

**SOCIO-ECONOMIC DETERMINANTS OF ADOPTION OF
SUNFLOWER PRODUCTION BY THE FARMERS OF
PATUAKHALI SADAR UPAZILA**

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SUNFLOWER PRODUCTION BY THE FARMERS OF
PATUAKHALI SADAR UPAZILA**

by

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CERTIFICATE

This is to certify that the thesis entitled, “**Socio-Economic Determinants of Adoption Of Sunflower Production by the Farmers of Patuakhali Sadar Upazila**” submitted to the Faculty of Agriculture, Sher-e-Bangla Agricultural University, Dhaka in partial fulfilment of the requirements for the degree of **Master of Science (MS) in Agricultural Extension**, embodies the result of a piece of bona-fide research work conducted by **ISRAT JAHAN, Registration no. 15-0700** under my supervision and guidance. No part of this thesis has been submitted for any other degree or diploma.

I further certify that any help or source of information, received during the course of this study has been dully acknowledgement by him.

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**Devoted
to My
Beloved
Parents**

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ABBREVIATION AND ACRONYMS

BBS	Bangladesh Bureau of Statistics
GDP	Gross Domestic Product
HYV	High Yielding Variety
USA	United State of America
FAO	Food and Agriculture Organization
MoA	Ministry of Agriculture
GoB	Government of Bangladesh
BINA	Bangladesh Institute of Nuclear Agriculture
RDRS	Rangpur Dinajpur Rural Service
IPM	Integrated Pest Management
UAO	Upazila Agriculture Officer
SAAO	Sub-Assistant Agriculture Officer
SPSS	Statistical Package for Social Sciences

SOCIO-ECONOMIC DETERMINANTS OF ADOPTION OF SUNFLOWER PRODUCTION BY THE FARMERS OF PATUAKHALI SADAR UPAZILA

ABSTRACT

The major thrust of this study were to determine and describe the socio-economic determinants of sunflower growers, determine the extent of adoption of different practices of sunflower by the growers, explore the contribution of the socio-economic determinants of adoption of different practices of sunflower by the growers. Data were collected from randomly selected 113 sunflower farmers of five blocks of five union under Patuakhali sadar upazila. The selected five (05) blocks namely Bollovpur, Birajala, Morichbunia, kewabunia, Bara Auliapur by using an interview schedule during 17 September to 25 September, 2018. The highest proportion (69.1 percent) of the sunflower growers fell under the medium adoption category, while 21.2 percent had high adoption and 9.7 percent had low adoption of sunflower production technologies. Thus, an overwhelming majority (90.3 %) of the sunflower farmers had medium to high adoption of improved sunflower production technologies. Among the ten hypothesized relationships, five (5) variables namely knowledge, education, family size, extension media contact and organizational participation were found significantly contribution to the adoption of improved practices of sunflower production (Table 4.13) while rest of the variables showed no significant contribution. All the factors jointly contribute 73.7% of the variance of the adoption ($R^2 = 0.737$). Which were; age, farm size, land under sunflower cultivation, profitability from sunflower production, training in sunflower production technology had no significant contribution.

CHAPTER I

INTRODUCTION

1.1 General Background

At present, sunflower (*Helianthus annuus*) production is one of the agricultural activities practiced in some parts of Bangladesh. Despite its relatively small share of the total GDP, primary agriculture is an important sector in the Bangladesh economy. It remains a significant provider of employment, especially in the rural areas, and a major earner of foreign exchange. According to FAO (2004), it has been observed that sunflower was grown in about 21.39 million hectares of land with production of 26.21 million tons during 2004 in the world. Russia was the largest producer of sunflower occupying 21.03 per cent of area with 16.41 per cent of production in the world during the same period. The other major sunflower producing countries were Ukraine (12.97 per cent), Argentina (11.83 per cent), China (7.17 per cent), Romania (6.56 per cent), France (5.56 per cent), India (4.77 per cent), Hungary (4.27 per cent), USA (4.14 per cent) and Spain (3.09 per cent) during the same period.

Oilseed sector occupies a unique position in Bangladeshi agriculture. The country is one of the largest producers and exporters of oilseed in the world, 1-2 per cent of world's oilseed production (BBS, 2011). The production of oilseed during 2007-08 was 2.93 million tones and rose to 4.53 million tons in 2011-12 (BBS, 2013). This gap is filled up by importing from other nations. The importance of oilseed arises from the fact that it is the chief source for supply of fat to the human beings and oil cake to the domesticated animals. Among the oilseed crops, groundnut, sunflower, safflower, rapeseed-mustard, sesame, niger and soybean are the major ones. Bangladesh in the mid-1990s had almost attained self-sufficiency in the production of oilseeds to extract vegetable oil, which are essential in the Bangladeshi diet.

As per statistics given by the Ministry of Agriculture (MoA) of Government of Bangladesh (GoB), the Patuakhali occupies fifth and sixth position in term of total oilseed production in the country in 2010-11 and 2011-12, respectively. However, sunflower dominates the oil seed sector in Patuakhali district. It is registered as the highest sunflower producing state in the country. In 2011-12, the state produced 38 percent of country's total sunflower oilseed. Sunflower crop is a drought tolerant crop and suitable for dry land farming. This made Patuakhali on the top in term of

sunflower cultivation in the country. Unfortunately, despite the state's contribution of sunflower crop in the country, the yield rate of this crop is relatively lower than the national level. This clearly indicates that the state has got the room to improve the production and productivity of sunflower crop in the country. This is the area where we need to emphasize on the adoption of improved practices of sunflower production.

Sunflower production has emerged as a major source of income in Patuakhali. Apart from earning income it is used for both domestic and foreign consumption. Sunflower production is one of the rising crops which have gained significance in the recent years. Sunflower production is relatively easier compared to other oil crops such as mustard oil and groundnuts; however its low yield at the study area demands to revisit the sunflower production status at the locale. Hence, this researcher undertook the study entitled, "socio-economic determinants of adoption of sunflower by the farmers of Patuakhali sadar upazila"

1.2 Statement of the Problem

The purpose of the study had an understanding of the socio-economic determinants of adoption of sunflower production by the farmers of Patuakhali sadar upazila". Moreover, since various characteristics of an individual are likely to have an influence on the socio-economic determinants of adoption of sunflower by the farmers of Patuakhali sadar upazila", it would be necessary to ascertain the associations and contributions of such factors with respect to the adoption. Therefore, examining the associations and contributions of a set of personal, socio-economic and socio-psychological characteristics of the sunflower growers with their adoption of sunflower would be considered pertinent to the study. In view of the above background and facts, the present study was undertaken with the title "socio-economic determinants of adoption of sunflower production by the farmers of Patuakhali sadar upazila ".

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

- i. What are the socio-economic determinants of sunflower growers?
- ii. What is the extent of adoption of different practices of sunflower cultivation by the growers?
- iii. What is the contribution of the socio-economic determinants of the growers to their extent of adoption of different practices of sunflower cultivation?

1.3 Objectives of the Study

Based on the issue explanations made in area 1.2, the accompanying research goals were detailed to direct the research. The following specific objectives were set forth in order to proper direction to the study:

- i. To determine and describe the socio-economic determinants of sunflower growers,
- ii. To determine the extent of adoption of different practices of sunflower by the growers,
- iii. To explore the contribution of the socio-economic determinants of adoption of different practices of sunflower by the growers,

1.4 Justification of the Study

Sunflower cultivation is getting popularity among the farmers of Bangladesh by the introduction of new hybrid varieties coupled with growing market demand as well as poultry feed have opened a tremendous potentiality of sunflower. The government is also supporting this growth. Needless to say that research is necessary to determine pattern of diffusion of sunflower cultivation in order to formulate long-term strategy on sunflower production. As no research in the field of adoption of this technology has been identified so far, the researcher deemed it a timely necessity to undertake the present study.

1.5 Scope and Limitations of the Study

The main focus of the study was to determine adoption of sunflower cultivation. The findings of the study will be specifically applicable to Patuakhali sadar upazila. 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 adoption. These will be of special interest to the policy makers and planners in formulating and redesigning the extension programmers especially for sunflower cultivation. 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 peoples.

1.6 Assumptions of the Study

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

- ❖ The responses furnished by the respondents were reliable. They expressed the truth about their opinion and interest.
- ❖ The researcher who acted as interviewer was adjusted to social and environmental conditions of the study area. Hence, the data collected by her from the respondents were free from bias.
- ❖ The respondents included in the sample for this study were competent enough to furnish proper responses to the queries included in the interview schedule.
- ❖ Views and options furnished by sunflower growers included in the sample selected those of the population of the study.

1.7 Limitation 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:

- ❖ Populations for the present study were kept confined within the heads of the sunflower growing farm families as because they were the major decision makers in the adoption of sunflower cultivation.
- ❖ Characteristics of sunflower growers 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.
- ❖ The study was confined mainly to socio-economic determinants of adoption of sunflower by the farmers of Patuakhalisadarupazila.
- ❖ Facts and figures were collected by the investigator applied to the present situation in the selected areas.

1.8 Definition of the Terms

This study intended to determine extension professionals' intention to use social media for sharing agricultural information, and the salient factors that might affect

their social media use behavior. Before further discussion, some key concepts and definitions of the terms are presented in this section.

Adoption: Adoption is the implementation of a decision to continue the use of an innovation. According to Rogers (1995) “adoption is a decision to make full use of an innovation as the best course of action available”. When an individual takes up a new idea as the best course of action and practice it, the phenomenon is known as adoption (Ray, 1991). In this study, adoption was defined as the phenomenon of taking up a new idea (sunflower) and put it into practices by the farmers of Patuakhalisadarupazila.

Knowledge in sunflower cultivation: It referred to awareness of the rural farmers of land preparation, sowing time, sowing method, fertilizer and irrigation management, pest control, harvesting method, storage method, etc.

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.

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

Farm size: It referred to the total area on which a farmer’s family carries on farming operation. The area is estimated in terms of full benefit to the farmer’s family.

Technology: The combination of all the management practices used for producing and otherwise managing of a given crop, crop mixture, livestock and other farm activities.

Sunflower production technologies: Sunflower production technologies referred to the different kind of technologies which were used for sunflower cultivation. In this study, technology was defined as the combination of four practices (i.e. variety, intercropping, recommended dose of urea and use of Sheller) used for sunflower cultivation.

Training exposure: It referred to the total number of days that a respondent received training in his entire life from different organizations under different training programme.

Problem faced: Problem faced refers to different problems faced by the farmers during sunflower cultivation.

Sunflower Cultivation: Sunflower cultivation referred as the cultivation of sunflower with the uses of method or technique viz. sowing method, application of fertilizer, use of varieties etc.

CHAPTER II

REVIEW OF LITERATURE

The intent of this chapter is to review the after-effects of a portion of the past examinations and prominent articles having pertinence to this investigation. The researcher made and elaborated search of available literature for this research. But no study could be found to be specially undertaken in this direction. Therefore, attempt has been made in the present chapter to review some interlinked literature on this aspect from home and abroad. The interlinked reviews conveniently presented on the major objectives of the study as far as possible. This chapter is divided into three major sections. The first section deals with review of relevant literature regarding adoption of modern sunflower cultivation by the farmers. The second section deals with past research findings relating to the relationship of farmers' adoption behavior with their selected characteristics. The conceptual framework of the study is presented in the third section.

2.1 Review of Relevant Literature on Technology Adoption

Hussen (2001) conducted investigation on adoption of modern sugarcane cultivation practices by the farmers of Daweangonjupazila in Jamalpur district. The study revealed that about ninety one percent (91 percent) of the farmers had medium adoption compared to 7 percent having low adoption and only 2 percent having high adoption of modern sugarcane cultivation practices.

Rahman (2001) conducted an investigation on knowledge attitude and adoption of Aalok-6201 hybrid rice by the farmers of sadarupazila in Mymensingh district. The study revealed that the majority (75 percent) of the farmers had medium adoption while 18 percent and 7 percent had high and low adoption in Aalok-6201 hybrid rice cultivation respectively. Islam (2002) conducted a study on adoption of modern agricultural technologies by the farmers of Sandwip. The study revealed that 69 percent of the farmers had medium adoption while 13 percent had low adoption and 18 percent had high adoption of modern agricultural technologies.

Podder (1999) concluded a research study on the adoption of Mehersagar Banana by the farmers. He found 47 percent of the respondents had medium adoption compared to 14 percent having low and 39 percent high adoption.

Rahman (1999) conducted an investigation on adoption of balanced fertilizer by the farmers of Ishargonjupazila in Mymensingh district. The study revealed that the majority (71 percent) of the respondents had medium adoption compared to 29 percent having below optimum level.

Chowdhury (1997) conducted an investigation on adoption of selected BINA technologies by the farmers of Boura union in Mymensingh district. The study revealed that the majority (53 percent) of the respondents had no adoption of BINA technologies and 42 percent were adopted BINA technologies.

Sarker (1997) studied the extent of adoption of improved sunflower cultivation practices by the farmers in Comilla district. The study revealed that more than half (55 percent) of the respondents had medium adoption compared to 23 percent having low adoption and 22 percent high adoption of improved sunflower cultivation practices.

Akanda (1995) studied the adoption of recommended dose of fertilizer and found that 36.64 percent respondents used recommended dose of urea 6.93 percent used recommended dose of MP, 11.88 percent used T.S.P and only 2 respondents used gypsum in their sunflower cultivation.

Muttaleb (1995) studied the extent of the adoption of improved technologies of sunflower cultivation by the farmers in Haibatpur union under sadarthana of Jessore district. The study revealed that 8 percent of the sunflower growers had high adoption of improved technologies, 43 percent has medium and 49 percent had low adoption.

Hoque (1993) conducted an investigation on the adoption of improved practices of sugarcane cultivation in Sreepurupazila of Gazipur district. The study revealed that 31 percent of the sugarcane growers had high adoption while 37 percent had medium and 32 percent had low adoption of improved practices in sugarcane cultivation.

Nikhadeet *al.* (1993) observed on adoption of improved practices of soybean cultivation that cent percent adopted improved varieties. More than 82 percent had adoption of package practices like line sowing, spacing and intercultural operations. Partial adoption was observed in majority of the soybean growers (74.6 percent) with regard to recommended seed rate.

Hossain (1991) studied the extent of adoption behavior of contact wheat growers in sadarupazila of Jamalpur district. He found that more than half (52 percent) of the

growers had medium adoption of improved farm practices compared to 34 percent having low adoption and only 14 percent high adoption.

Bembridge and Williams (1990) studied the personal, sociological, socio-psychological and communication characteristics that influence the adoption of maize practice in Farmer Support Programme in South Africa. The study revealed less than 50 percent of the farmers who adopted practices were implementing them according to recommendations and many did not have a clear concept that the practices were interrelated.

Kariuka (1990) studied the economic impact of the adoption of hybrid maize in Swaziland. The study revealed the sensitivity of hybrid maize adoption to different farming systems and the limited usefulness of a partial analysis in evaluating the impact of innovations.

Rai Grover and Gangwar (1989) conducted a study on identifying factors responsible for acreage substitution and low yield of maize. This study showed a general downward trend in area and productivity of maize in Haryana, India. It argued that maize acreage in given year was influenced by size of irrigated area, lag year maize acreage and lag year relative income.

2.2 Review of the Literature Concerning the Relationship between Farmers' Characteristics and their Adoption

2.2.1 Age and adoption

Islam (2002) conducted a study on adoption of modern agricultural technologies by the farmers of Sandwip. He found that age of the farmers was not related to their adoption of modern agricultural technologies.

Aurangozeb (2002) conducted a study on adoption of integrated homestead farming technologies by the rural women in RDRS. He found that there was a significant negative relationship between age and adoption of integrated homestead farming Technologies.

Sardar (2002) conducted a study on adoption of IPM practices by the farmers under PETRRA project of RDRS. He found that age of the farmers had a negatively significant relationship with their adoption of IPM practices.

Rahman (2001) observed that there was no significant relationship between age and adoption of Aalok-6201 hybrid rice cultivation practices. Podder (1999) and Hossain (1999) are found similar results in their respective studies.

Hussen (2001) conducted a study, which concluded that age of the sugarcane growers had a significant negative relationship with their adoption of modern sugarcane cultivation practices. Rahman (1999) also found similar result in this study.

Chowdhury (1997) observed that the age of the farmers had no significant relationship with their adoption of selected BINA technologies.

Sarkar (1997) observed that there was no significant relationship between age of the farmers and their adoption of improved sunflower cultivation practices. Similar findings were observed by Singh (1989) and Kher (1992) in their respective studies.

Hamid (1995) conducted a study on adoption of recommended sugarcane cultivation practices by the farmers. He found that age had a significant negative relationship with the adoption of recommended sugarcane cultivation practices.

2.2.2 Education and adoption

Islam (2002) conducted a study on adoption of modern agricultural technologies by the farmers of Sandwip. He found that education of the farmers had a positive significant relationship with their adoption of modern agricultural technologies.

Sardar (2002) conducted a study on adoption of IPM practices by the farmers under PETRRA project of RDRS. He found that education of the farmers had a positive significant relationship with their adoption of IPM practices.

Aurangozeb (2002) conducted a study on adoption of integrated farming technologies by the rural women in RDRS. He found that there was a positive relationship between education and their adoption on integrated farming technologies.

Hussen (2001) conducted a study on farmers' knowledge and adoption of modern sugarcane cultivation practices. He found that education of the growers had a positive significant relationship with their adoption of modern sugarcane cultivation practices.

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

Chowdhury (1997) found a positive significant relationship between the education of the farmers and their adoption of selected BINA technologies.

Similar results were found by Barkatullah (1985), Ali *et al.* (1986), Hoque (1993), Bashir (1993) Khan (1993), Pal (1995) and Sarkar (1997) in their respective studies.

Krishna (1969) conducted a research study on the adoption of hybrid maize in Karimnagar, India. He found significant negative relationship between the education of the respondents and their adoption of hybrid maize.

2.2.3 Farm size and adoption

Islam (2002) conducted a study on adoption of modern agricultural technologies by the farmers of Sandwip. He observed that farm size of the farmers had a positive significant relationship with their adoption of modern agricultural technologies by the farmers under PETRRA project of RDRS. He found that farm size of the farmers had a positive significant relationship with their adoption of IPM practices.

Aurangzeb (2002) conducted a study on adoption of integrated homestead farming technologies by the rural women in RDRS. He found that there had no relationship between homestead area and their adoption of integrated homestead farming technologies.

Rahman (2001) conducted an investigation on knowledge, attitude and adoption of Aalok-6201 hybrid rice by the farmers of sadar upazila in Mymensingh district. He observed that there was a significant positive relationship between farm size of the farmers and their adoption of Aalok-6201 hybrid rice.

Hussen (2001) conducted an investigation on adoption of modern sugarcane cultivation practices by the farmers of Dewanganj upazila in Jamalpur district. He observed that there was a significant positive relationship between farm size of the farmers and their adoption of modern sugarcane cultivation practices.

Chowdhury (1997) conducted a research on adoption of selected BINA technologies by the farmers. He indicated that farm size of the farmers had a strongly positive significant relationship with their adoption of selected BINA technologies.

Rahman (1986), Okoro *et al.* (1992), Khan (1993), Hoque (1993) and Sarkar (1997) observed similar results in their respective studies.

2.2.4 Family size and adoption

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

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

Hossain (1999) conducted a study to determine the farmers' perception of the effects of agro-chemicals on environment. He found no relationship between the farmer's family sizes with their adoption of fertilizer.

Chowdhury (1997) conducted a research study on adoption of selected BINA technologies by the farmers of Boira union in Mymensingh district. He observed that family size of the farmers had positive and significant relationship with the adoption of selected BINA technologies.

Hossain (1991) in his study in sadarthana of Jamalpur observed that family size of the farmers had no significant effect on their adoption of improved farm practices. Similar results were observed by Sobhan (1975), Hoque (1993), Bashar (1993),

Hossain (1999) also found that family size of the farmers had positive significant relationship with the adoption of agro-chemical. Similar results were also observed by Pal (1995), Muttalab (1995), Sarker (1997), Chowdhury (1997), Rahman (1986), Hoque (1993) and Khan (1993).

2.2.5 Land under sunflower cultivation

No findings were noticed on this aspect to the researcher at the time of reviewing literature. However, considering the findings of others studies, this study assuring that farmers having large land size will motivate to cultivate sunflower more than marginal farmers.

2.2.6 Profitability from sunflower cultivation

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

2.2.7 Training 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.

2.2.8 Extension contact and adoption

Bezborra (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.

Osunloogunet *al.* (1986) studied adoption of improved agril. Practices by cooperative farmers in Nigeria. The findings of the study indicated a positive relationship between extension contact and adoption of improved practices.

Rahman (1986) conducted a study on correlates of adoption of improved practices in transplanted aman rice by the farmers. He observed a significant and positive relationship between the farmers' extension contact and their adoption of improved practices in transplanted aman rice.

Heong (1990) observed that the lack of adoption of IPM technologies in rice was frequently attributed to lack of sufficient extension.

Juliana *et al.* (1991) found that mass media exposure of the farmers were positively associated with their extent of adoption of integrated pest management practices.

Singh (1991) observed in his study that mass contact of the farmers had significant relationship with their level of adoption of plant protection measures.

Alam (1997) studied the use of improved farm practices of rice cultivation by the farmers of Anwara Thana of Chittagong district. The study indicated no significant relationship of extension contact of the farmers with their use of improved farm practices in rice cultivation. Rahman (2001) conducted a study on knowledge, attitude and adoption of the fanners 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 of Aalok 6201 hybrid rice.

Sardar (2002) concluded that the extension contact had positively significant relationship with their adoption of IPM practices. Haque (2003) concluded that

extension contact of the farmers had a significant positive relationship with their adoption of modern maize cultivation technologies.

Hossain (2003) concluded that communication exposure of the farmers had a significant and positive relationship with their adoption of modern Boro rice cultivation. Hossain (2006) concluded that the extension contact of the farmers had positive significant relationship with their adoption of selected HYV rice.

2.2.9 Organizational participation and adoption

Hossain (1971) study revealed a positive significant relationship of organizational participation of the farmers with their adoption of recommended doses of fertilizers and plant protection measures. Similar result was also reported by Hossain (1991).

Hossain (1983) in his study found that organizational participation of transplanted aman growers had no relationship with their adoption of HYV rice. Balasubramanian and Kaul (1985) studied adoption of improved practices by fish trawler owners in Kerala. The study indicated no relationship between organizational participation and adoption of improved practices. Similar finding was also observed by Alam (1997), Khan (1993) and Space (1993). Rahman (1995) in his study found that organizational participation of sunflower growers had no relationship with their knowledge regarding improved practices of sunflower cultivation. Hossain (2000) found insignificant relationship between organizational participation of the farmers and their knowledge on Binadhan-6.42. Hossain (2003) concluded that organizational participation of the farmers had no significant relationship with their adoption of modern Boro rice cultivation. Hossain (2006) revealed that organizational participation of the farmers had no significant relationship with their adoption of HYV rice.

2.2.10 Knowledge and adoption

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

2.3 The Conceptual Framework of the Study

Adoption is a decision to make full use of innovation as the best course of action available (Ray, 1991). When an individual takes up a new idea as the best course of action and practices, this phenomenon is known as adoption. The present study tried

to focus two concepts: first adoption of sunflower production technologies by the farmers and the second their selected characteristics. A dependent variable may be influenced and affected through interacting forces of many characteristics in his surroundings. It is impossible to deal with all characteristics in a single study.

The conceptual framework of Rosenberg and Hovland (1960) was kept in mind while framing the structural arrangement for the dependent and independent variables. This study expected that farmers' adoption of sunflower cultivation as dependent variable, which was influenced by selected characteristics of the farmers as independent variables viz. age, education, farm size, family size, land under sunflower cultivation, profitability from sunflower production, training in sunflower production technology, extension media contact and knowledge on improved practices of sunflower cultivation. The conceptual model of the study has been presented in figure 2.1.

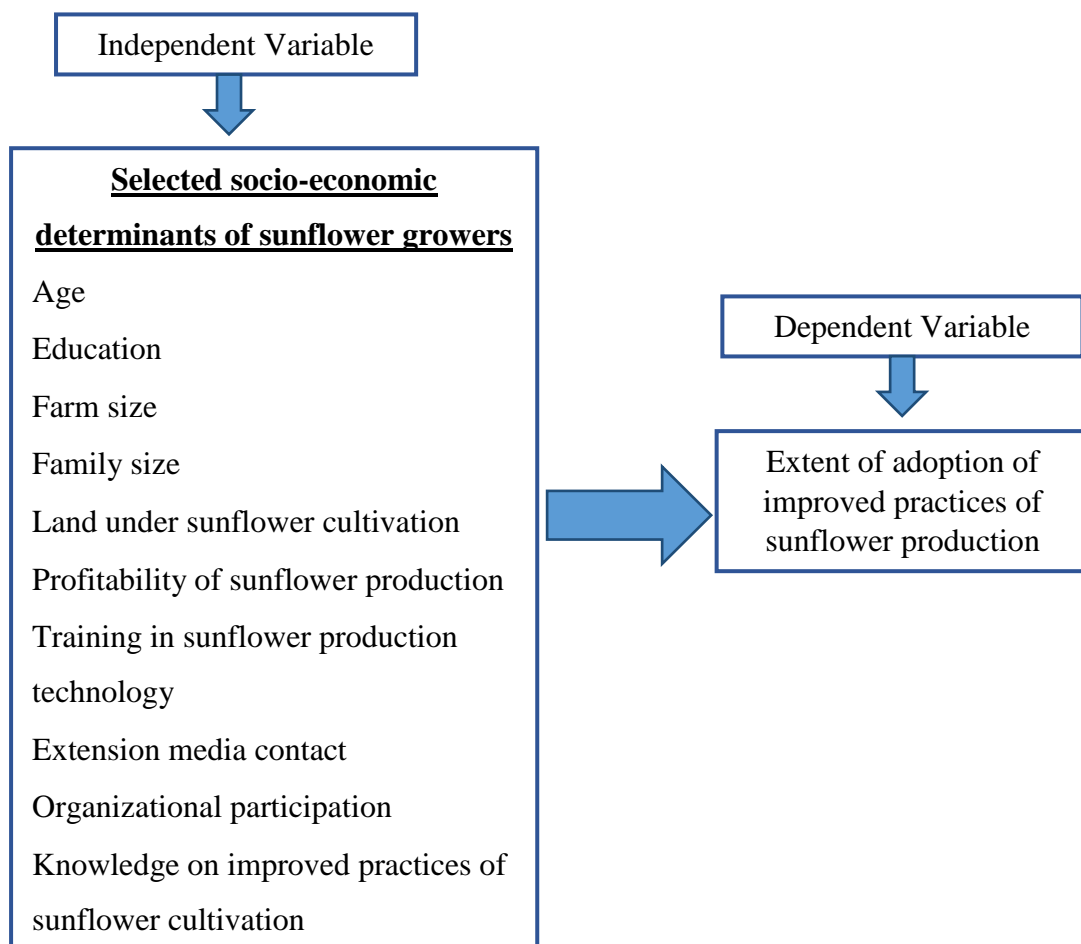


Figure 2. 1 The conceptual framework of the study

CHAPTER III

METHODOLOGY

This chapter deals with the procedures for the collection of valid information as well as procedure of data coding and also data analysis. For conduction, a research work smoothly proper methodology is an obligatory one and it is very difficult to address the study objectives with a scientific manner without a define methodology. A sequential description of the methodologies that was followed in conducting this research work has been presented in this chapter under the following headings-

3.1 Research Design

3.1.1 Locale of the study

The southeast district ‘Patuakhali’ is the second largest sunflower growing area in Bangladesh. Nowadays, the district is facing a lot of sunflower production problems and the farmers are being deprived from the desired benefits. After being a number of news covered in the media, the researcher selected the locale purposively. The study was conducted in the Patuakhali sadar upazila under Patuakhali district. Patuakhali sadar upazila has 13 unions; out of these five (05) unions was selected purposively for this study based on adequate numbers of sunflower cultivars/farmers. Each five (05) unions is consisted of three (3) blocks. One block is selected from each of these five (05) unions by considering random selection procedure. The selected five (05) blocks are Bollovpur under kalikapur union, Birajala under Madarbunia uninon, Morichbunia under Morichbunia union, kewabunia under Bara bighai union, Bara Auliapur under Auliapur union. A map of Bangladesh showing Patuakali district and a map of Patuakhali district showing five unions considered as study area have been presented in Figure 3.1 and 3.2, respectively.

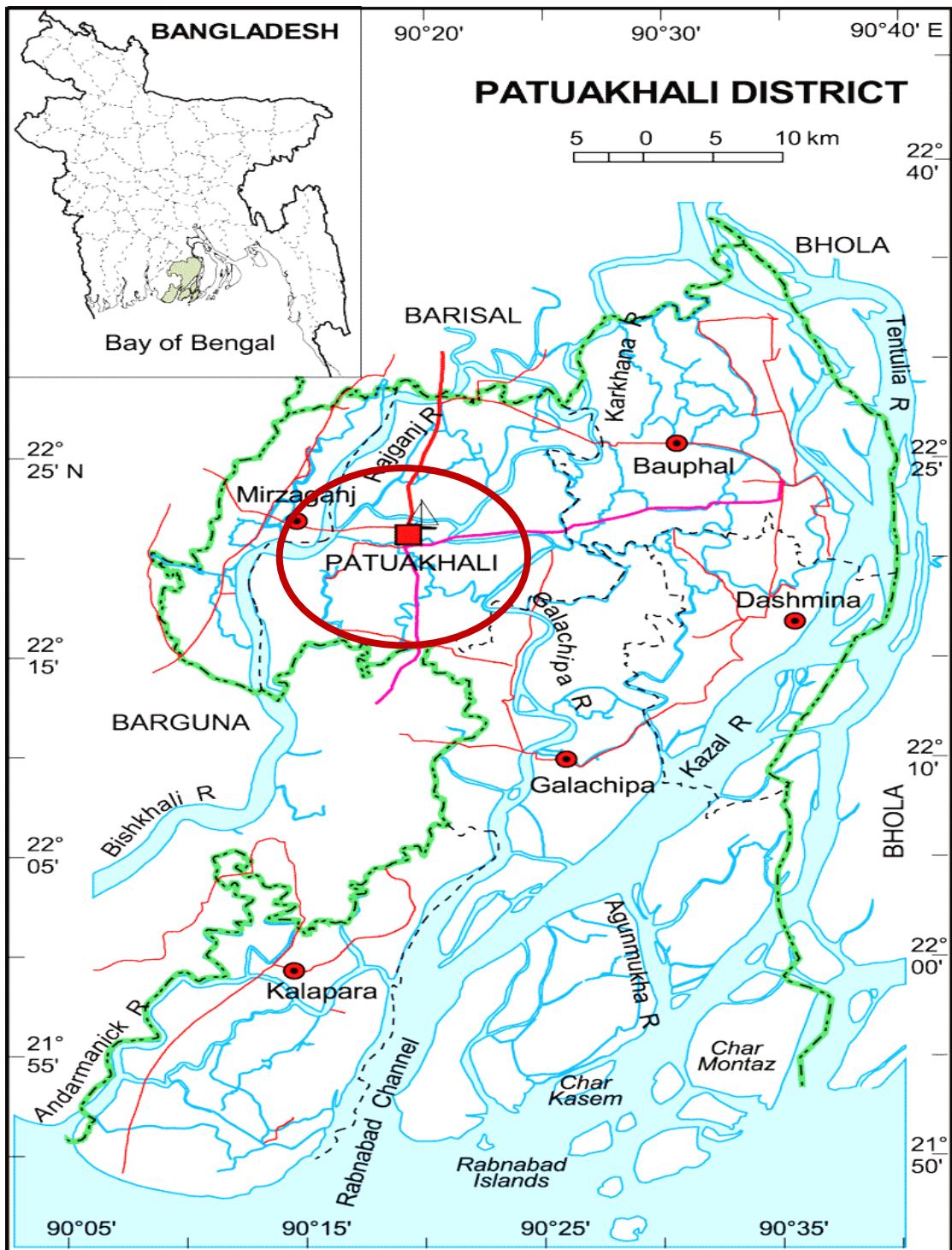


Figure 3.1 A map of Patuakhali district showing Patuakhali sadar upazila

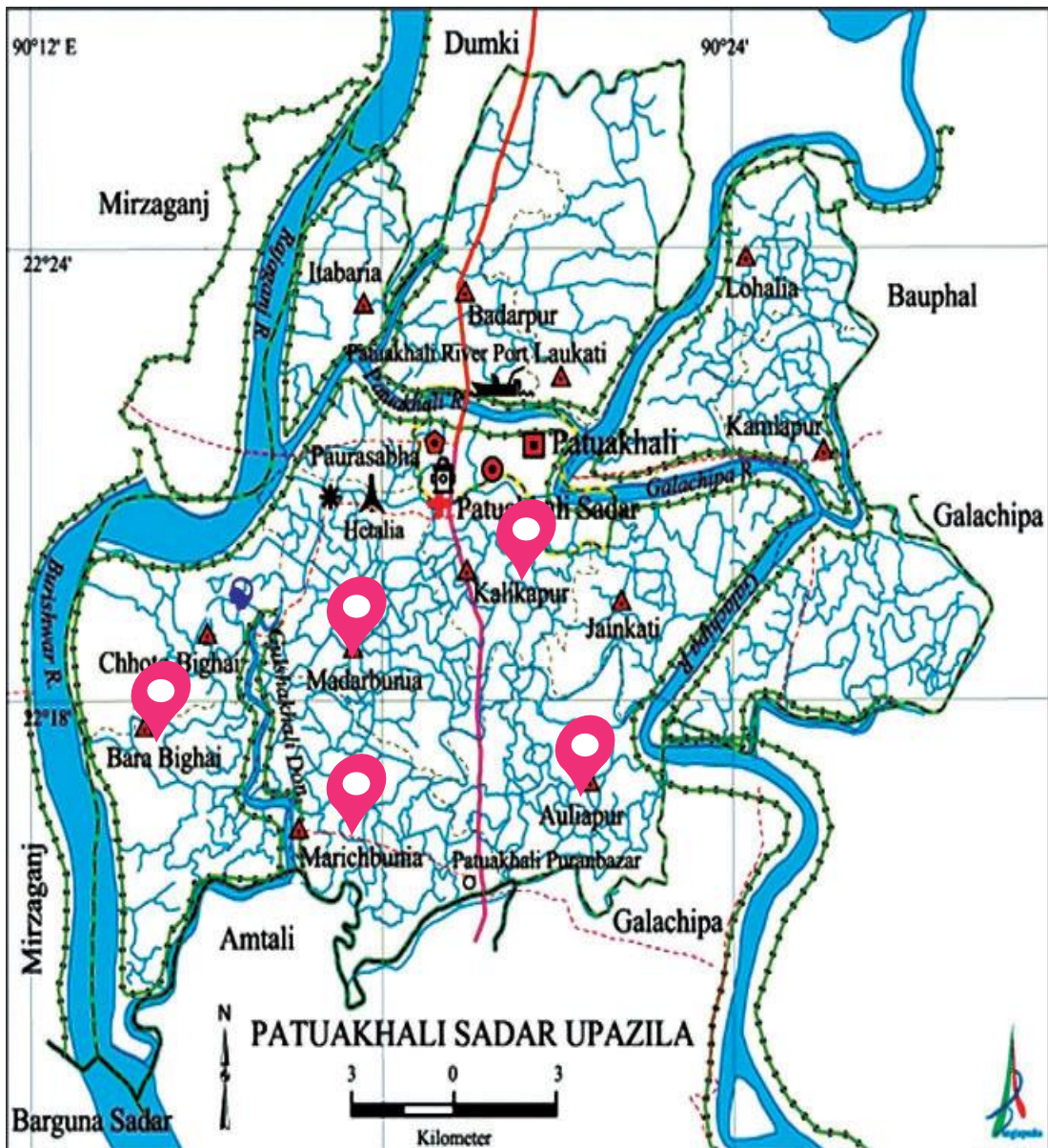


Figure 3.2 A map of Patuakhali district showing five unions under Patuakhali sadar upazila

3.1.2 Population and sampling frame

An update list of sunflower farmers of the selected area was collected from the local office of the UAO. The total numbers of sunflower farmers in these blocs were 450. Consider 25% of total population, 113 respondents were considered as the sample of the study. Data were collected from the selected sample size using proportionate random sampling procedure. A reserve list of 10 sunflower farmers (10% of the sample list) was also prepared so that the respondents of this list could be used for interview if the respondents included in the original sample were not available during the data collection period (Table 3.1). All the respondents were informed beforehand

to collect the data and data were collected in a face-to-face situation during a period from 17th September, 2018 to 25th September, 2018.

Table 3.1 Population and sample size and reserve list of the study

Union Name	Block Name	Population size	Sample size	No. of farmers included in reserve list
Kalikapur	Bollovpur	80	20	2
Madarbunia	Birajala	161	40	4
Morichbunia	Morichbunia	50	13	1
Bara bighai	Kewabunia	101	25	2
Auliapur	Bara Auliapur	60	15	1
Total		452	113	10

3.1.3 Data collection instrument

Since the reasons for study were to test the hypotheses and measure the variances, a cross-sectional survey strategy was operationalized for this study. Henceforth, data was gathered utilizing an organized meeting plan. Remembering the targets, the study adjusted approved estimation things from earlier investigations, at whatever point conceivable. The beforehand prepared interview schedule, a pre-test was conducted. In most instances, closed form questions were used. Appropriate scales of each construct were adopted from prior literature, whenever possible and were exhibited in an English version of the interview schedule attached in the Appendix-A.

3.1.4 Variables of the study

The variable is a characteristic, which can assume varying or different values in successive individual cases. A research work usually contains at least two important variables viz. independent and dependent 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 dependent variable is that factor which appears, disappears or varies as the researcher introduces, removes or varies the independent variable (Townsend, 1953). In the scientific research, the selection and measurement of variable constitute a significant task. Following this conception, the researcher reviewed literature to widen this understanding about the natures and scopes of the variables relevant to this research.

Two types of variables were used for this study:

- i. **Dependent variable:** It is a variable that is the outcome or result or impact of different factors. This variable is frequently known as a criterion or reliant

variable. The estimation of the reliant variable relies upon the estimation of alternate factors, that is, autonomous factors. In this study, “adoption of sunflower production” was considered as the reliant variable.

- ii. **Independent variables:** These variable are regularly called as indicator variables or predictor variables. In a trial setting, a researcher needs to control the variable or acquaint another variable with see its impact on the criterion variable. In this study, selected ten (10) independent variables were selected. The independent variables were: age, education, farm size, and experience in sunflower production, sunflower production area, profitability from sunflower production, training in sunflower production, extension media contact, organizational participation, and knowledge on improved practices of sunflower.

3.2 Measurement of Variables

The methods and procedures in measuring the variables of this study are presented below:

3.2.1 Measurement of independent variables

The 10 characteristics of the sunflower farmers mentioned above constitute the independent variables of this study. The following procedures were followed for measuring the independent variables

3.2.1.1 Age

Age of respondent sunflower farmers was measured by the period of time from their birth to the time of conducting interview and it was measured in terms of complete years on the basis of their response. A score of one (1) was assigned for each year age. This variable appears in item number one (1) in the interview schedule as presented in Appendix.

3.2.1.2 Education

Education was measured by assigning score against each successful year of schooling by a respondent. One score was given for passing each level in an educational institution. For example, if a respondent passed the final examination of class five or equivalent examination, his/her education score has given five (5). Each respondent of can't read & write has given a score of zero (0). A person not knowing reading or writing but being able to sign only has given a score of 0.5. If a farmer did not go to school but took non-formal education, his educational status was determined as the

equivalent to a formal school student. This variable appears in item number two (2) in the interview schedule as presented in Appendix.

3.2.1.3 Farm size

Farm size of a respondent referred to the total area of land on which his family carried out the farming operation, the area being in terms of full benefit to the family. The term refers to the cultivated area either owned by the respondent or cultivated on share-cropping, lease or taking from other including homestead area. It was measured in hectares for each respondent using the following formula:

$$FS = A + B + \frac{1}{2}(C + D) + E$$

Where, FS = Farm size,

A = Homestead area,

B = Own land under own cultivation,

C = Land taken from others as borga

D = Land given to other as borga,

E = Land taken from others on lease,

The data was first recorded in terms of local measurement unit i.e. decimal and then converted into hectare. The total area, thus, obtained is considered as his farm size score (assigning a score of one for each hectare of land). This variable appears in item number three (3) in the interview schedule as presented in Appendix.

3.2.1.4 Family size

Family size of an advise was determined by the total number of members in his/her family who live under same roof and share same kitchen including himself/herself, his/her wife/husband, sons, daughters and others fully or partially dependent on him/her. Total number of family members was considered as the family size score of a respondent. For example, if a respondent has four (4) members in his/her family, his/her family size score was 4 (four). This variable appears in item number three (4) in the interview schedule as presented in Appendix.

3.2.1.5 Land under sunflower cultivation

Sunflower cultivation areas refer to the area used in sunflower cultivation only by the sunflower farmers. It was first recorded in terms of local measurement unit i.e.

decimal and bigha. Then it was converted in hectare (ha). The total area thus obtained was considered as the score of land under sunflower cultivation by assigning 1 score for one hectare (ha)' of land. This variable appears in item number four (5) in the interview schedule as presented in Appendix.

3.2.1.6 Profitability from sunflower production

Profitability from sunflower production refers to the total financial return from sunflower production in one year. It was expressed in Taka. One score was given for 1000 taka. A score of 1 was assigned for Tk. 1000. For an amount less than Tk.1000, a fraction score was computed and added with the main score. This variable appears in item number six (6) in the interview schedule as presented in Appendix.

3.2.1.7 Training in sunflower production technology

Training of a respondent was measured by the total number of days for which a respondent attended in different training programs on agriculture. If a respondent takes training for 7 days, he will get 7 scores. This variable appears in item number six (7) in the interview schedule as presented in Appendix.

3.2.1.8 Extension contact for sunflower practices

Extension contact was measured as ones extent of contact to different information sources. Each respondent was asked to indicate his nature of contact for each of 7 selected media with five alternative responses was prepared for the respondents.

Following scores were assigned for each of 7 media.

Extent of exposure	Score Assigned
Not at all	1
Rarely	2
Occasionally	3
Often	4
Regularly	5

Thus, the extension media contact scores of sunflower farmers could range from 0 to 28 where '0' indicated no exposure and 28 indicated very high media contact. This variable appears in item number three (8) in the interview schedule as presented in Appendix.

3.2.1.9 Organizational participation

Social organizational participation of respondent was measured on the basis of the nature of their participation in 6 selected organizations. Final score was computed by adding all the scores of selected organizations.

Following scores were assigned for nature of participation

Nature of participation	Score Assigned
No participation	1
Participation as ordinary member	2
Participation as executive member	3
Participation as executive committee officer	4

The social organizational participation score could range from 0 to 18 where ‘0’ indicated no participation and ‘18’ indicated very high social organizational participation. This variable appears in item number six (9) in the interview schedule as presented in Appendix.

3.2.1.10 Knowledge on improved practices of sunflower

Knowledge on sunflower cultivation of the sunflower farmers referred to the knowledge gained by the respondent in sunflower cultivation activities. A scale consisting of 10 questions was used to determine the sunflower cultivation knowledge score of the respondents. The questions were selected from different dimensions of sunflower cultivation after thorough consultation with the relevant experts and review of relevant literatures as shown in Appendix A. The score allotted for each question was 2. A respondent could get 2 score against each question for correct response and 0 for wrong or no response and partial score was assigned for partially correct answer. Thus, sunflower cultivation knowledge score of the respondents could range from 0 to 20, where 0 indicated very low sunflower cultivation knowledge and 20 indicated very high sunflower cultivation knowledge. This variable appears in item number six (10) in the interview schedule as presented in Appendix.

3.2.2 Measurement of dependent variable

Adoption of selected sunflower production technologies was the dependent variable of this study. It was measured on the basis of the extent of adoption of 6 selected sunflower production technologies by the farmers for three year. Adoption of multiple technologies is measured by the proportion of summation of mean area coverage (1)

out of mean potential area (L) by the number of practices for particular time period; it is expressed in percentage resulting mean (X) area coverage. The formula calculating the adoption stands as G. L. Ray (1998);

$$\text{Adoption scores} = \frac{\sum X}{\text{No. of technologies}} \times 100$$

Suppose a farmer is using sunflower variety 8 with its cluster of technologies for the subsequent years 2015, 2016 and 2017.

- a) Use of modern high yielding varieties
- b) Use of TSP
- c) Use of bio-fertilizer
- d) Line transplanting
- e) Heightening and
- f) Integrated pest management (IPM)

Calculate the adoption of above mentioned technologies. In this case adoption can be measured in the following ways?

Name of technologies	Year of the adoption			$\sum I/L$	X adoption
	2015	2016	2017		
Allocated area for cultivation (I)	2	2	3	1.75	.58
Potential area (L)	4	4	4		
Proportion of area coverage (I/L)	0.5	0.5	0.75		

Total adoption score of a respondent was found by adding one's adoption scores on eight aspects of adoption and then dividing by number of aspects. The adoption was expressed in percentage. Hence the adoption of a sunflower grower could range from 0 to 100, where '0' indicate no adoption and '100' indicate highest adoption.

3.3 Hypothesis of the Study

According to Kerlinger (1973), "a hypothesis is a conjectural statement of the relation between two or more variables". Hypothesis are always in declarative sentence form and they are related, either generally or specifically from variables to variables. In broad sense hypotheses are divided into two categories: (a) Research hypothesis and (b) Null hypothesis.

3.3.1 Research hypothesis

Based on review of literature and development of conceptual framework, the following research hypothesis was formulated:

“Each of the 10 selected characteristics (age, education, farm size, family size, land under sunflower cultivation, profitability from sunflower production, training in sunflower production technology, and extension contact for sunflower practices, organizational participation, and knowledge on improved practices of sunflower) of the sunflower farmers had significant influenced to adoption of sunflower production technologies”.

However, when a researcher tries to perform statistical tests, then it becomes necessary to formulate null hypothesis.

3.3.2 Null hypothesis

A null hypothesis states that there is no contribution between the concerned variables. The following null hypothesis was formulated to explore the contribution of the selected characteristics in empowering the farmers through e-Agriculture. Hence, in order to conduct tests, the earlier research hypothesis was converted into null form as follows:

“There is no contribution of the selected characteristics (age, education, farm size, family size, land under sunflower cultivation, profitability from sunflower production, training in sunflower production technology, extension media contact for sunflower practices, organizational participation and knowledge on improved practices of sunflower) of adoption sunflower production.”

3.4 Data Analysis

3.4.1 Instrument for collection of data

In order to collect reliable and valid information from the respondents, an interview schedule was prepared for collection of data from respondents keeping the objectives of the study in mind. The question and statements contained in the schedule were simple, direct and easily understandable by the farmers. Simple and direct question, different scales, closed and open form statements and questions were included in the interview schedule to obtain necessary information. The draft interview schedule was prepared in accordance with the objective of the study. The interview schedule was

pre-tested with 10 respondents of the farmers in the study area during 11 to 14 September, 2018.

The draft interview schedule was pretested in actual field situation before finalizing it for collection of data. The pre-test was helpful to identify inappropriate questions and statements in the draft schedule. Necessary addition, alternation and adjustments were made in the schedule on the basis of the experience of the pretest. The interview schedule was then printed in its final form. An English version of the interview schedule has been shown in Appendix.

3.4.2 Data Collection

Data were collected personally by the researcher himself through personal interview schedule from the sampled farm families of the selected blocks. Before starting the collection of data; the researcher met the respective upazila Agriculture Officer (UAO), Additional Agriculture Extension Officer (AAEO) and the concerned Sub-Assistant Agriculture Office (SAAO). The researcher also discussed the objectives of the present study with the respondents and above mentioned officers and requested them to provide actual information. A rapport was established with the rural people so that they feel easy to answer the questions.

The researcher took all possible care to establish rapport with the respondents so that they would not feel any indecision while starting the interview. Very good cooperation was obtained from the field extension workers and the local leaders. No serious difficulty was faced by the researcher during the collection of data. The interviews were made individually in the places of respondents. Questions were asked in direct manner so that the respondents could easily understand the questions. Whenever a respondent faced difficulty in understanding any questions, care was taken to explain the same clearly with a view to enabling him to answer it properly.

Before going to the respondents' home for interviewing they were informed verbally to ensure their availability at home as per schedule date and time. In the case of failure to collect information from the respondents due to their other business, a revisit was made with prior to appointments. Data were collected during 17 September, 2018 to 25 September, 2018.

3.4.3 Compilation of data

After completion of field survey, data recorded in the interview schedules were coded, compiled, tabulated and analyzed in accordance with the objectives of the study. In this process, all the responses in the interview schedule were given numerically coded values. Local units were converted into standard units and qualitative data were converted into quantitative ones by means of suitable scoring whenever necessary. All the collected data were checked and cross-checked before transplanting to the master sheets. To facilitate tabulation, the collected data were properly coded and transferred from interview schedule to a master sheet. Tabulation and cross tabulation was done on the basis of categorization developed by the researcher.

3.4.4 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-subsequent sections of next chapter.

3.4.5 Statistical analysis

Data collected from the respondents were analyzed and interpreted in accordance with the objectives of the study. The analysis of data was performed using statistical treatment with SPSS (Statistical Package for Social Sciences) computer program, version 20. Statistical measures as a number, range, mean, standard deviation were used in describing the variables whenever applicable. Regressions of coefficient test were used to determine the contribution and among the categories of farmers with regard to their adoption to sunflower production technologies based on selected characteristics. Throughout the study the 0.01 and 0.05 levels of probability was used as the basis of rejection or accepting a null hypothesis.

CHAPTER IV

RESULTS AND DISCUSSION

In this Chapter, the findings of the study and interpretation of the results have been presented. Data obtained from respondents through interview were measured, analyzed, tabulated and statistically treated according to the objectives of the study. These are presented in three sections according to the objectives of the study. The first section deals with the selected socio-economic determinants of the sunflower growers, the second section deals with the extent of adoption of sunflower production technologies, the third section deals with the contribution of the socio-economic determinants to the extent of adoption of sunflower production of the farmers.

4.1 Selected Socio-economic Determinants of the Sunflower Growers

This section deals with the classification of the farmers according to their various characteristics. Behavior of an individual is largely determined by his characteristics. These characteristics of an individual contribute to a great extent in the matter of shaping of his behavior. In this section, findings on the farmers' ten selected characteristics have been discussed. The selected characteristics were age, education, family size, farm size, land under sunflower cultivation, profitability from sunflower production, training received in sunflower production technology, extension media contact, organizational participation and knowledge on improved practices of sunflower. Therefore, the major hypothesis of the study was that the adoption of sunflower production would also be influenced by various characteristics of the farmers. Range, mean and standard deviations of these characteristics of the farmers have been described in the following sub-sections. Table 4.1 gives a summary profile of the farmer's characteristics.

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

Categories	Measuring unit	Range		Mean	S.D
		possible	observed		
Age	Year	-	20-70	44.18	11.61
Level of education	Year of schooling	-	0.00-12	4.19	3.25
Family size	No. of member	-	3-9	5.59	1.36
Farm size	Ha	-	.19-3.44	.80	.56
Land under sunflower cultivation	Ha	-	.10-1.10	.33	.17
Profitability from sunflower production	000' taka	-	10-56	25.65	11.90
Training in sunflower production technology	No. of days	-	0-9	2.81	1.78
Extension media contact	Score	0-28	12-19	15.29	1.45
Organizational participation	Score	0-18	9-17	13.16	1.77
Knowledge on improved sunflower cultivation	Score	0-20	10-17	14.18	1.56

4.1.1 Age

Age of the growers was found to range from 20 to 70 years. The average age was 44.18 years with the standard deviation 11.61. On the basis of age, the farmers were classified into three categories as shown in Table 4.2.

Table 4.2 Distribution of the farmers according to their age

Category	Number of farmers	Percent	Observed range	Mean	Std
Young aged (up to 35)	35	31.0	20-70	44.18	11.61
Middle aged (36-50)	48	42.5			
Old aged (51 & above)	30	26.5			
Total	113	100			

Data presented in Table 4.2 indicate that the highest proportion (42.5 percent) of the respondents was in medium aged category compared to 26.5 percent old age and 31.0 percent young aged category. However, data also revealed that 73.5 percent of the growers in the study area were middle to young aged. The middle aged growers are the most productive group in the adoption of sunflower. The extension agents can make use of these views and opinions in designing their extension activities among young and middle aged growers.

4.1.2 Education

Education scores of growers ranged from 0 to 12. The average score was 4.19 with the standard deviation 3.25. Based on their score, the growers were classified into five

categories as shown in Table 4.3.

Table 4.3 Distribution of the farmers according to their education

Category	Number of farmers	Percent	Observed range	Mean	Std
Cannot read and write (0)	13	11.5	0-12.0	4.19	3.25
Can only sign (.5)	17	15.0			
Primary level (1-5)	48	42.5			
Secondary level (6-10)	34	30.1			
Above secondary	1	0.9			
Total	113	100			

Data presented in Table 4.3 indicate that a large proportion (42.5 percent) of the respondents fell under category of primary education compared to 11.5 percent cannot read and write, 15.0 percent can only sign, 30.1 percent secondary and only 0.9 percent above secondary education. The findings indicate that 72.6 percent of the respondents were educated that varied from primary to secondary levels. The literacy rate of the country is 65.5 percent (BBS, 2017). Thus the findings indicate that in the study area, the literacy seems to be greater than the national average.

4.1.3 Family size

The family size of the growers ranged from 3 to 10. The average score was 5.59 with the standard deviation 1.36. On the basis of their family size, the growers were classified into three categories as shown in Table 4.4.

Table 4.4 Distribution of the farmers according to their family size

Category	Number of farmers	Percent	Observed range	Mean	Std
Small family (up to 4)	20	17.7	3-9	5.59	1.36
Medium family (5-6)	67	59.3			
Large family (above 7)	26	23.0			
Total	113	100			

Data presented in Table 4.4 reveal that the highest proportion (59.3 percent) of the growers fell under the small family category compared to 23.0 percent large family and 17.7 percent small family category, respectively. The data also indicate that the average family size (5.59 percent) of the respondents in the study area was lower than the national average of 4.9 (BBS, 2003). This may be due to the effect of proper adoption of family planning measures and knowledge about family planning among the respondents or the prevalence of joint family planning among area.

4.1.4 Farm size

The farm size of the growers in the study area ranged from 0.19 to 3.44 hectares (ha). The average farm size was .80 ha with the standard deviation .56. Based on their farm size, the growers were classified into three categories as shown in Table 4.5.

Table 4.5 Distribution of the respondents according to their farm size

Category	Number of farmers	Percent	Observed range	Mean	Std
Marginal farm (up to .20)	1	0.90	0.19-3.44	0.80	0.56
Small farm (.21-1.0)	89	78.7			
Medium farm (above	23	20.4			
Total	113	100			

Data presented in Table 4.5 show that the major portion of the respondents (78.7 percent) fell under small farm category while 0.90 percent marginal farm and 20.4 percent were medium farm. Data also revealed that majority (99.1 percent) of the growers of the study area small to medium farms. Thus, most of the growers were in possession of medium and small farms.

4.1.5 Land under sunflower cultivation

The farm size of the growers in the study area ranged from 0.10 to 1.10 hectares (ha). The average farm size was .33 ha with the standard deviation .17. Based on their farm size, the growers were classified into three categories as shown in Table 4.6.

Table 4.6 Distribution of the farmers according to their land under sunflower cultivation

Category	Number of farmers	Percent	Observed range	Mean	Std
Marginal farm (up to .20)	29	25.7	0.10-1.10	0.33	0.17
Small farm (.21-1.0)	83	73.4			
Medium farm (above	1	.9			
Total	113	100			

Data presented in Table 4.6 show that the major portion of the respondents (73.4 percent) fell under small land under sunflower cultivation category while 25.7 percent marginal land and .9 percent were medium land under sunflower cultivation. Data also revealed that majority (99.1 percent) of the growers of the study area small to marginal land. Thus, most of the growers were in possession of marginal and small farms.

4.1.6 Profitability from sunflower cultivation

Profitability of a respondent was determined on the basis of his total profit from sunflower cultivation. Profit of the growers ranged from Tk. 10 to 56 (Taka in thousand) with the mean of Tk. 25.65 thousand and standard deviation 11.90. On the basis of the annual income the growers were classified into three categories as shown in Table 4.7.

Table 4.7 Distribution of the farmers according to their profit from sunflower cultivation

Category	Number of farmers	Percent	Observed range	Mean	Std
Low profit (up to 14)	29	25.7	10-56	25.65	11.90
Medium profit (15-36)	67	59.3			
High profit (above 36)	17	15.0			
Total	113	100			

Data presented in Table 4.7 indicated that the highest proportion (59.3 percent) of the respondents had medium profit from sunflower cultivation compared to 15.0 percent having high profit and 25.7 percent having low profit. Thus, the majority (85.0 percent) of the respondents had medium to low profit, indicating that adoption of improved practices in sunflower cultivation are usually done by the growers having comparatively higher economic standings.

4.1.7 Training received in sunflower cultivation

The training of the respondents varied from 0 to 9 with a mean of 2.81 and a standard deviation of 1.78. The respondents were classified into four categories based on their training experiences scores: low training (0-1), medium training (2-3) and high training (above 3). The categories and the distribution of the farmers according to their training received in sunflower cultivation are shown in Table 4.8

Table 4.8 Distribution of the farmers according to their training received in sunflower cultivation

Category	Number of farmers	Percent	Observed range	Mean	Std
Low training (0-1)	24	21.2	0-9	2.81	1.78
Medium training (2-3)	66	58.4			
High training (above 3)	23	20.4			
Total	113	100			

Data presented in Table 4.8 indicate that the highest proportion (58.4 percent) of the

respondents received medium training compared to about 21.2 percent of them having low training and 20.4 percent having high training

4.1.8 Extension contact

The computed extension contact scores of the respondents ranged from 12 to 19 with an average of 15.29 and standard deviation of 1.45 against the possible range of 0 to 28. On the basis of extension contact scores, the respondents were classified into three categories: low extension contact (up to 12), medium extension contact (13- 16) and high extension contact (>16). The distribution of the respondents according to their extension contact is shown in Table 4.9.

Table 4.9 Distribution of the farmers according to their extension contact

Category	Number of farmers	Percent	Observed range	Mean	Std
Low contact (up to 14)	41	36.3	12-19	15.29	1.45
Medium contact (15-16)	45	39.8			
High contact (above 16)	27	23.9			
Total	113	100			

Data presented in Table 4.9 indicate that the highest proportion (39.8 percent) of the farmers had medium extension contact, while 23.9 percent had high extension contact and the proportion of respondents having low extension contact was 36.3 percent. The findings of the study indicate that most of the respondents had medium and low extension contact with various information sources for getting necessary agricultural information.

4.1.9 Organizational participation

The maximum organizational participation score of the respondents was 16 and the minimum was 9 against the possible range of 0 to 18. However, the average was 13.16 and the standard deviation 1.77. Based on their participation scores, the respondents were classified into three categories: low participation (up to 10), medium participation (11-14) and high participation (>14). The distribution of the respondents according to their organizational participation is shown in Table 4.10

Table 4.10 Distribution of the farmers according to their organizational participation

Category	Number of farmers	Percent	Observed range	Mean	Std
Low participation(up to 12)	37	32.7	9-16	13.16	1.77
Medium participation (13-14)	53	46.9			
High participation (above 14)	23	20.4			
Total	113	100			

Data contained in table. 4.10 indicate that highest proportion (46.9 percent) of the growers had medium participation as compared to 20.4 percent high participation and 32.7 percent low participation. Data also revealed that majority (79.6 percent) of the respondents of the study area had medium to low level of organizational participation.

4.1.10 Knowledge on improved sunflower production technology

Knowledge on improved sunflower production scores of the respondents ranged from 10-17 with an average of 14.18 and standard deviation of 1.56 against the possible range of 0 to 20. On the basis of sunflower production knowledge scores, the respondents were classified into three categories, low knowledge (up to 13), medium knowledge (14 to 15) and high knowledge (>15). The distribution of the respondents according to their knowledge on improved sunflower production is shown in Table 4.11.

Table 4.11 Distribution of the farmers according to their knowledge on improved sunflower production technology

Category	Number of farmers	Percent	Observed range	Mean	Std
Low knowledge (up to 13)	32	28.3	10-17	14.18	1.56
Medium knowledge (14-15)	52	46.0			
High knowledge (above 15)	29	25.7			
Total	113	100			

Data contained in Table 4.11 indicate that the majority (46.0 percent) of the respondents had medium knowledge compared to 28.3 percent felt in low knowledge and 25.7 percent possesses high knowledge. It therefore revealed that majority of the sunflower farmers (74.3 percent) in the study area were under low to medium knowledge categories.

4.2 Adoption of Sunflower Production Technology

Adoption of sunflower cultivation score was found to range from 28.33 to 69.78. The

average score was 53.55 with a standard deviation of 9.39. Based on the scores of adoption of sunflower cultivation, the farmers were classified into three categories as low adoption (≤ 44), medium adoption (45-62) and 'high adoption (> 62). The distribution of the respondents according to their adoption of sunflower cultivation has been presented in Table 4.12.

Table 4.12 Distribution of the farmers according to their adoption of sunflower cultivation technologies

Category	Number of farmers	Percent	Mean	Std
Low adoption (≤ 44)	11	9.7	53.55	9.39
Medium adoption (45-62)	77	69.1		
High adoption (> 62)	25	21.2		
Total	113	100		

Table 4.12 revealed that the highest proportion (69.1 percent) of the respondents had medium, while 9.7 percent had low adoption and the rest 21.2 percent had high adoption of sunflower production technologies. It also reveals that an overwhelming majority (90.3 percent) of the farmers had medium to high adoption of improved sunflower production technologies which might suggest the reasons of lower production at the study area. Farmers always want to ensure their food security first then the return from their cultivation. In that case rice is first choice as it is their staple food. Few years ago some high yielding varieties of rice became famous for their yield as well their return. But with the time passing the cost of production of rice is increasing which lead the famers of the study area switch to adopt sunflower cultivation.

4.3 Contribution of the Socio-economic Determinants of the farmers to the Adoption of Sunflower Production Technologies

In order to determine the contribution of socio-economic determinants of sunflower growers to their extent of adoption of improved practices of sunflower, regression analysis was carried out which is presented in Table 4.13.

Table 4.13 Multiple regression coefficients of the selected factors indicating contribution to adoption of sunflower production by the farmers

Dependent variable	Independent variables	β	p	R^2	Adj. R^2	F
Adoption of sunflower production technologies	Age	0.021	0.747	.737	.711	28.86
	Education	0.333	0.016*			
	Family size	0.164	.003**			
	Farm size	0.031	.690			
	Land under sunflower cultivation	0-.017	.860			
	Profitability from sunflower production	-0.120	.116			
	Training in sunflower production technology	0.015	.789			
	Extension media contact for sunflower practices	0.195	.024*			
	Organizational participation	0.237	.023*			
	Knowledge on improved practices of sunflower	0.206	.014*			

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

Among the ten hypothesized relationships, five (5) variables namely knowledge, education, family size, extension media contact and organizational participation were found significantly contribution to the adoption of improved practices of sunflower production (Table 4.13) while rest of the variables showed no significant contribution. All the factors jointly contribute 73.7% of the variance of the adoption ($R^2 = 0.737$). Each predictor may explain some of the variance in respondents' adoption of sunflower farmers simply by chance. The adjusted R^2 value (0.711) penalizes the addition of extraneous predictors in the model, but values of 0.711 still show that the variance in respondents' adoption of sunflower cultivation technologies can be attributed to the predictor variables rather than by chance, and that both are suitable models (Table 4.13). In summary, the models suggest that the respective authority should consider the respondents' level of education, family size, extension media contact for sunflower practices and organizational participation, and knowledge on improved practices of sunflower of farmers.

4.3.1 Significant contribution of family size in adoption of sunflower production by farmers in Patuakhali sadar upazila

The contribution of family size in adoption of sunflower farmers by testing the following null hypothesis; “there is no contribution of family size in adoption of sunflower farmers in Patuakhali sadar upazila”.

The p-value of the concerned variables was found .003. 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 family size was at 1% significance level. So, the null hypothesis could be rejected.

Farmer’s family size had positive influence on farmers’ adoption of sunflower cultivation. It had the 1st most significant (significant at $p < 0.003$) contribution on their adoption. It could be said that sometimes new technologies were not accepted by small family compared to large family and they might face obstacles sometimes to take new decision for going outside from traditional practices considering benefit.

4.3.2 Significant contribution of knowledge on improved practices of sunflower in adoption of sunflower production

From the multiple regression, it was concluded that the contribution of knowledge on improved practices of sunflower in adoption of sunflower was measured by the testing the following null hypothesis; “there is no contribution of knowledge on improved practices of sunflower in adoption of sunflower”.

- a. The following observations were made on the basis of the value of the concerned variable of the study under consideration.
- b. The contribution of the knowledge on improved practices of sunflower in adoption of sunflower was significant at 5% level (0.014).
- c. So, the null hypothesis could be rejected.

The p-value of knowledge on improved practices of sunflower in adoption of sunflower is (0.206). So, it can be stated that as knowledge on improved practices of sunflower in adoption of sunflower increased by one unit, knowledge on improved practices of sunflower in adoption of sunflower increased by 0.206 units. Considering the effects of all other predictors are held constant.

Based on the above finding, it can be said that farmers had more knowledge on improved practices of sunflower increased the adoption of sunflower in Patuakhali sadar upazila. So, knowledge on improved practices of sunflower has high significantly contributed to the farmers' adoption of sunflower.

4.3.3 Significant contribution of education in adoption of sunflower production by farmers in Patuakhali sadar upazila

The contribution of education in adoption of sunflower farmers by testing the following null hypothesis; "there is no contribution of education in adoption of sunflower farmers in Patuakhali sadar upazila".

The p-value of the concerned variables was found .016. 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. So, the null hypothesis could be rejected.

Based on the above finding, it can be summarized that a sunflower farmers had more education increased the capabilities to adoption of sunflower production in Patuakali district. Education enhances the abilities of the sunflower farmers at short time than others which enabled them to adoption of sunflower. So, education has significantly contributed to the adoption of sunflower farmers. It seemed that educated farmers had more knowledge, a greater ability to understand and respond to anticipated changes, were better able to forecast future scenarios and, overall, have greater access to information and opportunities than others, which might encourage adoption.

4.3.4 Significant contribution of organizational participation in adoption of sunflower production by farmers in Patuakhali sadar upazila

The contribution of organizational participation in adoption of sunflower farmers by testing the following null hypothesis; "there is no contribution of organizational participation in adoption of sunflower farmers in Patuakhali sada rupazila".

The p-value of the concerned variables was found .023. 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 at 5% significance level. So, the null hypothesis could be rejected.

The b-value of level organizational participation is (0.237). So, it can be stated that as organizational participation increased by one unit, farmers' adoption of sunflower increased by 0.237 units. Considering the effects of all other predictors are held constant. Based on the above finding, it can be said that farmers' have more organizational participation increased the farmers' adoption of sunflower.

4.3.5 Significant contribution of extension media contact for sunflower practices in adoption of sunflower production by farmers in Patuakhali sadar upazila

The contribution of extension media contact for sunflower practices in adoption of sunflower farmers by testing the following null hypothesis; "there is no contribution of extension media contact for sunflower practices in adoption of sunflower farmers in Patuakhali sadar upazila".

The p-value of the concerned variable was found .024. 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 farm size was at 5% significance level. So, the null hypothesis could be rejected.

Farmer's extension media contact for sunflower practices had positive influence on farmers' adoption of sunflower production and it was the 5th strongest (significant at $p < 0.024$) contribution on their adoption. This implies that with the increase of extension media contact of the farmers will increase their adoption of sunflower.

CHAPTER V

SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

This chapter deals with the summary of findings, conclusions and recommendations of this study. Regression analysis was used to test the proposed hypotheses using SPSS v.23. In this chapter, the summary of this study is presented.

5.1 Summary of the Findings

The major findings of the study are summarized below:

5.1.1 Selected factors influencing the adoption of sunflower production

Age

The middle aged sunflower farmers comprised the highest proportion (42.5 percent) followed by old aged category (26.5 percent) and the proportion were made by the young aged category (31.0 percent).

Education

Farmers under primary education category constituted the highest proportion (42.5 percent) compared to 11.5 percent cannot sign category, 30.1 percent secondary level and 15.0 percent can only sign category. On the other hand the lowest (.9 percent) belonged to above secondary level category.

Family Size

Greater the half (59.3%) of the respondent had medium family compare to 23.0% and 17.7% had large and medium family size.

Farm Size

The small land holder constituted the highest proportion (78.7 percent) of the farmers followed by .9 percent with marginal land holder and remaining 20.4 percent with medium land holder.

Land under sunflower cultivation

The small land under sunflower cultivation constituted the highest proportion (73.4 percent) of the farmers followed by 25.7 percent with marginal land under sunflower cultivation and remaining .9 percent with medium land under sunflower cultivation.

Profitability from Sunflower Production

The farmers having medium profitability from sunflower production constitute the highest proportion (59.3 percent) followed by high profit (15.0 percent) and low profit (25.7 percent).

Training in sunflower production technology

Findings revealed that majority 58.4% of the respondents has medium training received in sunflower production technology compared to 21.2% low training and 20.4% had high training received in sunflower production technology.

Extension Contact

The farmers having medium extension media contact category constituted the highest proportion (39.8 percent) followed by high media contact (23.9 percent) and low media contact category (36.3 percent).

Organizational Participation

From the data it was observed that majority (46.9%) of the respondent had medium participation compared to 20.4% high participation and 32.7% and low organizational participation.

Knowledge on improved sunflower production technology

The highest proportion (46.0 percent) of the respondents had medium knowledge on improved sunflower production technology, while 28.3 percent and 25.7 percent of the respondents had low and high knowledge on improved sunflower production technology respectively.

5.1.2 Adoption of sunflower production technologies

The highest proportion (69.1 percent) of the respondents had medium adoption of sunflower cultivation, while 9.7 percent had low adoption and the rest 21.2 percent had high adoption of sunflower cultivation.

5.1.3 Contribution of the selected characteristics of the farmers to their adoption of sunflower

Education, family size, extension media contact, organizational participation and knowledge on improved sunflower production technology had significant positive contribution with the adoption of sunflower cultivation. Age, land under sunflower

cultivation, profitability from sunflower production and training in sunflower production technology had no contribution with the adoption of sunflower cultivation.

5.2 Conclusions

Conclusions drawn on the basis of the findings of this study and their logical interpretation in the light of the other relevant factors are furnished below:

- i. In the study area farmers have been adopting sunflower in various extents. There were 69.1% medium adopters, 9.7% low adopters and 21.2% high adopters. Therefore, it may be concluded that adoption of improved practices of sunflower production was moderate at the study area.
- ii. Family size of the farmers showed a significant positive contribution to their adoption of sunflower. However, considering that most of the farmers belonged under the small family size group. Therefore, it may be concluded that motivation programs should be taken especially for the farmers who have small family labor to adopt sunflower.
- iii. A great majority (74.3 percent) of the farmers had low to medium knowledge on improved sunflower production technology, while there had a positive significant contribution with knowledge on improved sunflower production technology of the farmers and their adoption of sunflower cultivation. Therefore, it may be concluded that, farmers had higher knowledge on sunflower production technology were adopted more sunflower cultivation in the study area.
- iv. Education of the farmers had significant positive contribution with their adoption of sunflower cultivation. Majority (72.6%) of the farmers belonged to secondary to primary category.
- v. Majority (79.6%) of the respondents' belonged medium to low level of organizational participation categories. It therefore, may be concluded that organizational participation of the farmers should be increased.
- vi. Majority (76.1 percent) of the respondents belonged low to medium extension contact of sunflower farmers' categories. Therefore, it may be concluded that the extension contact of sunflower farmers should be increased.

5.3 Recommendations

From discussion and findings of the study, it is clear that sunflower production is fast becoming an integral part of agriculture economy and it is being readily accepted as the next big thing in DAE. Though agricultural organizations are slowly adopting to the changing, faster actions are required to better initiative to increase the adoption rate of sunflower adoption. To overcome the challenges, a multipronged approach is needed at different levels:

5.3.1 Recommendations for policy

Recommendations based on the findings and conclusions of the study are presented below:

- i. A majority (90.3 percent) of the farmers had medium to high adoption of sunflower cultivation. All the sample farmers were more or less involved in sunflower cultivation yet their extent of adoption of improved practices was not satisfactory. Therefore, it may be recommended that necessary steps should be taken to increase the adoption of sunflower cultivation in the study area.
- ii. Family size of the farmer had significant positive contribution with adoption of sunflower. Therefore, it may be recommended that necessary steps should be taken by the concerned authority, so that the farmers especially those who have small family labor could adopt mixed cropping in a larger scale.
- iii. Knowledge on sunflower cultivation had significant positive relationship with their adoption of sunflower cultivation. Therefore, it may be recommended that, there should be conducted more extension works for educating and training the farmers which will be supportive to adoption of sunflower cultivation.
- iv. Education of the farmers had significant positive contribution with their adoption of sunflower cultivation. Therefore, it may be recommended that, adult education should be provided to the farmers so that they could increase their educational level which might be helpful to increase their adoption of sunflower cultivation.

- v. The findings had a significant positive contribution between the extension media contact and adoption of sunflower cultivation of the farmers. So, it may be recommended that the extension workers of the concerned authority should increase the contact with farmers personally and motivate them to be connected with electronic and printed media that can help them to exchange related information which will reduce their problems.
- vi. Organizational participation of the farmers had positive significant contribution with their adoption sunflower cultivation. If the organizational participation increases the adoption of sunflower cultivation will increase.

5.3.2 Recommendations for further studies

On the basis of scope and limitations of the present study and observation made by the researcher, the following recommendations are made for future study. This study investigated adoption of sunflower by the farmers of Patuakhali sadar upazila under Patuakhali district. As a small and limited research has been conducted in the present study cannot provide much information related to this aspect. Further studies should be undertaken to cover more information in the relevant matters. So the following suggestions were put forward for further research:

- ✓ It is difficult to determine the socio-economic determinants of adoption of sunflower by the farmers of Patuakhali sadar upazila. Measurement of adoption of the farmers is not free from questions. More reliable measurement of concerned variables is necessary for further study.
- ✓ The present study was conducted only in five blocks under five unions of Patuakhali sadar upazila under Patuakhali district. Findings of the study need further verification through similar research in other parts of the country.
- ✓ The study investigated the contribution of ten characteristics of the sunflower farmers with their adoption of sunflower cultivation. So it is recommended that further study would be conducted with other dependent and independent variables.

- ✓ Research should be undertaken on the effectiveness of agricultural extension services and other related organizations in helping farmers for adoption of improved practices of sunflower production

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APPENDIX- A

English Version of the Interview Schedule

Department of Agricultural Extension & Information System
Sher-e-Bangla Agricultural University
Dhaka-1207

Interview Schedule for data collection for the Research on
**“Socio-Economic Determinants of Adoption of Sunflower Production
by the Farmers Patuakhali Sadar Upazila”**

(This interview schedule is entitled for a research study. Collected data will only be used for research purpose and will be published aggregately)

Serial no.....

Name of respondent.....

Union.....

Village.....

Upazila

District.....

(Please answer the following questions. Give tick (√) marks if necessary. Provided information will be kept confidently)

1. Age: What is your present age?Years.

2. Education:

a) Cannot read and write b) Can sign only.....

c) I read up to class: d) I passedclass

3. Farm size: Please indicate area of your lands according to the following items

SI. No.	Use of land	Measuring unit	
		Local unit	Hectare
1	Homestead area (A1)		
2	Own land under own cultivation (A2)		
3	Land taken from others on borga system(A3)		
4	Land given to others on borga system (A4)		
5	Land taken from others on lease (A5)		

Total farm size = A1 + A2 + 1/2 (A3 + A4) + A5=.....

4. Family Size: How much members in your family?----- Person

5. Land under sunflower cultivationhectare

6. Profitability from sunflower productiontaka.

7. Training in sunflower production technology: (Have you participated in any professional training program regarding sunflower cultivation?)

Yes..... No..... (If yes, furnish the following information)

No.	Name of the training	Sponsoring Organization	Days
1			
2			
3			

8. Extension media contact for sunflower practices: Please indicate the extent of your contact with the following information sources-

SI. No	Sources	Not at all (0)	Extent of Contac			
			Regularly (4)	Often (3)	Occasionally (2)	Rarely (1)
	UAO		More than 6 times/year	5-6times /year	3-4 times/year	1-2 times/year
	AEO		More than 6 times/year	5-6 times /year	3-4 times/year	1-2 times/year
	AAEO		More than 6 times/year	5-6times/year	3-4 times/year	1-2 times/year
	SAAO		More than 5times/month	4-5 times/month	2-3 times/month	1 time/month
	NGO workers		More than 5 times/month	4-5 times/month	2-3 times/month	1 time/month
	Radio listening		More than 5 times/month	4-5 times/month	2-3 times/month	1 time/month
	Television watching		More than 5 times/month	4-5 times/month	2-3 times/month	1 time/month

9. Organizational participation: Please mention the nature and duration of your participation in the following organizations

SI. No	Duration/Nature of the participation (yrs)				
	Name of the organizations	No participation	Ordinary Member	Executive Member	Executive Officer
	BRAC				
	PROSHIKA				
	ASA				
	IPM club				
	Cooperative Society				
	Grameen Bank				

10. Knowledge on improved practices of sunflower: Please answer the following questions:

SI. No	Questions	Full marks(2)	Obtained Marks
1	Name two high yielding varieties of sunflower.	2	
2	Mention two diseases of sunflower	2	
3	Mention two local varieties of sunflower	2	
4	Which type of land is suitable for sunflower product	2	
5	Mention harvesting time of sunflower	2	
6	What is the proper sowing time of sunflower seed?	2	
7	What is the proper sowing method of sunflower varieties?	2	
8	What is the ideal seed rate (kg/bigha) for sunflower varieties?	2	
9	Mention the rate of fertilizer per/ bigha is needed in sunflower production?	2	
10	How can you control harmful insects in sunflower field?	2	

11. Adoption of sunflower: Please give your information about the use of following sunflower production technologies:

SI. No	Technologies	Potential Area (L)	Allocated Area(l)	Years of the adoption		
				2015	2016	2017
1	Use of modern high yielding varieties					
2	TSP					
3	Line transplanting					
4	Heightening					
5	Bio-fertilizer					
6	Integrated Pest Management (IPM)					

$$\text{Adoption scores} = \frac{\sum X}{\text{No. of technologies}} \times 100$$

(Thank you for your kind cooperation)

Respondent's contact no.:

.....
Name and Signature of the enumerator

