well as the relationship between the adoptions of different practices. One source of regression may be complementarities (positive regression) and substitutability (negative regression) between different practices. Failure to capture unobserved factors and interrelationships among adoption decisions regarding different practices will lead to bias and inefficient estimates. The econometric specification in this study examines the determinants of multiple adoption decisions of CSA, using a multiple regression model. This does not only improve the precision of the estimation results, it also provides consistent standard errors of the estimates and enables an analysis of interrelations between the different adoption decisions.

The three pillars of CSA: Productivity: CSA aims to sustainably increase agricultural productivity and incomes from crops, livestock and fish, without having a negative impact on the environment. This, in turn, will raise food and nutritional security. A key concept related to raising productivity is sustainable intensification. Adaptation: CSA aims to reduce the exposure of farmers to short-term risks, while also strengthening their resilience by building their capacity to adapt and prosper in the face of shocks and longer-term stresses. Particular attention is given to protecting the ecosystem services which ecosystems provide to farmers and others. These services are essential for maintaining productivity and our ability to adapt to climate changes. Mitigation: Wherever and whenever possible, CSA should help to reduce and/or remove greenhouse gas (GHG) emissions. This implies that we reduce emissions for each calorie or kilo of food, fiber and fuel that we produce. That we avoid deforestation from agriculture and that we manage soils and trees in ways that maximizes their potential to acts as carbon sinks and absorb CO2 from the atmosphere.

Climate-smart agriculture (CSA) is an approach that helps to guide actions needed to transform and reorient agricultural systems to effectively support development and ensure food security in a changing climate. CSA aims to tackle three main objectives: sustainably increasing agricultural productivity and incomes; adapting and building resilience to climate change; and reducing and/or removing greenhouse gas emissions, where possible.

CSA is an approach for developing agricultural strategies to secure sustainable food security under climate change. CSA provides the means to help stakeholders from local to national and international levels identify agricultural strategies suitable to their local conditions. CSA is one of the 11 Corporate Areas for Resource Mobilization under the FAO Strategic Objectives. It is in line with FAO vision for Sustainable Food and Agriculture and supports FAO goal to make agriculture, forestry and fisheries more productive and more sustainable.

Climate-smart agriculture (CSA) may be defined as an approach for transforming and reorienting agricultural development under the new realities of climate change (Lipper et al. 2014). The most commonly used definition is provided by the Food and Agricultural Organization of the United Nations (FAO), which defines CSA as "agriculture that sustainably increases productivity, enhances resilience (adaptation), reduces/removes GHGs (mitigation) where possible, and enhances achievement of national food security and development goals". In this definition, the principal goal of CSA is identified as food security and development (FAO 2013a; Lipper et al. 2014); while productivity, adaptation, and mitigation are identified as the three interlinked pillars necessary for achieving this goal.

Key characteristics of CSA: CSA addresses climate change: Contrary to conventional agricultural development, CSA systematically integrates climate change into the planning and development of sustainable agricultural systems (Lipper et al. 2014). CSA integrates multiple goals and manages trade-offs: Ideally, CSA produces triple-win outcomes: increased productivity enhanced resilience and reduced emissions. But often it is not possible to achieve all three. Frequently, when it comes time to implement CSA, trade-offs must be made. This requires us to identify synergies and weigh the costs and benefits of different options based on stakeholder objectives identified through participatory approaches.

CSA maintains ecosystems services: Ecosystems provide farmers with essential services, including clean air, water, food and materials. It is imperative that CSA interventions do not contribute to their degradation. Thus, CSA adopts a landscape approach that builds upon the principles of sustainable agriculture but goes beyond the narrow sectorial approaches that result in uncoordinated and competing land uses, to integrated planning and management (FAO 2013).

Despite the attention paid to agricultural development and food security over the past decades, there are still about 800 million undernourished and 1 billion malnourished people in the world. At the same time, more than 1.4 billion adults are overweight and one third of all food produced is wasted. Before 2050, the global population is

expected to swell to more than 9.7 billion people (United Nations 2015). At the same time, global food consumption trends are changing drastically, for example, increasing affluence is driving demand for meat-rich diets. If the current trends in consumption patterns and food waste continue, it is estimated we will require 60% more food production by 2050 (Alexandratos and Bruinsma 2012). CSA helps to improve food security for the poor and marginalized groups while also reducing food waste globally (CCAFS, 2013).

1.1 Specific Objectives of the Study

The following specific objectives were set forth in order to proper direction to the study:

1. To determine and describe some selected characteristics of the farmers
2. To estimate the extent of adoption of CSA
3. To determine the determinants of the adoption of climate smart agriculture

1.2 Statement of the Problem

In view of the foregoing discussion, the investigator under took a piece of study entitled "**DETERMINANTS OF THE ADOPTION OF CLIMATE SMART AGRICULTURE**". This research information are required which could be helpful to the policy maker, concerned bodies with the supply of inputs, technologies, knowledge and confronted with several problems having solution.

The study also aimed at finding out those factors, which facilitated as well as those, which caused the problems of the determinants of the adoption of climate smart agriculture.

The purpose of this study was to have answers to the following research questions:

- What are the determinants of the adoption of climate smart agriculture?
- What are the characteristics of the climate smart agriculture farmers?
- Is there any relationship between the farmers selected characteristics and their adoption of climate smart agriculture?
- What are the problems of the adoption of climate smart agriculture?

1.3 Justification of the Study

Climate smart agriculture is getting popularity among the farmers of Bangladesh by the introduction of new hybrid varieties coupled with growing market demand as well as food have opened a tremendous potentiality of rice, wheat and maize. The government is also supporting this growth. Needless to say that research is necessary to determine pattern of diffusion of climate smart agriculture in order to formulate long-term strategy on crops production. As no research in the field of diffusion-adoption of this technology has been identified so far, the researcher deemed it a

timely necessity to undertake the present study entitled “determinants of the adoption of climate smart agriculture”.

1.4 Scope of the Study

The main focus of the study was to determinants of the adoption of climate smart agriculture. The findings of the study will be specifically applicable to Chuadanga district. However, the findings will also have implications for other areas of the country having relevance to the socio-cultural context of the study area.

The investigator believes that the findings of the study will reveal the phenomenon related to diffusion of innovation. These will be of special interest to the policy makers and planners in formulating and redesigning the extension programmes especially for climate smart agriculture. The findings are expected to be helpful to the field workers of different nation building departments and organizations to develop appropriate extension strategies for effective working with the rural people.

1.5 Assumptions of the Study

An assumption is the supposition that an apparent fact or principle in true in the light of the available evidence (Good, 1945). The researcher has the following assumption in mind while undertaking this study:

1. The responses furnished by the respondents were reliable. They expressed the truth about their opinion and interest.
2. The researcher who acted as interviewer was adjusted to social and environmental conditions of the study area. Hence, the data collected by him from the respondents where free from bias.
3. The respondents included in the sample for this study were competent enough to furnish proper responses to the queries included in the interview schedule.
4. Views and options furnished by climate smart agriculture included in the sample selected those of the population of the study.

1.6 Limitations of the Study

Considering the time, money and other necessary resources available to the researcher and to make the study manageable and meaningful, it became necessary to impose certain limitations as noted below:

1. Population for the present study were kept confined within the heads of the climate smart agriculture families as because they were the major decision makers in the determinants of the adoption of climate smart agriculture.
2. Characteristics of climate smart agriculture farmers are many and varied but only ten were selected for investigation in this study as stated in the objectives. This was done to complete the study within limited resources.
3. The study was confined mainly to determinants of the adoption of climate smart agriculture.
4. Facts and figures were collected by the investigator applied to the present situation in the selected area.

1.7 Definition of important Terms

Age

Age of the respondent was defined as the period of time in actual years from his birth up to the time of interviewing.

Education

Education referred to the development of desirable Knowledge, skill and attitude in the individual through reading, writing and other related activities. It was measured in terms of actual grades or class passed by a respondent.

Farm size

It referred to the total area on which a farmers family carries on farming operation. The area is estimated in terms of full benefit to the farmers family.

Accessibility to media services

It referred to an individual exposure to or contact with different communication media and sources and personalities being used for dissemination of new technologies among the farmers.

Training received

It referred to the total number of days that a respondent received training in his entire life from different organization under different training programs.

Climate-smart agriculture

Climate-smart agriculture may be defined as an approach for transforming and reorienting agricultural development under the new realities of climate change (Lipper et al. 2014). The most commonly used definition is provided by the Food and Agricultural Organization of the United Nations (FAO**)**, which defines CSA as "agriculture that sustainably increases productivity, enhances resilience (adaptation), reduces/removes GHGs (mitigation) where possible, and enhances achievement of national food security and development goals". In this definition, the principal goal of CSA is identified as food security and development (FAO 2013a; Lipper et al. 2014); while productivity, adaptation, and mitigation are identified as the three interlinked pillars necessary for achieving this goal.

Market access refers to the ability of a company or country to sell goods and services across borders. Market access can be used to refer to domestic trade as well as international trade, although the latter is the most common context. Market access is not the same thing as free trade. The ability to sell into a market is often accompanied with tariffs, duties or even quotas, whereas free trade means that goods and services flow across the borders without any extra costs imposed by governments. Even so, market access is seen as an early step towards deepening trade ties. Market access has increasingly been referenced as the stated goal of trade negotiations as opposed to true free trade.

ICT or information and communication technology is the infrastructure and components that enable modern computing.

Agriculture is the science, art, or practice of cultivating the soil, producing crops, and raising livestock and in varying degrees the preparation and marketing of the resulting products.

Objectives are concrete attainments that can be achieved by following a certain number of steps.

Hypotheses as defined by Goode and Halt (1952) a hypothesis is "a proposition which can be put to test to determine its validity. It may seem contrary to, or in accord

with common sense. It may prove to be correct or incorrect. In any event, however, it leads to an empirical test." Assumption is a supposition accepted as true to the investigator to be reasonable in the light of available evidence.

Regression is a statistical measure that attempts to determine the strength of the relationship between one dependent variable (usually denoted by Y) and a series of other changing variables (known as independent variables).

CHAPTER II

REVIEW OF LITERATURE

To find out the adoption of climate smart agriculture and its relationship with selected characteristics of the farmers were the main task of the study. This Chapter contains synthesis of selected literature those were related to the present study. The researcher made an elaborate search of available literature for this purpose. There was no literature directly related to the present study. Therefore, the present researcher searched relevant studies conducted by different scientist and authors on the adoption of CSA. The finding of such studies related to the extent of adoption of CSA the farmers and other partial studies have been reviewed and partially discussed in this Chapter. This Chapter is divided into three major sections, the first section deals with the review of literature on general context of adoption, the second section deals with the relationship between farmers characteristics and their adoption of CSA and the third section deals with the conceptual framework of the study.

2.1 Review of Literature on General Content of Adoption

Haque (2003) found that the majority (47 percent) of the growers had medium adoption of modern maize cultivation technologies while 28 percent had high adoption and 25 percent low adoption.

Rahman (2003) found that ninety seven percent of the pineapple growers adopted 2-4 intercrops viz, Zinger, turmeric, sweet ground and aroid in pineapple cultivation.

Salam (2003) found that an overwhelming majority (94 percent) of the respondents were found having high constraints in adopting environmentally friendly farming practices while 6 percent had medium constraints. No farmer was found having low constraint.

Hossain (2003) found that majority (67 percent) of the Boro rice farmers had medium adoption, 17 percent had low adoption and 16 percent high adoption of modern Boro rice cultivation practices.

Hasan (2003) found that majority (60 percent) of the farmers had medium adoption while 33 percent had low adoption and 7 percent had high adoption of recommended potato cultivation practices.

Rahman (2003) revealed that about half (47 percent) of the growers had medium adoption, 44 percent had low and 9 percent had high adoption of year-round homestead fruit cultivation practices.

Zegeye *et al*. (2002) studied the determinants of adoption of improved maize technologies in major maize growing region of Ethiopia. He found that the rate of adoption of improved maize varieties and chemical fertilizer, factors affecting the adoption of improved maize varieties and the determinant factors affecting adoption of chemical fertilizers are also highlighted.

Gebre (2002) conducted a study on Maize technology adoption in Ethiopia. This study presents the results of the Sasakawa-Global 2000 Agriculture program in Ethiopia and its influence on agricultural research and maize production in the region. The Sasakawa-Global 2000 is an international non-government organization initiated in 1986 because of the 1984-85 famine in Ethiopia, with the aim of empowering Africa to produce its own food through the adoption of improved agricultural technologies.

Alexznder and Goodhue (2002) conducted the study on pricing of innovations. They evaluate the producers returns to planting patented seed innovation, using a calibrated optimization model of a south-central maize producer adoption decision in Iowa, USA. Their results suggest that patented seed innovations do not increase the market power of biotechnology firm in the relevant market for production system.

Swinkels *et al*. (2002) studied assessing the adoption potential of hedgerow intercropping for improving soil fertility, in western Kenya. They conduct that the average cost of hedgerow intercropping was 10.5% (SD = 5.5) when based on returns to land and 17.5% (SD = 6.5) based on returns to labour. Fifth planted additional hedges and only 14% did so to improve soil fertility. It thus appears that the potential for its adoption as a soil fertility practices. Hedgerow intercropping appears to have

greater adopter potential if its aim is to provide feed for an intensive dairy operation or for curbing soilerosion.

Sardar (2002) studied on “adoption of IPM practices by the farmers under PETRRA Project of RDRS. He observed that majority (45.9 percent) of the farmers had medium, 38.3 percent had low and 15.8 percent had high adoption of IPMpractices.

Aurangojeb (2002) studied on the extent of adoption of integrated farming technology by the rural women in RDRS. He observed that the highest (64) percent of rural women used high level, 28% of the women used medium level and only 8% used low level integrated homestead farming technologies.

Haider *et al*. (2001) observed that one-third (37 percent) of the farmers fell in low adopter category compared to 32.5 percent falling in optimum adopter 23.5 percent above optimum adopter and only 7 percent had non-adopter on Nitrogenous fertilizer. In respect of extent of phosphoric fertilizer two thirds (68 percent) of the farmers had non adopter category compared to 23 percent having above optimum adopter, 5 percent optimum adopter and only 4 percent had below optimum adopter of phosphoric (P) fertilizer. In respect of extent of potassic fertilizer three quarters categories compared to 10 percent falling below optimum adopter, 8 percent optimum adopter and only 3 percent above optimum adopter of potassic (K) fertilizer.

Haider *et al*. (2001) studied the adoption level of improved Package of practices for T. aman rice cultivation in Gouripur upazila of Mymensingh district. He found that the adoption level of farmers categories were 5 percent non adoption, 62 percent low adoption, 24.5 percent medium adopter and 8.5 percent high adopter. Vast majority (95 percent) of the farmers adopted MV programme of T. aman rice.

Podder and Kashem (2000) studied on, Use of Extension Contact Media by the farmers in the Adoption of Mehersagar banana. They concluded that about half (47%) of the growers had medium adoption compare to 14 percent low adoption and 39 percent high adoption of Mehersagar banana.

Mostafa (1999) studied the adoption of recommended mango cultivation practices by the mango growers of Nawabganj Sadar thana. He found that about half (49 percent) of the mango growers had "low adoption" 31 percent "very low" adoption and 20 percent had "medium" adoption of fertilizers.

Rahman (1999) studied the adoption of balanced fertilizer by the boro rice farmers of Ishwarganj thana. He found that the extent of use of balanced nitrogenous fertilizer, 48.57 percent of the farmers had optimum adoption and above optimum respectively. In respect of extent of use of balanced phosphoric fertilizer, 79.05 percent of the farmers had below optimum adoption compared to 20.95 percent having optimum adoption. Regarding the extent of use of balanced potassic fertilizer, 80.95 percent of the farmers had below optimum adoption compare to 18.10 and 0.95 percent having optimum and above optimum adoption, respectively.

Muttaleb *et al*. (1998) found that over all adoption of plant protection practices was medium. Among the plant protection practices high adoption were observed in fungicides, insecticide and soil treatment and low adoption were found that treatment and low adoption were found in suberization of cut tuber hand picking of cutworm and rouging of diseased plant.

Islam (1996) carried out a study on farmers use of indigenous technical knowledge (ITK) in the context of sustainable agricultural development. He found the extent use of ITK by individual farmers that, the highest proportion (42.73 percent) of the respondents belonged to the lower user category as compared to 41.82 percent in the moderate user category and 15.45 percent in the higher user category, respectively.

Hasan (1996) found in his study that the highest proportion (44 percent) of the respondents perceived the existence of medium adoption, compared to 26 percent low adoption and 3 percent high adoption in respect of selected agricultural technologies.

Siddaramaiha *et al.* (1995) studied adoption of improved Seri-cultural practices among big and small farmers. They indicate that there was cent percent adoption in following the recommended system of planting by both big and small farmers. Other practices adoption by a large percentage of farmers was: optimum time of planting

(95%), adoption of recommended irrigation schedule (93.75%), recommended spacing (91.25%) and the use of improve variety of mulberry crop (87.50%). Nearly half of the respondents used the recommended quantity of farmyard manure and plant protection chemicals in mulberry cultivation.

Nikhade *et al.* (1995) found that the adoption gap about the use of recommended technology of cotton among cotton growers was found to be about 30 percent which was quite high.

Nikhade *et al.* (1993) observed in their study on adoption of improved practices of soybean cultivation that cent percent adopted improved varieties. More than 82 percent had complete adoption of package practices like timely sowing, spacing and inter cultural operations. Partial adoption was observed in majority of the soybean growers (74.6 percent) with regard to recommended seed rate.

Kashem *et al*. (1992) conducted a study on adoption behaviour of sugarcane growers of Zilbangla Sugar Mill, Dewanganj. Jamalpur, Bangladesh. They found among the sugarcane growers, 89 percent had high level of adoption of recommended practices of sugarcane.

Singh *et al*. (1992) undertook a research study in India on factors affecting the adoption of improved sugarcane production technology. They observed that majority of sugarcane growers had the medium level of adoption and were partial adopters of scientific recommendations of sugarcane production technology.

Juliana *et al*. (1991) undertook a study on adoption of integrated pest management practices in five villages of vasusdevanallar block in Tirunelvi district, Tamilnaru, India. They found that about 50 percent of marginal farmers, 47.50 percent of small farmers and 52.50 percent of big farmers had medium adoption and 42.50 percent of big farmers, 22.50 percent of small farmers and 5 percent of the marginal farmers had high level of adoption. In both adoptions level of big farmers participation was higher in comparison to other categories of farmers.

Gogoi and Gogoi (1989) conducted a study on adoption of recommended plant protection practices in rice in Zorhat district of Assam state in India. The study revealed that among the respondents, 50 percent had low level of adoption,35.36 percent medium level of adoption and 13.64 percent had high level of adoption of recommended plant protection practices.

Karim and Mahboob (1986) studied the adoption of HYV wheat in Kushtia union of Mymensingh district. They found that among the respondent wheat farmers 74 percent adopted HYV wheat cultivation and 26 percent farmers were non-adopters.
Rahman (1986) conducted a research study on the extent of adoption of four improved practices, which were use of fertilizers, line sowing, irrigation and use of insecticides in transplanted aman rice cultivation in two village of Mymensingh district. It revealed that 22 percent of the farmers adopted all the four practices compared to 49 percent adopted three practices, 22 percent adopted two practices, 5 percent adopted one practices and only 2 percent adopted of the four practices.

Hossain (1983) studied the extent of adoption of HYV rice as transplanted aman and other related aspect in Bhabalhali union of Mymensingh district. He observed that among the respondent farmers, 54 percent had high adoption of HYV rice and 46 percent had medium adoption of HYV rice as transplanted aman.

Razzaque (1977) studied on the extent of adoption of HYV rice in three villages of Bangladesh Agricultural University Extension Project area. He observed that among the respondent growers, 6.6 percent of the farmers had high adoption of HYV rice,
33.3 percent had medium adoption and 40 percent low adoption.

Sobhan (1975) studied on the extent of adoption of ten winter vegetables namely tomato, radish, lettuce and potato in Boilar union of Mymensingh district. Over all winter vegetable adoption scores of the farmers could range from 0 to 140. Over all adoption scores indicated that 27 percent of the farmers did not adopted winter vegetables cultivation while 28 percent had low adoption and 55 percent high adoption.

Mohammad (1974) studied the extent of adoption of insect control measures by the farmers in Khamar union of Rajshahi district. He found that among the respondent farmers, 25 percent did not adopt insect control measure; 28 percent had high level of adoption; 32 percent had medium level of adoption and 25 percent had low level of adoption.

Rahman (1974) studied the adoption of IR-20 variety of paddy in Bhabakhali union of Mymensingh districts. He found that 29 percent of the growers had medium adoption of IR-20 while 31 percent of the growers did not adopt the innovation.

Karim (1973) conducted a study on the adoption of fertilizers by transplanting aman growers in former Keyotkhali union of Mymensingh district. He studied the adoption of three fertilizer-ureas, super phosphate (TSP) and muriate of potash (MP). He found that 4 percent of the respondent growers had high adoption of fertilizers while 9 percent had medium adoption and 41 percent low adoption. Remaining forty six percent (46 percent) of the respondent growers did not use any of the three fertilizers.

Hossain (1971) carried out a research study on the adoption of four improved practices in Gouripur of Mymensingh district. The practices were (i) plant protection measure, (ii) recommended variety of paddy, (iii) line transplanting and (iv) recommended dose of fertilizers. It revealed that among the responded farmers 57.40 percent adopted plant protection measure, 35.51 percent adopted recommended variety of paddy, 25.36 percent adopted line transplanting and11.52 percent adopted recommended dose of fertilizers.

2.2 Relationship between Farmers' Characteristics and their Adoption of climate smart agriculture

2.2.1 Education and adoption

Hossain (2003) concluded that education of the farmers had a significant and positive relationship with their adoption of modern Boro rice cultivation practices.

Sardar (2002) found that the education of the farmers had significant positive relationship with their adoption of IPM practices.

Aurangozeb (2002) studied on the extent of adoption of integrated homestead farming technologies by the rural women in RDRS. He observed that there was positive relationship between education and adoption of integrated homestead farming technologies.

Hussen (2001) indicate that the education had positive significant relationship with their adoption of modern sugarcane cultivation practices.

Sarker (1997) conducted a study to determine the relationship between selected characteristics of potato cultivation practices in five villages of Comilla District. He found that education of potato growers had significant relationship with their adoption of improved potato cultivation practices. Similar results were found by Kashem (1991).

Hasan (1996) concluded a study on adoption of some selected agricultural technologies among the farmers as perceived by the frontline GO and NGO workers. He observed that education have no significant relationship with the perceived adoption of selected agricultural technologies. Similar results were found by Kher (1992) and Islam (1996).

Bavalatti and Soundaarswamy (1990) observed no significant relationship between education of the farmers and their adoption of dry land farming practices.

Kaur (1988) found that education influenced the opinion of the women about adoption of vegetable gardening animal husbandry etc.

2.2.2 Farm size and adoption

Hossain (2003) revealed that farm size of the farmers had a significant and positive relationship with their adoption of modern Boro rice cultivation practices.

Sardar (2002) found that the farm size of the farmers had significant positive relationship with their adoption of IPM practices.

Rahman (2001) conducted a study on knowledge, attitude and adoption of the farmers regarding Aalok 6201 hybrid rice in Sadar upazila of Mymensingh district. He found that farm size of the farmers had a significant and positive relationship with their adoption of Aalok 6201 hybrid rice.

Hussen (2001) found that the farm size had positive significant relation with their adoption of modern sugarcane cultivation practices.

Alam (1997) studied the use of improved farm practices in rice cultivation by the farmers. The findings of the study showed that the farm size had a significant relationship with their use of improved farm practices in rice cultivation.

Islam (1996) found that there was significant and negative relationship between the farm size of the farmers with their extent of use of indigenous technical knowledge. Ali *et at*. (1986), Hoque (1993), Hasan (1996), and Rao (1976) observed similar relationships.

Hossain and Crouch (1992) studied the relationship of farm size with adoption of farm practices. They found positive relationship between the farm size and adoption of farm practices. Similar result was found by Kashem (1991).

Gogoi and Gogoi (1989) in their study observed that size of land holding of farmers had a significant relationship and positive effect on their adoption of plant protection practices.

Hossain (1983) found that size of the farm of transplanted aman farmers in Bhabakhali union of Mymensingh district had a negative relationship with their adoption of HYV T-aman rice.

2.2.3 Training received and adoption

Rahman (2001) observed in study that training received of the farmers had a significant and positive relationship with their adoption regarding Aalok-6201 hybrid rice.

Islam (2002) conducted a study on farmers knowledge and adoption of ecological agricultural practices under the supervision of Proshika. He found that agricultural training exposure of the farmers had no significant relationship with their adoption of ecological agricultural practices.

2.2.4 Organizational participation and Adoption

Sardar (2002) conducted a study on adoption of IPM practices by the farmers under PETRRA project of RDRS. He observed that organizational participation of the farmers had no significant relationship with their adoption of IPM practices.

Rahman (2001) conducted a study on knowledge attitude and adoption of the farmers regarding Aalok 6201 hybrid rice in Sadar upazila of Mymensingh district. He found that organizational participation of the farmers had a significant and positive relationship with their adoption regarding Aalok 6201 hybrid rice.

Mostafa (1999) conducted a study on adoption of recommended mango cultivation practices by the mango growers of Nawabganj Sadar thana. He found that organizational participation of mango growers had a significant positive relationship with their adoption of recommended mango cultivation practices.

Sarker (1997) conducted a study on correlates of selected characteristics of potato growers with their adoption of improved potato cultivation practices in five village of Comilla district. He observed that organizational participation of the potato growers had no relationship with their adoption of improved potato cultivation practices.

Kher (1992) carried out a research study on the adoption of improved wheat cultivation practices by the farmers in selected village Rajouri block, India. He observed that there was no significant relationship between the farmers' social participation and their adoption of improved wheat cultivation practices.

2.2.5 Market access and Adoption

No findings were noticed on this aspect to the researcher at the time of reviewing literature.

2.2.6 Access to finance and Adoption

No findings were noticed on this aspect to the researcher at the time of reviewing literature.

2.2.7 Extension services and adoption

Haque (2003) concluded that extension contact of the farmers had significant positive relationship with their adoption of modern maize cultivation technologies.

Sardar (2002) concluded that the extension contact had positively significant relationship with their adoption of IPM practices.

Aurangozeb (2002) observed that there was significant relationship between contact with extension media and adoption of integrated homestead farming technologies.

Rahman (2001) conducted a study on knowledge, attitude and adoption of the farmers regarding Aalok 6201 hybrid rice in Sadar upazila of Mymensingh district. He found that extension contact of the farmers had a significant and positive relationship with their adoption regarding Aalok 6201 hybrid rice.

Hussen (2001) found that the extension media contact had positive significant relationship with their adoption of modern sugarcane cultivation practices.

Sarker (1997) observed a positive and significant relationship between extension contact and adoption of improved potato cultivation practices. Karim (1973), Kashem *et al*. (1990), Kashem (1991), Pathak *et al*. (1992), Kher (1992), Islam (1993), Hoque (1993) and Pal (1995) also found the similar results.

Slade *et al*. (1988) studied that adoption rates among farmers receiving one or more VEW visits per month were generally higher than those farmers who were not visited by VEW'S contact farmers were better adopter of some technologies that non-contact farmers.

Osunloogun *et al*. (1996) studied adoption of improved Agricultural practices by co-operative farmers in Nigeria. The findings of the study indicated a positive relationship between extension contact and adoption improved practices.

Bezbora (1980) studied adoption of improved agricultural technology by the farmers of Assam. The study indicated a positive relationship between extension contact and adoption of improved cultivation practices.

2.2.8 Access to ICT and Adoption

No findings were noticed on this aspect to the researcher at the time of reviewing literature.

2.2.9 Knowledge and adoption

Sarkar (1997) found that potato production knowledge of potato growers had a positive and significant relationship with their adoption of improved potato cultivation practices. Ali et at. (1986), Muttaleb (1995) and Rahman (1995) observed similar results in their respective studies.

2.2.10 Farmers perception and Adoption

No findings were noticed on this aspect to the researcher at the time of reviewing literature.

2.3 Conceptual Framework of the Study

Review of the past studies and literature indicated various factors influenced the adoption of climate smart agriculture of the farmers. It is sometimes difficult to deal with all the factors in a single study. Related literature, discussion with the experts and research fellows in the relevant field and available resources at hand helped the researcher in selecting 10 variables to assess the adoption of climate smart agriculture by the farmers. In this study, researcher therefore, tried to assess the reflection of some selected variables. An independent variable is that factor which is manipulated by the researcher in his attempt to ascertain its relationship to an observed phenomenon. A simple conceptual Framework for the study is shown 2.1below:

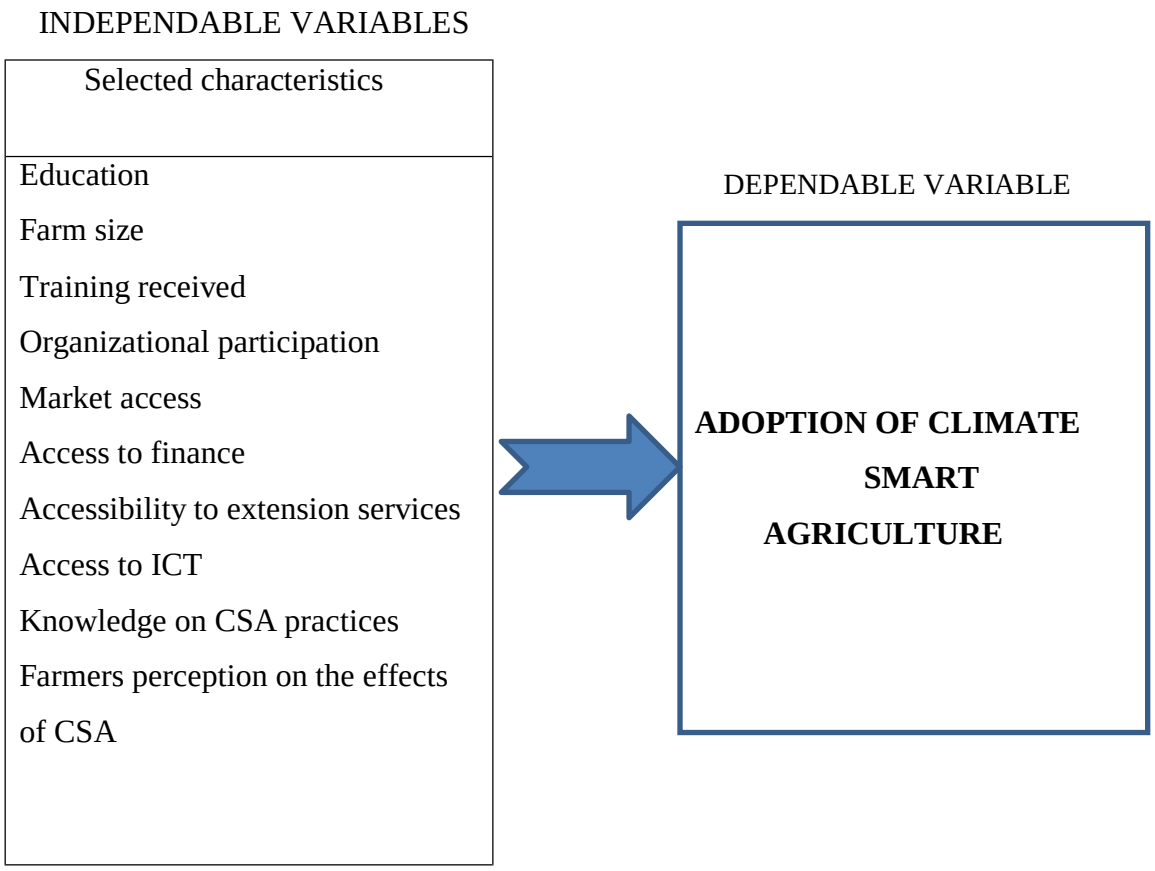

Figure 2.1 The conceptual framework of the study

CHAPTER III

METHODOLOGY

Methodology deserves a very careful consideration in conducting scientific research. Importance of methodology in conducting any research cannot be undermined. Methodology enables the researcher to collect valid and reliable information and to analyze them properly to arrive at correct decisions. Keeping this point in view, the researcher took utmost care for using proper methods in all the aspects of this piece of research work. Methods and procedures followed in conducting this study has been described in this chapter.

3.1 The Locale of the Study

Dauki and Jamjami unions of Alamdanga Upazilla under Chuadanga district was purposefully selected due to easy communication as well as easy contact with the farmers who pracrice CSA practices and technologies. . This Upazilla is situated at about 3 Km north-west of Chuadanga town. According to the guidance of the research supervisory committee two Union with CSA as the more cultivated crop were to be the study area of the present research. Four villages were selected randomly by taking two from each selected unions. Thus, Noatha panchila, Gosbila, Binodpur and Bademaju villages were selected as the locale of the study.A map of Chuadanga district showing Alamdanga Upazila and a map of Alamdanga upazila showing the study area have been presented in figure 3.1and 3.2 respectively.

3.2 Population and Sampling Design

The farmers of the selected villages were the population of the study. Four separated CSA practicing farmers of the selected villages were prepared with the help of Sub Assistant Agriculture Officer and Upazila Agricultural officer of Alamdanga Upazila in Chuadanga district. The total numbers of CSA growers in these four villages were 210. Half of the populations were selected randomly from each village as the sample of the study. So, 105 CSA farmers were the sample of the study. If anyone included in the original sample were unavailable during data collection, the next farmers regarding that list were considered turn by turn for collecting data. The distribution of populations, sample and reserve list are shown in the Table 3.1.

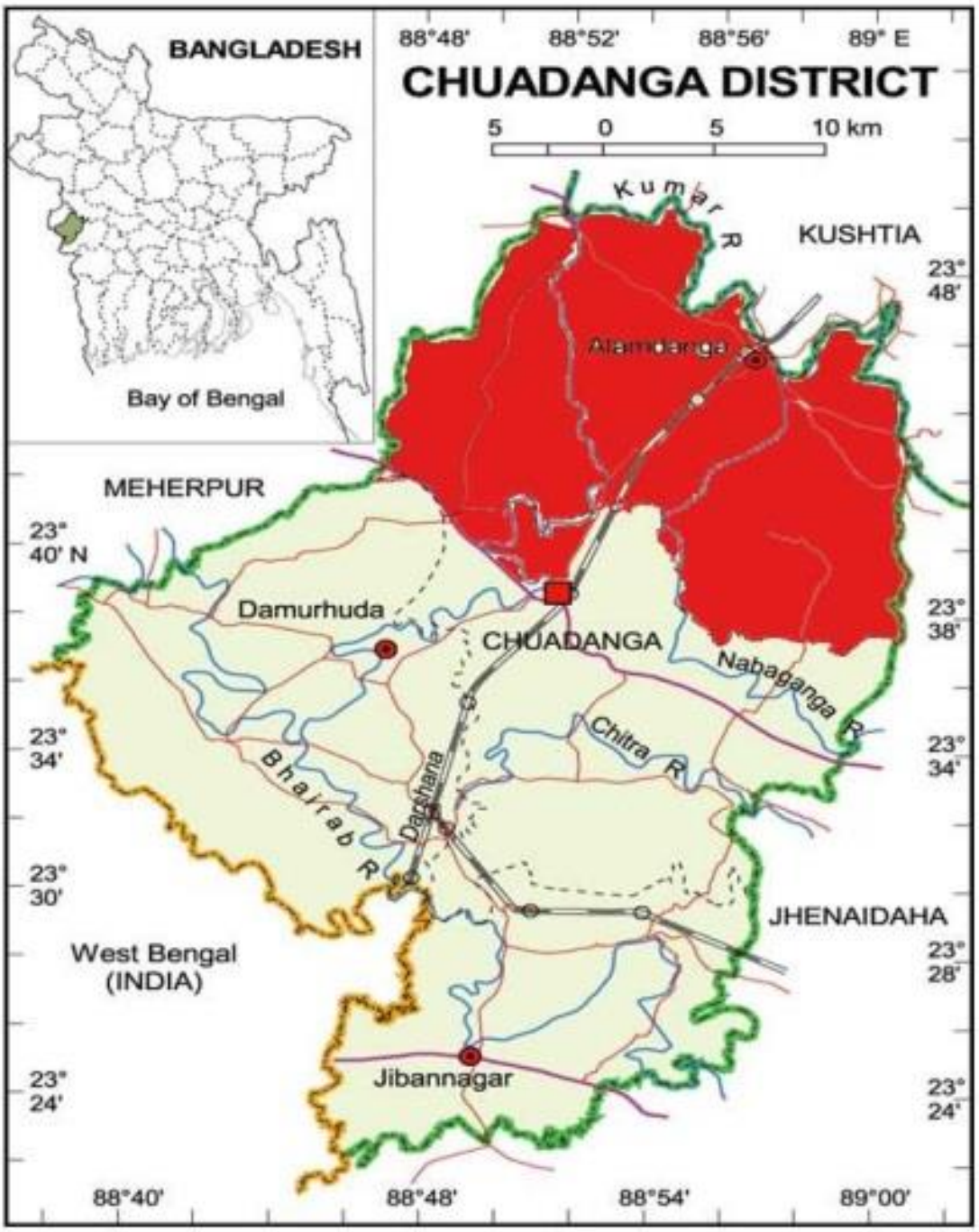

Figure 3.1 A map of Chuadanga district showing Alamdanga upazila

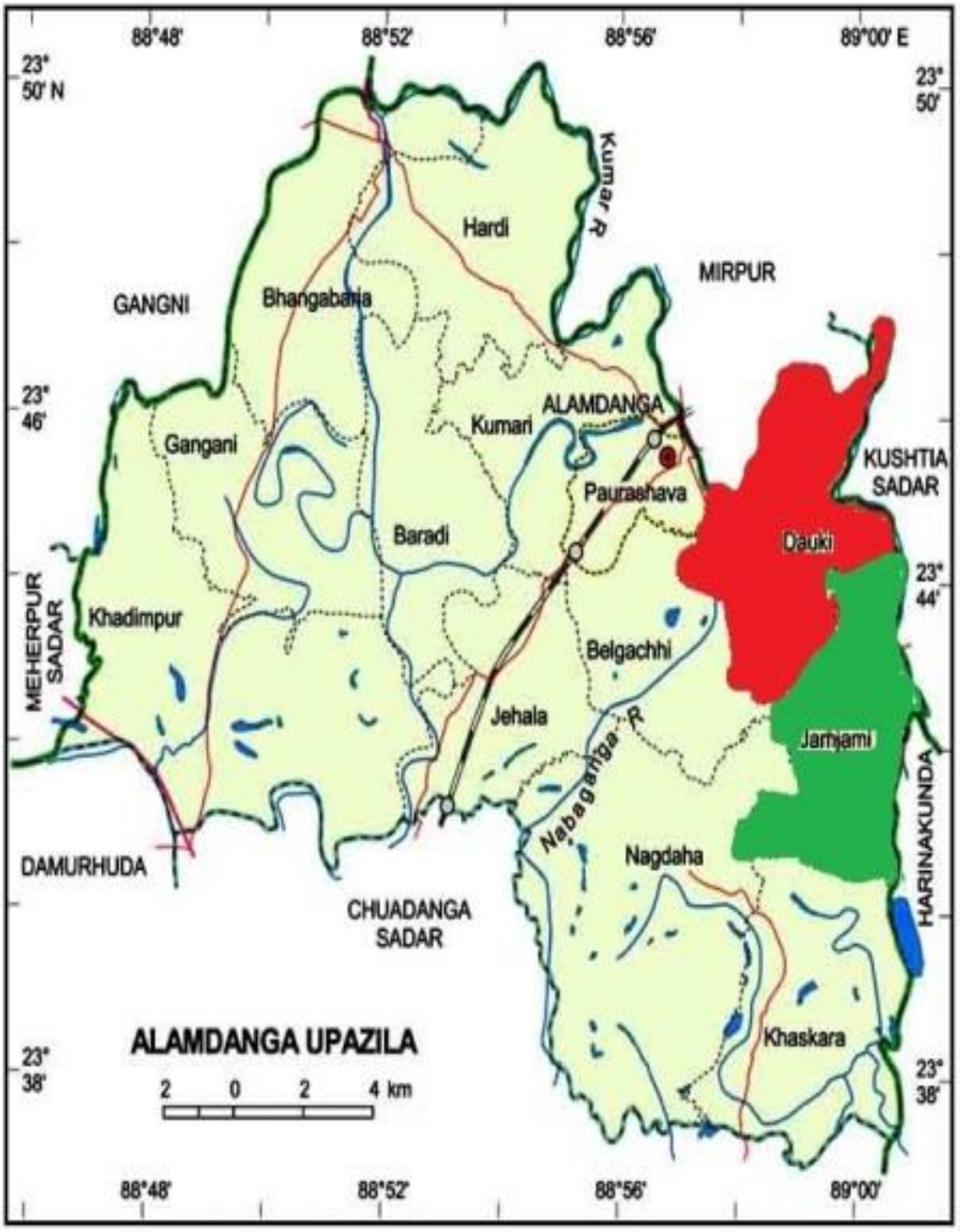

Figure 3.2 A map of Alamdanga Upazila showing Dauki and Jamjami Union

Table 3.1 Distribution of populations, sample and reserve list

Name of the Unions	Name of the villages	Population	Sample size	Reserve list
Jamjami	Noatha panchlia	54	27	3
	Gosbila	50	25	2
Dauki	Binodpur	56	28	3
	Bademaju	50	25	2
Total		210	105	10

3.3 Instrument for Data Collection

In order to collect reliable and valid Information from the CSA farmers, an interview schedule was prepared carefully keeping the objectives of the study in mind. The interview schedule contained both open and closed form questions.

Appropriate schedule was also developed to operationalize the selected characteristics of the CSA farmers. The draft interview schedule was prepared in English version and was pre-tested with CSA farmers. This pre-test facilitated the researcher to examine the suitability of different questions and statements in general. The interview schedule may be seen at Appendix-A.

3.4 Measurement of Variables

A variable is any characteristic, which can assume varying, or different values in successive individual cases (Ezekiel and Fox, 1959). An organized research usually contains at least two important variables, viz. an independent and a dependent variable. An independent variable is that factor which is maintained by the researcher in his attempt to ascertain its relationship to an observed phenomenon. A dependent variable is that factor which appears, disappears or varies as the researcher introduces, removes or varies the independent variable (Townsend, 1953). According to the relevant research area, the researcher selected 11 characteristics of the CSA farmers as the independent variable and adoption of CSA as the dependent variable.

3.5 Measurement of independent variables

The independent variables of the study were 11 selected characteristics of the CSA growers. These were education, farm size, training received ,organizational participation, market access, access to finance, accessibility to extension services, access to ICT, knowledge on CSA practices and farmers perception on the effects of CSA. The procedures followed in measuring the independent variables are briefly discussed below:

3.5.1 Education

Education was measured in terms of successful years of schooling. One (1) score was given for passing each level in the educational institution. For example, if a respondent passed class viii, his education score was given as 8. If a respondent did not know how to read and write his educational score was given as 0. This variable appears in item no. 1 in the interview schedule as presented in Appendix-A.

3.5.2 Farm Size

The farm size of a CSA farmer referred to the total area of land, on which his family carried out farming operations, in terms of full benefit to his family. The farm size was measured in hectares for each CSA farmers using the following formula:

The data were first recorded in term of local unit i.e. bigha and then converted to hectare. Total farm size of each respondent was categorized into 5 types (Islam, 2007). The farmers who had land bellow 0.02 hectare were considered as landless farmer. The farmers who had land between 0.02-.20 hectare were considered as marginal farmers ; the farmers who had the land between 0.2-1.00 hectare were considered as small farmers; the farmers who had land between 1.0-3.0 hectare of land considered as medium farmers and above 3.0 hectare considered as large farmers. This variable appears in item number 2 in the interview schedule as presented in Appendix-A.

3.5.3 Training Received

Training received was measured by total number of days of agricultural training received by the respondents` farmer in his/her life. One score was assigned for each day of training received by the respondent. Maximum five score given for each of the days and one score given for every sponsoring agency According to training received the respondents` farmer were categorized as no training, low training and medium training. This variable appears in item number 3 in the interview schedule as presented in Appendix-A.

3.5.4 Organizational participation

Organizational participation of a respondent was measured by computing an organizational participation score according to his/her nature and duration of participation in ten (10) selected different organizations upto the time of interview. The organizational participation score was evaluated for each respondent on the basis of his/her membership with five different types of organization. The following scale was used for computing the organizational participation score. The nature of participation was the respondent no participation, participation as ordinary member, participation as executive member and participation as secretary/president. The score was 0, 1, 2 and 3 respectively. Organizational participation score of a respondent was determined by adding together the scores obtained from each of the ten types of participation. Organizational participation score of the respondents could range from 0 to 30, where, 0 indicating no participation and 30 indicating high participation. This variable appears in item number 4 in the interview schedule as presented in Appendix-A.

3.5.5 Market access

Market access refers to the capability of an individual to sell goods and services in the market (FAO, 2015). There are two categories of market access: buying and selling. For each category: 1= yes; 0= no. If yes, then for the open questions received one point for the right answers (max.). A score of one (1) was assigned for each of product buying and selling of a respondent. The market access of farmers score of the respondents ranged from 0 to 6 where, 0 indicates no access and 6 indicates very high access. Based on their market access, the respondents were

classified into three categories as low, medium and high access. This variable appears in item number 5 in the interview schedule as presented in Appendix-A.Access to finance

3.5.6 Access to finance

access to finance of a respondent was measured on the basis of the farmers taken of his finance of selected ten items. Access to finance from one available sources by putting tick mark against one of the three responses- sustained, intermittent and no access to finance. The responses were scored as 3, 1 and 0 respectively. The access to finance of farmers score of the respondents ranged from 0 to 30 where, 0 indicates no access and 30 indicates very high access. Based on their access to finance, the respondents were classified into three categories as low, medium and high access to finance. This variable appears in item number 6 in the interview schedule as presented in Appendix-A.

3.5.7 Accessibility to extension services

The extension services of a respondent was measured on the basis of the response of the farmers against the extent of his visiting of selected two criteria (one extension officers visit to farmers and two farmers visit to extension officers) by putting tick mark against any one of the four responses- 4 times and above, 2-3 times, once time and no visit at all. The responses were scored as 3, 2, 1 and 0 respectively. The visit of extension services score of the respondents ranged from 0 to 6 where, 0 indicates no visit and 6 indicates very high visit. Based on their extension services, the respondents were classified into three categories as low, medium and high services. This variable appears in item number 6 in the interview schedule as presented in Appendix-A.

3.5.8 Access to ICT

The access to ICT of a respondent was measured on the basis of the farmers against the extent of his use of selected ten items by putting tick mark against any one of the two responses- if yes, given one and no given 0 and for which one given one score. The access to ICT of farmers score of the respondents ranged from 0 to 30 where, 0 indicates no access and 30 indicates very high access. Based on their access to ICT, the respondents were classified into three categories as low, medium and high access to ICT. This variable appears in item number 8 in the interview schedule as presented in Appendix-A.

3.5.9 Knowledge on CSA practices

Knowledge of the farmers towards CSA practices was measured on 10 basic open ended questions. Each question contains 2 marks. Knowledge of rural farmers was determined by summing up the weights for their responses to all the ten statements. Thus knowledge of the farmers towards CSA score of the respondents could range from 0 to 20, where zero (0) indicating no knowledge and 20 indicate sound knowledge. Based on their CSA knowledge, the respondents were classified into three categories as low knowledge, medium knowledge and high knowledge. This variable appears in item number 9 in the interview schedule as presented in Appendix-A.

3.5.10 Farmers perception on the effects of CSA

Ten relevant statements were carefully constructed to develop perception scale. The Likert scale was used to serve the purpose. A respondent was asked to indicate his/her degree of agreement about each of the statements along with a five-point scale as, strongly agree, agree, no opinion, disagree and strongly disagree. Scores were assigned to these five alternate responses as 5, 4, 3, 2, and 1 respectively for each positive statement. However, the score of a respondent was obtained by adding his/her scores for all the 10 statements. Thus, the perception score of a respondent could range from 0 to 50, where, 0 indicate unfavourable perception on the effects of climate smart agriculture and 50 indicates favourable perception on the effects of climate smart agriculture. This variable appears in item number 10 in the interview schedule as presented in Appendix-A.

3.6 Measurement of dependent variable

The procedure followed in measuring the dependent variable is presented below:

Adoption of CSA was the dependent variable of this study. It was measured on the basis of the extent of adoption following of 10 selected adoption practices by the farmers for three year namely, 2015, 2016 and 2017.

i. Use of Guti urea
ii. Integrated pest management (IPM)
iii. Green Manuring
iv. Mulching

v. Agro-Forestry
vi. social Forestry
vii. Flood resistant Variety
viii. Drought Resistant Variety
ix. Salt tolerant variety
x. Bio- fertilizer

Respondents were asked to response against three alternative choices at each of the 10 selected practices as low adoption, medium adoption, and high adoption and scores were assigned to those as following manure:

Level of adoption	Score
Low adoption	0
Medium adoption	1
High adoption	2

Adoption score was measured by summing up the scores of all the 10 selected practices of three years. Thus the adoption score of a respondents could range from 0 – 60, while 0 indicated no adoption and 60 indicated highly adoption.

3.7 Statement of the Hypotheses

In order to guide relevant data collection, analysis and interpretation of data, a set of hypothesis would be formulated for empirical testing. As defined by Goode and Hatt (1952), "Hypothesis is a proposition which can be put to test to determine its validity. It may seem contrary to, in accord with common sense. It may prove to be correct or incorrect. In any event, however, it leads to an empirical test." In broad sense, hypothesis may be divided into two categories, namely, research hypothesis (H_1) and null hypothesis (H_0). In studying relationships between variables an investigator first formulates research hypothesis which states anticipated relationships between the variables. On the other hand, for statistical test, it becomes necessary to formulate null hypothesis. A null hypothesis states that there is no contribution with the concerned variables. The following null hypothesis would be formulated to explore the relationship of the selected characteristics of the growers with their adoption of CSA.

There is no significant contribution with the selected characteristics of the growers and their adoption of CSA.

3.8 Instrument for Data Collection

In order to collect relevant information an interview schedule was carefully designed keeping the objectives of the study in mind. The interview schedule was designed in Bangla to ensure easy communication between the researcher and the respondent. The interview schedule initially prepared was pre-tested by administering the same to ten CSA farmers of the study area. The pre-test was helpful to identify faulty questions and statements in the draft schedule. Necessary additions, corrections alterations and adjustments were made in the schedule on the basis of the pre-test experience. The schedule was multiplied in its final form for the collection of data. An English version of the interview schedule has been presented in the Appendix I.

3.8.1 Collection of Data

The researcher himself collected data from the CSA farmers by using the interview schedule. The interviews were conducted individually in the houses of the respondents during their leisure period. Only ten CSA farmers of the original list were not available during interview and hence ten CSA farmers were replaced from the reserve list. Prior information was given to the respondents before going to them for interviewing. The researcher took all possible care to establish rapport with them. While any respondent faced difficulty in understanding any question, the researcher took utmost care to explain the issue. He obtained excellent cooperation from the respondents and others concerned during the time of interview. The entire process of collecting data took 30 days from February 20 to March 20, 2018.

3.8.2 Data Processing

A detail coding plan was prepared. Data were coded into a coding sheet. These were then compiled, analyzed in accordance with the objectives of the study. Qualitative data were converted into quantitative form by means of suitable scoring techniques for the purpose of analysis.

3.8.3 Categorization of respondents

For describing the various independent and dependent variables the respondents were classified into various categories. In developing categories, the researcher was guided by the nature of data and general consideration prevailing on the social system. The procedures have been discussed while describing the variable in the sub-sequent sections of next chapter.

3.9 Statistical Analysis

The analysis was performed using Statistical Package for Social Sciences (SPSS V 20) computer package. Descriptive analyses such as range, number, percentage, mean, standard deviation were used whenever possible. Multiple regression Coefficient of Regression (Y) test was done to find relationship. To find out the contribution of identified characteristics of the climate smart agriculture farmers, multiple regressions was used. Throughout the study, five per cent (0.05) level of probability was used as basis of rejecting a null hypothesis.

CHAPTER IV
RESULTS AND DISCUSSION

The recorded observations in accordance with the objective of the study were presented and probable discussion was made of the findings with probable justifiable and relevant interpretation under this chapter. The chapter content in three (3) sections. The first section of this chapter deals with the characteristics of the CSA farmers. The second section deals with the farmers adoption of climate smart agriculture. The third section deals with the contribution between individual characteristics of the farmers and their adoption of climate smart agriculture.

4.1 Selected Characteristics of the Farmers

In this section the findings of the farmers' selected characteristics have been discussed in Table 4.1. The selected characteristics are i) education ii) farm size iii) training received iv) organizational participation v) market access vi) access to finance vii) accessibility to extension services viii) access to ICT ix) knowledge on CSA and x) farmers perception on the effects of CSA.

Table 4.1 The salient features of the selected characteristics of the farmers

Categories	Measuring unit	Range		Mean	S.D
		Possible	Observed		
Education	Year of schooling	-	0.00-15	5.63	3.98
Farm size	Hectare	-	.02-4.0	1.43	1.07
Training received	No of days	-	20-28	22.58	1.49
Organizational participation	Score	0-30	17-25	20.58	1.98
Market access	Score	0 -6	3-6	4.29	.74
Access to finance	Score	0-30	12-24	17.85	3.33
Accessibility to extension services	Score	0-6	3-5	4.14	.73
Access to ICT	Score	0-30	12-25	19.56	2.95
Knowledge on CSA practices	Score	0-20	13-19	16.36	1.46
Farmers perception on the effects of CSA	Score	0-50	36-46	39.32	1.87

4.1.1 Education

The level of educational scores of the CSA farmers ranged from 0 to 15 with a mean and standard deviation of 5.63 and 3.98 respectively. Based on the educational scores, the respondents were classified into four categories such as illiterate (.0-.5), primary education(1 to 5), secondary education (6 to 10), above secondary (above 10). The distributions of the respondents according to their level of education are presented in Table 4.2.

Table 4.2 Distribution of the CSA farmers according to their level of education

Category	Range (years)		Respondents		Mean	SD
	Score	Observed	Number	Percent		
Illiterate	0-0.5	0-15	25	23.8	5.63	3.98
Primary level	1-5		29	27.6		
Secondary level	6-10		**37**	**39.1**		
Above Secondary level	10-15		14	13.3		
Total			**105**	**100**		

Table 4.2 shows that farmers under secondary education category constitute the highest proportion (39.1%) followed by the primary education (27.6%).On the other hand, the lowest (13.3%) above secondary education and (23.8%) illiterate category. Education broadens the horizon of outlook of farmers and expands their capability to analyse any situation related to climate smart agriculture.

4.1.2 Farm size

The farm size of the farmers scores ranged from 0.02 to 4.00 with a mean and standard deviation of 1.43 and 1.07 respectively. Based on their farm size, the respondents were classified into five categories following the categorization of DAE. These categories were marginal landless (≤ 0.02), marginal farm holder (0.021-0.20 ha), small farm holder (0.21-1.00 ha), medium farm holder (1.01 ha to 3.0 ha) and high farm holder (above 3.0 ha). The distribution of the potato farmers according to their farm size is presented in Table 4.3.

Table 4.3 Distribution of the CSA farmers according to their farm size

Categories	Range (Hectare-ha)		Respondents'		Mean	SD
	Score (ha)	Observed	Number	Percent		
Landless	≤0.02	0.02-4.00	6	5.7	1.43	1.07
Marginal	0.021-0.20		16	15.2		
Small	0.21-1.00		38	36.2		
Medium	1.01-3.0		**40**	**38.1**		
Large	>3		5	4.8		
Total			**105**	**100**		

Table 4.3 indicates that the medium farm holder constitutes the highest proportion (38.1 percent) followed by small farm holder 36.2 percent, whereas 15.2 percent was marginal farm holder. The findings of the study reveal that majority of the CSA farmers were small to medium sized farm holder. The average farm size of the farmers of the study area (0.92 ha) was higher than that of national average (0.60 ha) of Bangladesh (BBS, 2014). The farmer with marginal farm size has very little scope to experiment about new technologies as their earnings depend on mainly in agriculture.

4.1.3 Training received

Training received scores of the respondents were found to be varying from 20 to 28 days with the average of 22.58 and the standard deviation of 1.49. The farmers on the basis of training received score were classified into three categories namely low training received, medium training received, and high training received as shown in Table. 4.4.

Table 4.4 Distribution of the CSA farmers according to their training received

Categories	Range (No of days)		Respondents		Mean	SD
	Score	Observed	Number	Percent		
Low	≤ 21	20-28	30	28.6	22.58	1.49
Medium	22- 23		**48**	**41.9**		
High	Above 23		27	27.6		
Total			**105**	**100**		

Data presented in the Table 4.4, showed that the highest proportion (41.9%) of the respondents belonged to medium training received category as compared to 28.6%and 27.6% having low and high training received category respectively. Overwhelming majority (70.5 percent) farmers have low medium level training received. Who received training in any agricultural base they are more conscious about climate smart agriculture.

4.1.4 Organizational participation

The observed organizational participation score of the respondents ranged from 17 to 25. The mean score was 20.58 with the standard deviation 1.98. Based on the organizational participation scores, the respondents were classified into three categories namely, low participation, medium organizational participation and high organizational participation as shown in Table 4.5.

Table 4.5 Distribution of the CSA farmers according to their organizational participation

Categories	Range (score)		Respondents'		Mean	SD
	Score	Observed	Number	Percent		
Low	≤19	17-25	33	31.4	20.58	1.98
Medium	20-21		**41**	**39.1**		
High	Above 21		31	29.5		
Total			**105**	**100**		

Data contained in the Table 4.5, revealed that the majority (39.1%) of the farmers had medium organizational participation as compared to 31.4% and 29.5% having low and high organizational participation respectively. The majority of the farmers (70.5 percent) are in low to medium organizational participation. To know about climate smart agriculture organizational participation plays an important role.

4.1.5 Market access

The observed market access score of the respondents ranged from 3 to 6. The mean score was 4.29 with the standard deviation .74. Based on the market access scores, the respondents were classified into three categories namely „low market access" "medium market access" and "high market access" as shown in Table 4.6.

Table 4.6 Distribution of the CSA farmers according to their market access

Categories	Range (score)		Respondents'		Mean	SD
	Score	Observed	Number	Percent		
Low	≤ 3	3-6	17	16.2	4.29	0.74
Medium	4-5		**87**	**82.9**		
High	Above 5		1	0.9		
Total			**105**	**100**		

Data contained in the Table 4.6, revealed that the majority (82.9%) of the farmers had medium market access as compared to 16.2% and 0.9% having low and high market access respectively. The majority (99.1) percent of the farmers are in low to medium market access.

4.1.6 Access to finance

The observed access to finance score of the respondents ranged from 12 to 24. The mean score was 17.85 with the standard deviation 3.33. Based on the access to finance scores, the respondents were classified into three categories namely low access to finance, medium access to finance, and high access to finance as shown in Table 4.7.

Table 4.7 Distribution of the CSA farmers according to their access to finance

Categories	Range (score)		Respondents'		Mean	SD
	Score	Observed	Number	Percent		
Low	≤14	12-24	18	17.1	17.85	3.33
Medium	15-20		**52**	**49.6**		
High	Above 20		34	33.3		
Total			**105**	**100**		

Data contained in the Table 4.7, revealed that the majority (49.6%) of the farmers had medium access to finance as compared to 33.3% and 17.1% having high and low access to finance respectively. The majority (70.5%) of the farmers are in low to medium organizational participation.

4.1.7 Accessibility to extension services

Extension services scores of the farmers ranged from 3 to 5 with an average of 4.14 and standard deviation of 0.73. It was measured as one's extent of exposure with different information sources. On the basis of their extension services, the respondents classified into three categories namely, low contact, medium contact and high contact. The scale used for computing the extension services score of a respondent is given table 4.8.

Table 4.8 Distribution of the CSA farmers according to their extension services

Categories	Range (Score)		Respondents'		Mean	SD
	Score	Observed	Number	Percent		
Low	≤ 3	3-5	22	21.0	4.14	0.73
Medium	3-4		**46**	**43.8**		
High	Above 4		37	35.2		
Total			**105**	**100**		

Data contained in the Table 4.8, indicated that the highest proportion (43.8%) of the respondents had medium extension services as compared to 35.2% and 21.0% having high and low extension services respectively. It was assumed that the more

services an individual would have with different information sources, the more he becomes educated and knowledgeable. An extension services score was computed for each respondent on his extent of contact with 2 selected services.

4.1.8 Access to ICT

The observed access to ICT score of the respondents ranged from 12 to 25. The mean score was 19.56 with the standard deviation 2.95. Based on the access to finance scores, the respondents were classified into three categories namely low access to ICT, medium access to ICT, and high access to ICT as shown in Table 4.9.

Table 4.9 Distribution of the CSA farmers according to their access to ICT

Categories	Range (score)		Respondents'		Mean	SD
	Score	Observed	Number	Percent		
Low	≤17	12-25	32	30.5	19.56	2.95
Medium	18-21		**44**	**41.9**		
High	Above 21		29	27.6		
Total			**105**	**100**		

Data contained in the Table 4.9, revealed that the majority (41.9%) of the farmers had medium access to ICT as compared to 30.5% and 27.6% having low and high access to ICT respectively. The majority (72.4 percent) of the farmers are in low to medium access to ICT.

4.1.9 Knowledge on climate smart agriculture

The score of the knowledge on climate smart agriculture ranged from 13-19 with a mean and standard deviation of 16.36 and 1.46 respectively. On the basis of knowledge on climate smart agriculture farmers were classified into three categories such as, low knowledge, medium knowledge and high knowledge on climate smart agriculture. The distribution of the farmers according to their knowledge on climate smart agriculture scores is shown in the table 4.10.

Table 4.10 Distribution of the CSA farmers according to their knowledge on climate smart agriculture

Categories	Range (Score)		Respondents'		Mean	SD
	Score	Observed	Number	Percent		
Low	≤ 15	13-19	25	23.8	16.36	1.46
Medium	16-17		**56**	**53.3**		
High	Above 17		24	22.9		
Total			**105**	**100**		

Data presented in the Table 4.10 shown that the majority (53.3%) of the respondents had medium knowledge on climate smart agriculture while 22.9% had high knowledge and 22.8% of the farmers had low knowledge on climate smart agriculture. The majority (77.1%) of the farmers have medium to low knowledge on climate smart agriculture.

4.1.10 Farmers' perception on the effects of climate smart agriculture

The observed perception scores of the respondents ranged from 36 to 43. The mean scores were 39.32 with the standard deviation of 1.87. Based on their perception, the respondents were classified into three categories namely, unfavorable perception, neutral perception and favorable perception. The distribution of the farmers according to their perception shown in the Table 4.11

Table 4.11 Distribution of the CSA farmers according to their perception

Categories	Range (Score)		Respondents'		Mean	SD
	Score	Observed	Number	Percent		
Unfavorable	≤37	36-43	21	20.0	39.32	1.87
Neutral	38-40		**51**	**48.6**		
Favorable	Above 40		33	31.4		
Total			**105**	**100**		

Findings shown in the Table 4.11 revealed that the majority (48.6%) of the respondents had neutral perception while 31.4% and 20.0% having favorable to unfavorable perception categories. The majority (80%) of the farmers have neutral to highly perception about climate smart agriculture.

4.2 The Extent of Adoption of CSA

The observed adoption of CSA score of the respondents ranged from 45 to 54 against the possible range of o-60. The mean score was 49.36 with the standard deviation 2.19. Based on the adoption of CSA scores, the respondents were classified into three categories namely, low adoption, medium adoption, and high adoption as shown in Table 4.12.

Table 4.12 Distribution of the CSA farmers according to their adoption of CSA

Categories	Range (score)		Respondents'		Mean	SD
	Score	Observed	Number	Percent		
Low adoption	≤ 47	45-54	25	23.8	49.36	2.19
Medium adoption	48-51		**61**	**58.1**		
High adoption	Above 51		19	18.1		
Total			**105**	**100**		

Data contained in the Table 4.12, revealed that the majority (58.1%) of the farmers had medium adoption as compared to 23.8% and 18.1% having low and high adoption respectively. The majority (81.9 percent) of the farmers had in low to medium adoption.

4.3 The Contribution of the selected characteristics of the respondents to their adoption climate smart agriculture

In order to estimate the farmers adoption of climate smart agriculture, the multiple regression analysis was used which is shown in the Table 4.13**.**

Table 4.13 multiple regression coefficients of the contributing variables related to the determinants of the adoption of climate smart agriculture

Dependent variable	Independent Variable	β	P	R^2	Adj. R^2	F
Adoption of climate smart agriculture	Education	.113	.019*	0.477	0.421	8.56
	Farm size	-.068	.671			
	Training received	.157	.172			
	Organizational participation	.372	.000**			
	Market access	.032	.891			
	Access to finance	.047	.372			
	Accessibility to extension services	.142	.562			
	Access to ICT	.156	.013*			
	Knowledge on CSA	-.004	.973			
	Farmers perception on the effects of CSA	.280	.006**			

- ** Significant at p<0.01;
- *Significant at p<0.05

Table 4.13 shows that organizational participation, farmers perception on the effects of CSA, access to ICT and education were the main contributory factors for adoption of CSA of the respondents. Of these, organizational participation, and farmers perception on the effects of climate

smart agriculture were the most important contributing factors (significant at the 1% level of significant) and education and access to ICT (significant at 5% level of significant) while coefficients of other selected variables don't have any contribution on farmers adoption of climate smart agriculture.

The value of R^2 is a measure of how of the variability in the dependent variable is accounted by the independent variables. So, the value of R^2 = 0.477 means that independent variables accounts for 47% of the variation in farmers adoption of climate smart agriculture. The F ratio is 8.56 which is highly significant ($p<0$).

However, each predictor may explain some of the variance in respondents adoption of climate smart agriculture simply by chanced. The adjusted R^2 value penalizes the addition of extraneous predictors in the model, but values 0.421 is still show that variance is farmers adoption of climate smart agriculture can be attributed to the predictor variables rather than by chanced the suitable model (Table 4.13). In summary, the models suggest that the respective authority should be considers the farmers' education, organizational participation, access to ICT and farmers perception the effects of climate smart agriculture and in this connection some predictive importance has been discussed below:

4.3.1 Significant contribution of organizational participation to the farmers' adoption of climate smart agriculture

From the multiple regression, it was concluded that the contribution of organizational participation to the farmers adoption of climate smart agriculture was measured by the testing the following null hypothesis;

"There is no contribution of organizational participation to the farmers adoption of climate smart agriculture".

The following observations were made on the basis of the value of the concerned variable of the study under consideration.

a. The contribution of the organizational participation was significant at 1% level (.000)
b. So, the null hypothesis could be rejected.

c. The β-value of organizational participation is (0.372). So, it can be stated that as organizational participation increased by one unit, farmers adoption of climate smart agriculture increased by 0.372 units. Considering the effects of all other predictors are held constant.

Based on the above finding, it can be said that farmers had more organizational participation increased farmers adoption of climate smart agriculture. So, Organizational participation has high significantly contributed to the farmers adoption of climate smart agriculture.

4.3.2 Significant contribution of farmers perception on the effects of CSA to the farmers' adoption of climate smart agriculture

From the multiple regression, it was concluded that the contribution of farmers perception on the effects of CSA to the farmers adoption of climate smart agriculture was measured by the testing the following null hypothesis;

"There is no contribution of farmers perception on the effects of CSA to the farmers adoption of climate smart agriculture".

The following observations were made on the basis of the value of the concerned variable of the study under consideration.

a. The contribution of the farmers perception was significant at 1% level (0.006)
b. So, the null hypothesis could be rejected.
c. The β-value of farmers perception on the effects of CSA is (.280). So, it can be stated that as farmers perception on the effects of CSA increased by one unit, farmers adoption of climate smart agriculture increased by 0.280 units. Considering the effects of all other predictors are held constant.

Based on the above finding, it can be said that farmers had more perception on the effects of CSA increased adoption of climate smart agriculture. So, farmers perception on the effects of CSA has high significantly contributed to the farmers adoption of climate smart agriculture.

4.3.3 Significant contribution of access to ICT to the farmers' adoption of climate smart agriculture

From the multiple regression, it was concluded that the contribution of access to ICT to the farmers adoption of climate smart agriculture was measured by the testing the following null hypothesis;

"There is no contribution of access to ICT to the farmers adoption of climate smart agriculture".

The following observations were made on the basis of the value of the concerned variable of the study under consideration.

a. The contribution of the access to ICT was significant at 5% level (0.013)
b. So, the null hypothesis could be rejected.
c. The β-value of access to was (0.157). So, it can be stated that as access to finance increased by one unit, farmers adoption of climate smart agriculture increased by 0.157 units. Considering the effects of all other predictors are held constant.

Based on the above finding, it can be said that farmers had more access to ICT increased the adoption of climate smart agriculture. So, access to ICT has high significantly contributed to the farmers adoption of climate smart agriculture.

4.3.4 Significant contribution of education to the farmers adoption of climate smart agriculture

The contribution of education to farmers adoption of climate smart agriculture was measured by the testing the following null hypothesis;

"There is no contribution of education to the farmers adoption of climate smart agriculture.

The following observations were made on the basis of the value of the concerned variable of the study under consideration.

a. The contribution of the education was at 5% significance level (.019)
b. So, the null hypothesis could be rejected.
c. The β-value of level education is (0.113). So, it can be stated that as education increased by one unit, farmers adoption of climate change on agriculture increased by 0.113 units. Considering the effects of all other predictors are held constant.

Based on the above finding, it can be said that farmers education increased the farmers adoption of climate smart agriculture will increase. So, education has significantly contributed to the farmers adoption of climate smart agriculture.

CHAPTER V
SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

5.1 Major findings

5.1.1 Characteristics of the farmers

Education

The level of educational scores of the CSA farmers ranged from 0 to 15 with a mean and standard deviation of 5.63 and 3.98 respectively. Respondent under secondary education category constitute the highest proportion (39.1 percent) followed by primary (27.6 percent). On the other hand, the lowest 13.3 percent in above secondary category followed by illiterate category (23.8 percent).

Farm size

The farm size of the CSA farmers ranged from 0.02 ha to 4.00 ha with a mean and standard deviation of `1.43 and 1.07 respectively. The researcher found that the medium farm holder constitutes the highest proportion (38.1 percent) followed by small farm holder (36.2 percent), whereas 4.8 percent was large farm holder. The findings of the study reveal that majority of the CSA farmers were small to medium sized farm holder.

Training received

Training received score of the respondents ranged from 20 to 28 with an average of 22.58. Majority (41.9 %) of the respondents had medium training received followed by 23.8 percent and 27.6 percent had low training and high training exposure respectively.

Organizational participation

Organizational participation scores of the farmers ranged from 17 to 25.The average score being 20.58 with the standard deviation 1.98. The highest proportion (39.1 percent) of the farmers had medium organizational participation compared to 31.4 percent having low participation and 29.5 percent having high participation.

Market access

Market access score of the respondents ranged from 3 to 6 with an average of 4.29 and standard deviation of .74. Majority (82.9%) of the respondents had medium marker access followed by 16.2 percent and .9 percent had low market access and high market access respectively.

Access to finance

Access to finance score of the respondents ranged from 12 to 24 with an average of 17.85 and standard deviation of 3.33. Majority (81.9 %) of the respondents had medium access to finance followed by 17.1 percent low access to finance.

Access to extension services

The extension services scores of the farmers ranged from 3 to 5, against the possible ranged of 0 to 6. The average extension services was found to be 4.14 with the standard deviation of 0.73.The highest proportion (43.8%) of the respondents had medium extension services compared to 35.2 percent having high and 21.0 percent with low extension services.

Access to ICT

The access to ICT scores of the farmers ranged from 12 to 25, against the possible ranged of 0 to 30. The average access to ICT was found to be 19.56 with the standard deviation of 2.95.The highest proportion (41.9%) of the respondents had medium access to ICT compared to 30.5 percent having low and 27.6 percent with high access to ICT.

Knowledge on climate smart agriculture

Knowledge on climate smart agriculture scores of the farmers ranged from 13 to 19 against the possible range of 0 to 20 with average and standard deviation of 16.36 and 1.46, respectively. The highest proportion (53.3%) of the farmers had knowledge compared to 23.8 percent of them having low knowledge, and 22.9 percent had high knowledge.

Farmer's perception on the effects of CSA

Farmers perception on the effects of CSA scores of the farmers ranged from 36 to43 against the possible range of 0 to 50 with average and standard deviation of 39.32 and 1.87, respectively. The highest proportion (48.6.3 percent) of the farmers had neutral perception compared to 31.4 percent of them having favorable perception, and 20.0percent had unfavorable perception.

5.1.2 Farmers adoption of climate smart agriculture

Farmers adoption of climate smart agriculture scored varied from 45 to 54 with the mean and standard deviation of 49.36 and 2.19 respectively. On the basis of farmers' adoption of climate smart agriculture scores, the climate smart agriculture farmers were classified into three categories namely; low, medium and high adoption of farmers. Among the CSA farmers, the highest 58.1 percent CSA farmers belong to the group of medium and the lowest percentage 18.1 percent in high adoption followed by low (23.8 percent) by the CSA farmers in adoption of climate smart agriculture.

5.1.3 Contribution of the selected characteristics of the farmers' perception in adoption of CSA

There is a significant contribution of organizational participation and farmers' perception on the effects of CSA farmers and both of these were the most important contributing factors (significant at the 1% level of significance). Education and access to ICT were also the important contributing factors (significant at the 5% level of significance).

Adjusted R^2 = 0.477 of the variation in the CSA farmers changed adoption of CSA can be attributed to their farmer' level of education, organisational participation, access to ICT and farmers perception on the effects of CSA. The F value indicates that the model is significant ($p<0.000$). However, each predictor may explain some of the variance in adoption of climate smart agriculture farmers simply by chance. The adjusted R-square value penalizes the addition of extraneous predictors in the model, but values of 0.477 still show that the variance in adoption of climate smart agriculture can be attributed to the predictor variables rather than by chance.

5.2 Conclusions

Conclusion is the final decision or judgment, which is placed through contention at the end or termination of a research work. Conclusion should be so constructive that its words and contentions must draw the attention of the concerned individual/organizations. The findings and relevant facts of research work prompted the researcher to draw following conclusions:

i. Among the CSA farmers, the highest proportion (58.1 percent) belonged to the group of medium adoption compared to 18.1 percent and 23.8 percent in high and low adoption of climate smart agriculture respectively. Therefore, it may be concluded that there is scope to increase the extant of adoption of CSA by the farmers.

ii. Organizational participation of the farmers had the highest contribution to adoption of CSA farmers in Chuadanga district. It is therefore, concluded that if the organizational participation increases the adoption of climate smart agriculture will increase.

iii. Farmers perception on the effects of CSA had the 2nd highest contribution to the adoption of climate smart agriculture in the study area. The majority (80%) of the farmers had neutral to favorable perception about climate smart agriculture.It is therefore concluded that if the farmers perception is increase, the adoption of climate smart agriculture will increase.

iv. Access to ICT had the 3rd highest contribution to the farmers adoption of climate smart agriculture. The majority (72.4 percent) of the farmers had low to medium access to ICT. If access to ICT increased adoption of climate smart agriculture will also increase.

v. Education was the next contributor to the farmers' adoption of climate smart agriculture. It also showed that (66.9%) of the respondents had primary to secondary level of education. The result concluded that any arrangement made to increase of education will increase the farmers adoption of climate smart agriculture.

5.3 Recommendations

5.3.1 Recommendations for policy implications

On the basis of observation and conclusions drawn from the findings of the study following recommendations are made to the planners and policy makers in contriving micro or macro level policy for increasing of crop production:

i. Among the CSA farmers, the highest proportion (58.1 percent) belonged to the group of medium adoption compared to 18.1 percent and 23.8 percent in high and low adoption of climate smart agriculture respectively. It is, therefore, recommended that an effective step should be taken by the concerned authorities like Department of Agricultural Extension (DAE), Non-Government Organizations (NGOs) and others for strengthening the respondents qualities to increase the adoption of climate smart agriculture to a higher degree.

ii. Organizational participation was the highest contributor to adoption of CSA of the farmers. It is therefore, recommended that attempt should be taken by the concerned authorities to increase the organizational participation of the farmers' by regular contact with them.

iii. Farmers' perception on the effects of CSA had the 2nd highest contribution to the adoption of climate smart agriculture. The majority (80%) of the farmers had neutral to highly perception about climate smart agriculture. It is therefore, recommended that attempt should be taken by the concerned authorities to increase the farmers' perception by motivational campaign.

iv. Access to ICT had the 3rd highest contribution to the farmers adoption of climate smart agriculture.It is therefore recommended that, policies should be taken to engage farmers' with diversified ICT to broaden their knowledge in CSA. GOs and NGOs can also play a vital role in this regard.

v. Education was the next contributor to the farmers' adoption of climate smart agriculture.Findings also showed that majority (66.9%) of the respondents had primary to secondary level of education. Bureau of Non-formal Education (BNFE) and NGOs can take necessary steps to increase farmers' primary level of education through non-formal education (adult education) and regular farmers' training, workshop, to broaden their knowledge.

5.3.2 Recommendations for further study

i. Adoption of CSA farmers were conducted in one selected union of Chuadanga district. Findings of the study may be verified by similar research in other areas of Bangladesh.

ii. The study examined the effects of 10 selected characteristics of the farmers. Therefore, it is recommended that further research may be undertaken involving other variables in this regard.

iii. In this research the author conducted his survey in only CSA category farmers. So, further study can be taken with others farmers group or/and compare among these group.

iv. In the present study farm size, training received, market access, accecc to finance and accessibility to extension services had no contribution with their adoption of CSA. In this connection, further verification is necessary Researcher will have opportunity or scope to identify the factors causing hindrance towards adaptation of farming practices by farmers in agriculture.

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Appendix - I

An English Version of Interview Schedule

Department of Agricultural Extension and Information System

Sher-e-Bangla Agricultural University, Dhaka-1207

An Interview Schedule for the Study Entitled

DETERMINANTS OF THE ADOPTION OF CLIMATE SMART AGRICULTURE

Name of the respondent: …… Serial No: ……

Union: …….

Village: ……..……..….

(Please provide following information. Your information will be kept confidential and will be used for research purpose only)

1. Education

What is the level of your education?

a. Do not know reading and writing [ ]
b. Do not know reading and writing, but can sign [ ]
c. Read up to class (actual year of schooling) [ ]

2. Farm Size:

Which one of the following categories best describes your farm size?

a. Landless (<0.02 ha of land) [ ]
b. Marginal (0.02-<0.2 ha of land) [ ]
c. Small (0.2-<1 ha of land) [ ]
d. Medium (1-<3 ha of land) [ ]
e. Large (> 3 ha of land) [ ]

3. Training received: Did you attend any training? Yes / No. If yes, please give the following information.

Sl. No.	Subject of training	Sponsoring agency	Duration(days) (max.5)
1	Use of guti urea		
2	Use of IPM		
3	Use of green manuring		
4	Use of mulching		
5	Use of AWD (alternative witting and drying)		

4. Organizational participation: Please mention the nature and duration of your participation (past and/present) with the following organizations.

SL. NO	Organization	No participation (0)	Nature and duration (year)		
			Ordinary Member (1)	Executive committee member (2)	Executive committee officer(president, secretary) (3)
1	BRAC				
2	ASA				
3	PROSHIKA				
4	Grameen Bank				
5	Ganasastha Kendra				
6	Swanirvor Bangladesh				
7	Palli Mangal Karmasuchi				
8	TMSS				
9	RDRS				
10	Mass Education				

5. Market access – buying

1	Do you buy some of your items from producers?	Yes	No	If yes, for which ones?(max. 1)	
2	Are there items, which you can only access from one available producer?	Yes	No	If yes, which items?(max. 1)	
3	Do you have any agreement or binding documents with the seller/provider?	Yes	No	If yes, describe your agreement with the buyer, e.g. the time the contract is made, how you are paid(max. 1)	

Market access – selling

4	Do you sell/trade some of those items directly to consumers?	Yes	No	If yes, which ones? (e.g.c hickens, sorghum, millet)	
5	Do you have any product with only one available buyer?	Yes	No	If yes, for which products?	
6	Do you have any agreement or binding documents with the buyer?	Yes	No	If yes, which products?	

6. Access to finance

SL. N0.	Medium	Sustained(3)	Intermittent (1)	No access (0)
1	Family			
2	Friends			
3	Neighbors			
4	Bank			
5	Co-operative			
6	Microfinance			
7	Loan company			
8	Govt. program			
9	NGO programs			
10	Remittance			

7. Accessibility to extension services

Please mention the extent of extension contact in the last year

SL. NO.	Query	Extent of extension contact in the past year			
		No visit (0)	Once (1)	2 to 3 times (2)	4 times &above (3)
1	Extension officers (SAAO) visit to				
2	Farmers visits to extension officers				

8. Access to ICT

SL. No	Technologies	Do you use		**Do you own**		What do you use for? (max.1)
		Yes (1)	No(0)	Yes (1)	No (0)	
1	Mobile					
2	Internet connection					
3	Television					
4	Radio					
5	Computer					
6	Telephone					
7	News Paper					
8	NGO worker					
9	Senior person					
10	Neighbor					

9. Knowledge on CSA practices

Please answer the following question

SL. NO	Questions	Full Marks	Marks Obtained
1	What do you mean by CSA (Climate Smart Agriculture)?	(2)	
2	Mention two examples of CSA practices	(2)	
3	How to use green manure in crop cultivation?	(2)	
4	What are the benefits of guti Urea?	(2)	
5	What are the advantages of AWD (Alternative Wetting and Drying)?	(2)	
6	What do you mean by flood resistant variety,,?	(2)	
7	What is zero tillage?	(2)	
8	What is the benefit of Agro-forestry?	(2)	
9	What are the advantages of IPM?	(2)	
10	What do you mean by drought resistant variety?	(2)	

10. Farmers' perception on the effect of CSA

Please indicate your opinion on the following harmful effect of chemical pesticide in crop production on environmental pollution:

SL. NO	Farmers perception	Extent of farmer"s perception				
		Strongly agree (5)	Agree (4)	No opinion (3)	Disagree (2)	Strongly disagree (1)
1	CSA is needed for poverty					
2	CSA is needed for attaining the food security.					
3	CSA is important for					
4	CSA is needed to adverse condition.					
5	CSA is needed to enhance					
6	CSA is needed productivity.					
7	CSA is needed to emotion mitigate GHGs					
8	CSA is needed to fulfill					

	food.					
9	CSA is needed to adapt with the competition of resources					
10	CSA is needed to control temperature.					

11. Adoption of CSA

Practices	2017			2016			2015		
	No Adopti-on (0)	Partial Adopti-on (1)	Fully Adopti-on (2)	No Adopti-on (0)	Partial Adopti-on (1)	Fully Adopti-on (2)	No Adopti-on (0)	Partial Adopti-on (1)	Fully Adoption (2)
1. Guti Urea									
2. IPM									
3.Green Manuring									
4. Mulching									
5.Agro-Forestry									
6.social Forestry									
7.Flood resistant Variety									
8.Drought Resistant Variety									
9.Salt tolerant variety									
10.Bio-fertilizer									

Thanks for your kind co-operation

Dated: (Signature of the interviewer)