FARMERS' PERCEPTION TOWARDS HARMFUL EFFECTS OF LAND FRAGMENTATION ON CROP PRODUCTIVITY

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CERTIFICATE

This is to certify that thesis entitled, "**FARMERS' PERCEPTION TOWARDS HARMFUL EFFECTS OF LAND FRAGMENTATION ON CROP PRODUCTIVITY**" *submitted to the Department of Agricultural Extension and Information System, Faculty of Agriculture, Sher-e-Bangla Agricultural University, Dhaka, in partial fulfillment of the requirements for the degree of* **MASTER OF SCIENCE IN AGRICULTURAL EXTENSION AND INFORMATION SYSTEM***, embodies the result of a piece of bona fide research work carried out by Registration* No. **19-10347** *under my supervision and guidance. No part of the thesis has been submitted for any other degree or diploma.*

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

Dated:
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DEDICATED

TO

MY BELOVED

PARENTS

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The Author

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ABBREVIATIONS

ISF	Importer Security Falling
AIS	Agriculture Information Service
BAU	Bangladesh Agricultural University
BBS	Bangladesh Bureau of Statistics
GDP	Gross Domestic Product
SLM	Sustainable Land Management
LFI	Land Fragmentation Index
AEZ	Agricultural Economic Zone
UAE	Upzilla Agriculture Officer
AEO	Agriculture Extension officer
FAO	Food and Agriculture Organization
WHO	World Health Organization
DAE	Department of Agriculture Extension
NGOs	Non-government Organizations
SUS	Sabalamby Unnayan Samity
INM	Integrated Nutrient management
CIRDAP	Cintre on Intregated Rural Development for Asia and the Pacific
SAAO	Sub-Assistant Agriculture Officer
IFAD	International Fund for Agricultural Development
UNDP	United Nations Development Program
NAPA	National Adaptation Programed of Action
WB	World Bank
VFFP	Village and Farm Forestry Program
ICT	Information and Communication Technology

FARMERS' PERCEPTION TOWARDS HARMFUL EFFECTS OF LAND FRAGMENTATION ON CROP PRODUCTIVITY

ABSTRACT

Land fragmentation is a common scenario in Bangladesh and going on since long ago. It has both advantages and disadvantages. However, various study indicates land fragmentation has more disadvantages rather advantage. In this connection, the objectives of this study were to assess the farmers' perception towards harmful effects of land fragmentation on crop productivity, to describe the selected characteristics of the study farmers and to identify the factors that influence farmers' perception towards harmful effects of land fragmentation on crop productivity. The study was conducted in four villages of Nayergaon Dakshin union under Matlab Dakshin Upazila of Chandpur district. Data were collected by using interview schedule among 708 farmers randomly selected 106 respondents during January, 2021. The interview was held following a pre-tested structured questionnaire. Descriptive statistics, linear regressions were used for analysis and interpretation of the data. The survey revealed that the majority (84 percent) of the respondents had favorable perception while 16 percent of them had unfavorable perception towards harmful effects of land fragmentation on crop productivity. Farmers land fragmentation were influenced by higher education, higher extension media contact and the farmers higher number of plots. The findings may help to formulate better policies towards avoiding the harmful effects of land fragmentation on crop productivity.

Keyword: Perception, Harmful effects, Land fragmentation, Bangladesh agriculture

CHAPTER I

INTRODUCTION

1.1 General Background

Land is an important resource and land is at the center of social, economic, political development in most countries. Land is an essential natural resource, both for the survival and prosperity of humanity and for the maintenance of all global ecosystems FAO (2011). Land is also an important source of man's food, shelter and clothes. Now-a-days due to alteration in physiographic and social-economic conditions, climatic changes, adaptation and population growth, the land use pattern of Bangladesh is changing very rapidly. The country occupied huge population and showing very high intensity of land and resources utilization.

Land fragmentation, defined as the process of decreasing in the average size of farm holdings is one of the key challenges facing economic activities such as agriculture, pastoralism and industrial development Argarwal (1972). Particularly in term of agriculture the land fragmentation issue is impacting very forcefully. Land use pattern of a country reflects its socio-economic stipulation; the pattern of its changes in Bangladesh is to meet the dynamic demand of the society that creates pressure on natural environment. The attempt to understand and resolve the controversy surrounding the impact of land fragmentation on food production and land use Muyanga (2012). According to Jayne (2017), the major concern for Africa today is the declining average farm size over time within the densely populated smallholder farming areas where more than half of rural farm households' control less than one hectare of land.

Land fragmentation is a phenomenon that exists when a household operates a number of owned or rented noncontiguous plots at the same time. Various factors are responsible for land fragmentation. Among the main factors that have directly or indirectly contributed to subdivision and fragmentation is the traditional system of inheritance of land. Inheritance laws which divide a family's land among all the remaining sons, ensure that, as the population increases, not only does the size of holdings fall, but they are increasingly fragmented into small plots, scattered over a wide area Gebeyehu (1995).

The changes of agricultural land are remarkable in a land hungry country like Bangladesh. The total arable land of the country is not more than 0.782 crores ha and per capita land is only 0.0526 ha. Moreover, every year 1% of its arable land or 82900 ha of crop land and everyday 221 ha of arable land is losing in Bangladesh Mahbub, (2003), Despite the remarkable achievement in controlling the high birth rate, the population continues to grow by 2 million people each year because of the large existing population base Bhuiyan (2003). The country's population will be over around 190 million by 2030 when an extra 25% food grains will have to be produced but smaller area of cropland than is now available.

Land is a major resource needed in agriculture which, if absent, makes other resources less useful. It serves as a basis for most agricultural operations Apata, (2016). Some of the dominant problems associated with land fragmentation is the small size, irregular shape, and dispersion of parcels (Demetriou et al., 2013; Gonzalez et al., 2007). It is also a form of wealth that can be transferred across generations (Akintayo and Lawal, 2016). Particularly in South Asia, it is the primary source of livelihood of a majority of people. The relationship between land and the people is profound. People's standard of living, wealth, social status and aspirations are all closely linked to land. However, the ownership of land is decreasing rapidly FAO, (2001). According to CIRDAP (1987), on average, an individual in Bangladesh possessed 0.10 ha of land in 1980, which has currently reduced to 0.06 ha.

When landholdings and land parcels are fragmented, they get gradually smaller and disperse widely. The question arises as to how this process affects agricultural production and the condition of land, which determines crop yield. While seeking answer to this question, we will start from the effect of reduced landholding size. Following World War II, the prevailing notion was that reduced landholding size constrains production growth due to the diseconomies of scale. As a result, small farms cannot compete with large farms, which incur low costs of production because of economies of scale. Implying that small farms have to always operate at subsistence level., While land fragmentation is a known global phenomenon Latruffe and Piet, (2014) or a universal feature affecting all agriculture systems Alemu et al., (2017). Small farmers could use land intensively and manage properly by utilizing their household and mutually exchanged labor, while large farmers could not do this as such

operations incurred very high labor cost Ellis, (1989). However, findings of some studies carried

out particularly in India have shown a positive relationship between landholding size and productivity Ram et al. (1999). The inverse relationship between the size of the holdings and productivity has been weakened in recent times due to the availability of size-neutral biotechnology such as seed and fertilizer, and differences in management input (Ram et al., 1999).

Agricultural productivity is crucial to Bangladesh 's internal economic development and to global agricultural trade patterns in commodities and agricultural inputs. The land, labor and technology available to Bangladeshi farmers fundamentally influence agricultural productivity. In terms of land, Chinese reforms of the past few decades have created fragmented agricultural land holdings resulting in many individual farmers tending to several small fields, often in distinct locations. In terms of labor, macroeconomic conditions and manufacturing sector dynamics have altered rural labor markets fundamentally such that a once plentiful supply of farm labor is now more limited. In terms of technology, agricultural machinery, which may logically substitute for increasingly scarce labor, has been the focus of recent government subsidies. Given that policy pathways exist in China to alter both machinery subsidies and patterns of land holdings, it is critical to understand the interactions between land fragmentation, farm machinery use and farm productivity. Less land fragmentation may be a crucial step to promoting the general productivity enhancing features of economies of scale, particularly the adoption of agricultural machinery in lieu of tightening farm labor availability. In this context a study entitled farmers' perception towards harmful effects of land fragmentation on crop productivity has been taken.

1.2 Statement of the Problem

Agriculture has always been an important sector in Bangladesh which is serving 80% of the population either directly or indirectly that placed the smallholder farmers as central focus of development policies and strategies. The average farm size shrank to a level (0.68 ha) at which it is unlikely to sustain livelihoods Niroula and Thapa, (2005). The rational use of agricultural land is influenced by land use limitations. One of the obstacles for agricultural development is land fragmentation J. Hristov, (2016). Land fragmentation is defined as the situation in which a single farm or ownership consists

of numerous spatially separated plots (J. W. Bentley, 1987). The total arable land of the country is not more than 0.782 crores ha and per capita land is only 0.0526 ha. Moreover, every year 1% of its arable land or 82900 ha of crop land and everyday 221 ha of arable land is losing in Bangladesh. The country's population will be over around 190 million by 2030 when an extra 25% food grains will have to be produced but smaller area of cropland than is now available Bhuiyan, (2018). In each and every year the cropland is shrinking for human settlement and other human induced activities. It is estimated that the growing population pressure will use up 50 percent of the country's cultivable land by 2025.

In the context of the above circumstances the researcher intended to find out the answers of the following research questions:

- What is the farmers' perception towards harmful effects of land fragmentation on crop productivity?
- What are the selected characteristics of the farmers?
- Have any contribution of selected characteristics of the farmers on their perception towards harmful effects of land fragmentation on crop productivity?

1.3 Specific Objectives of the study

In order to answer the above the questions the following specific objectives were formulated that supposed provide proper direction and to the study

1. To assess farmers perception towards harmful effects of land fragmentation on crop productivity.
2. To describe the selected characteristics of the study farmers and
3. To explore contributing relationship between selected characteristics of the study farmers and their perception towards harmful effects of land fragmentation on crop productivity.

1.4 Justification of the Study

It is important to know farmers' perception towards harmful effects on land fragmentation on crop productivity. This might help to formulate letter polices towards reducing land fragmentation system on co-operation cultivation. Rural people living in the marginalized lands pursuing nature dependent agriculture are facing barriers and constraints earning well- being in the land fragmentation problem. The main focus of

the study is to ascertain the farmers' perception towards harmful effects of land fragmentation on crop productivity. Land fragmentation is a universal trait of all

agricultural systems that affect farmland productivity, and as yet, no one has documented a rural society where there was no land fragmentation (Austin, 2012). Land fragmentation is considered an impediment to efficient crop production. In addition to shrinking availability of land for farming, land fragmentation is on the rise in Bangladesh. Bangladesh is experiencing rapid decline in farm sizes coupled with an increase in the number of operational holdings. Thus, the findings of the study will have great importance to the agricultural development of Bangladesh.

1.5 Assumptions of the Study

An assumption is the supposition that an apparent fact or principle is true in the light of the available evidence (Goode and Hatt, 1952). The researcher had taken the following assumptions into consideration during carrying out the study:

I. The respondents had enough capability to provide proper response of the question furnished in the interview schedule.
II. The findings of the study would give clear concept of the harmful effect of land fragmentation on crop productivity.
III. The data furnished by the respondents were free from bias.
IV. The items, questions and scale of measurement of the variables were reasonably authentic to present the actual condition of the respondents.
V. The researcher was capable to adjust with the social and cultural environment of the study area. So, the respondents could provide their information correctly.
VI. The respondents were provided views and opinions included in the sample representative of the whole population of the study area.
VII. The responses furnished by the respondents were reliable. They expressed the truth about their opinion and interest.
VIII. The items, questions and scales included in the questionnaire were relevant and appropriate.
IX. Data were normally and independently distributed.
X. The information sought reveals the real situation to satisfy the objectives of the study.

Whereas the study tried to be as representative, cover all aspects and use appropriate methodologies as much as possible, it had some limitations. The coverage was 4 villages at Matlab Dakshin Upazila in Chandpur district and limited representative areas within the certain area. The findings are therefore not easily generalizable due to the uniqueness of other areas within the covered counties and country.

1.6 Limitations of the Study

It is necessary to impose certain limitations to make the research manageable and meaningful. Thus, during the entire research the most challenging limitations were:

I. The research was confined to the four villages of Matlab Dakshin Upazila under Chandpur district.
II. Data were collected from a small group of respondents taken as the sample of the study because of time and resource constrains.
III. The researcher had to face many difficulties during data collection. All the data were recall data. So, the researcher had to depend on the data as given by the respondents.
IV. Only nine characteristics of the farmers were selected as independent variables.
V. For information about the study, the researcher has to depend on the data furnished by the selected respondent's instant memory during the interview time.
VI. Time allocation and budget was also limitation in the study.

1.7 Definition of Important Terms

Perception can be defined as our recognition and interpretation of sensory information. Perception also includes how we respond to the information. We can think of perception as a process where we take in sensory information from our environment and use that information in order to interact with our environment. Perception allows us to take the sensory information in and make it into something meaningful.

Land is the solid surface of Earth that is not permanently submerged in water. Most but not all land is situated at elevations above sea level and consists mainly of crustal components such as rock, sand, soil, and sometimes ice.

Fragmentation describes a separating of something into pieces or the act or process of fragmenting; state of being fragmented.

Land fragmentation is the splitting of one or more aspects of land available for use as farmland through activities like subdivision and residential development, including expansion of urban areas.

Crop is a plant or plant product that can be grown and harvested for profit or subsistence. By use, crops fall into six categories: food crops, feed crops, fiber crops, oil crops, ornamental crops, and industrial crops.

Crop productivity is the quantitative measure of crop yield in given measured area of field. The use of new crop varieties and the efficient application of agrochemicals, immensely contributed to increased plant productivity.

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.

Age: Age of a farmer was defined as the period of time in years from his birth to the time of interview.

Education: Academic qualification referred to the development of desirable change in knowledge, skills and attitude in an individual through reading, writing and other related activities. It was measured in terms of years of schooling completed by and individual at the time of interview.

Extension Contact: The term referred to an individual's access to or contact with the communication media and sources being used for dispersion of new technologies among farmers.

Annual family income: Family annual income was defined as the total earning of a respondent and members of his/her family both from agriculture and other sources (business, service etc.) during a year. It was expressed in Taka.

Farm size: Farm size referred to the area on which a farmer carried out his farming operations. The area was being estimated in terms to lull benefit to the farmer‟s family.

CHAPTER II

REVIEW OF LITERATURE

The chapter deals with the past literature relevant to the objective of this study. In this aspect, information was collected from various published and unpublished thesis, journals and organizational reports etc. Information collected from these sources, therefore, this chapter divided into five sections.

Section 1: Land fragmentation scenario in Bangladesh and beyond the country

Section 2: Farmers' perception towards agricultural technology

Section 3: The relationship between farmers' characteristics and their perception towards various agricultural issues and

Section 4: The conceptual framework of the study

2.1 Land fragmentation scenario in Bangladesh and beyond the country

Abiodun Elijah Obayelu *et al* (2019), showed that the average land fragmentation index was 0.38, implying that smallholder farmland is highly fragmented. The average annual household income ($p < 0.01$), labor force of household ($p < 0.05$), education level ($p < 0.01$) and land ownership ($p < 0.1$) were the significant factors that negatively influenced land fragmentation in the study area. However, the size of land rented in by household ($p < 0.001$) significantly increases the degree of land fragmentation. Therefore, land consolidation and application of specific land protection policies to prevent agricultural land from being developed for non-agricultural purposes are recommended.

Blaikie and Sadeque (2000), observed that land fragmentation is becoming a critical constraint in increasing productivity in Nepal, India and other nearby regions.

Wu et al. (2005) estimated that land fragmentation does not have any significant impact on productivity.

Wan and Cheng (2001), concluded that land fragmentation reduces productivity. Similar contrasting arguments exist on the effects of land fragmentation on efficiency

Islam (2014) showed that the land fragmentation of Rajshahi district is changing, especially the agricultural land is decreasing in an alarming rate and now it is becoming more and more vulnerable. The agricultural land of the study area is losing each and every year. The agricultural production also is decreasing due to lack of agricultural land, industrialization, decreasing soil fertility and making soils toxics by using chemicals.

Rahman (2009) revealed that land fragmentation has a significant detrimental effect on productivity and efficiency as expected. The elasticity estimates of land fragmentation reveal that a one percent increase in land fragmentation reduces rice output by 0.05 percent and efficiency by 0.03 percent. On the other hand, ownership of key resources (land, family labor, and draft animals) significantly increases efficiency. The mean elasticity estimates reveal that a one percent increase in family labour and owned draft animal improve technical efficiency by 0.04 and 0.03 percent, respectively. Also, a one percent increase in the adoption of modern technology improves efficiency by 0.04 percent. The mean technical efficiency in rice production is estimated at 0.91 indicating little scope to improve rice production per se using existing varieties.

Balogun and Akinyemi (2017) showed that regional effects of land fragmentation on technical efficiency of 462 cassava farmers selected through a multitage sampling technique from South-West geopolitical zone of Nigeria. Results show that quantity of labour used, land size and quantity of planting material are influential determinants of technical efficiency of cassava farmers. The result further revealed that fragmentation index and distance between farm and farmstead are the only significant technical inefficiency variables. The study found that substantial technical inefficiency exists in cassava farming. The study recommends land reforms that directly targeted at cassava farmers in form of enhancement program to increase their production efficiency

Kadigi (2016) mentioned that there are polarized evidences of the impact of agricultural land fragmentation on land productivity. On the one hand, there viewpoints which consider land fragmentation to harm agricultural productivity. On the other hand, there are counter thoughts which view land fragmentation as a positive situation which allows farmers to cultivate many environmental zones, minimise production risk and optimise the schedule for cropping activities

Chaozheng Zhang and Danling Chen (2021), reported that land fragmentation has become a serious obstacle to agricultural production, and land transfer and consolidation are traditionally emphasized as the two most effective solutions to this quandary. To identify the extent of land fragmentation accurately and systematically, this study selected the number of plots, the average size of plots, and the average distance between plots to calculate the land fragmentation index (LFI). Taking the Wuhan metropolitan area as a case study, this study examined the effectiveness of farmer-led land transfer and consolidation on land fragmentation. The main results are as follows: (a) most of the transferred plots and contracted plots were not spatially adjacent, suggesting that the tenants could not merge and consolidate both plots; (b) land transfer caused the LFI to increase by 2.85%, suggesting that land transfer had intensified the degree of land fragmentation to some extent; (c) if the transferred and contracted plots were non-adjacent or adjacent but unmerged and unconsolidated, then the LFI might increase or decrease; (d) if the transferred and contracted plots were spatially adjacent, merged, and consolidated, then the LFI decreased significantly.

Graaff *et al* (2014) showed that farmers' perceptions about land quality, land fragmentation and tenure systems and their influences on sustainable land management (SLM) investments in the North Western Ethiopian Highlands. The study is based on a detailed farm survey among 300 households and 1,700 parcels in three watersheds. Simple descriptive statistics were applied to analyse the perception of farmers about land-related factors. The study shows that on average, sample households managed 4·54 parcels in different locations with an average parcel size of 0·26 ha.

Samuel (2018) conducted by analyzing the perceptions of farmers on the impact of land degradation hazard on agricultural land productivity decline. Descriptive results show that 57percent of the respondents were perceived the severity and its consequence on agricultural land productivity. the study recommended a need for the government to enforce effective policies to control and prevent land degradation and these policies should be community inclusive /participatory founded up on indigenous and age-honored knowledge and tradition of farmers' natural resource management as well as introduced scientific practices.

Nyamira *et. al,* (2021), the research established the existence of widespread fragmentation of agricultural land in the majority of the 13 Counties. Rapid Population

growth, inheritance of agricultural land, uncontrolled urbanization, absence/weak implementation of land protection policies, processes and procedures, land speculation, and development due to big public projects are the main drivers of land fragmentation identified by the research. The effects of fragmentation of agricultural land identified include; Low Agricultural Land Productivity, Disputes/Conflicts, Use of ineffective farming technology, Land Use Land Cover Changes.

Musambayi, (2013) observed that the consequence of this is that size and distribution of land varies quite widely just as population density which ranges from as low as 2 persons per sq. km. in the ASALs to a high of over 2000 in high rainfall areas. Cultivated land per person in agriculture has declined from 0.462 ha in the1960s to 0.219 ha in the 2000–08 period

Muyanga, (2012) conducted that the attempt to understand and resolve the controversy surrounding the impact of land fragmentation on food production and land use while the World Bank development indicators, reflects that arable land (hectares per person) was 0.11286 in 2018.

Iheke (2016) land fragmentation advocates however have cited positive effects such as it can help to reduce risk from natural disasters (such as floods and droughts), promote crop diversification, as well as to ease allocation of labour over cropping seasons.

Bentley (1987) opined that land fragmentation may enable risk management through the use of crop diversification and the practice of crop scheduling. Growing crops in different locations and irregularly shaped plots may impede the spread of pests and diseases hence reduce the use and therefore cost of pesticides.

Ndirangu (2017), commented that head's level of education, age, access to credit, extension, tenure security, access to water for irrigation, distance to market, all-weather, to name but a few. Ndirangu (2017) concludes that farm size has a negative effect on farm efficiency and "the extent to which farm efficiency is affected by the farm size and other factors vary with the AEZ". Therefore, the recommendations on how to reduce the impact of land fragmentation on food security also vary with AEZs

Steve Burton, (1982) land fragmentation is a spatial issue which depends on the following parameters holding size, number of parcels that belongs to the holding, size

of each parcel, shape of each parcel, the spatial distribution of parcels and the size distribution of parcels.

(Bentley, 1987) conducted that a measure of land fragmentation should capture at least one of these parameters if not all, viz. farm size, plot number, size, shape and spatial distribution.

Section 2.2: **Farmers' perception towards agricultural technology**

Oladele and Fawole (2017), showed that farmers are well aware of agricultural technologies, for instance snailery (99.17%), fadama development (75.00%), improved variety of cassava (95.83%), and soyabean thresher (95.83).

Aphunu and Otoikhian (2008), indicated that respondents perceived extension agents to be vast in knowledge of subject matter and they integrated theories with practical's well.

Akanda, (2015) identified the relationship between the characteristics of the farmers and their perception of climate change effects on coastal agriculture at Patuakhali district of Bangladesh. To make the outcomes useful, both qualitative and quantitative approaches of field investigations were done. Majority (80.20 percent) of the farmers had low to medium perception and 19.80 percent high perceptions were found in this area. The research showed that some respondents had a clear understanding of climate change which directly affecting their lives and livelihoods

Farouque, (2007) examined those different categories of farmer indicated that landless, marginal and small farmers had a low level of awareness when compared with medium and large farm holders. The overall perception of farmers in the study areas revealed that a significant proportion (78%) had either a low or a very low level of perception while 22% had a medium to high level of perception. Findings from individual interviews with farmers indicated that they perceived themselves as having a low perception of preparation of farm yard manure and the role of organic matter as well as the beneficial aspect of ISF and NM for sustainable crop production.

Islam, (2020) showed that perception index demonstrated most of the respondents experienced climatic changes having negative impacts on agricultural activities.

Rahman (2020), examined that farmers' perception of IPM and determinants of IPM adoption in vegetables production in Bangladesh. Approximately one-third of the farmers agreed that the implementation of IPM is beneficial for farmers' health

Section 3: The relationship between farmers' characteristics and their perception towards various agricultural issues

2.3.1 Age and farmers' perception

Adeola (2012) conducted a study on perceptions of environmental effects of pesticides use in vegetable production by the farmers in Ogbomoso, Nigeria. Adeola found that age had a significant influence on the farmers‟ perception.

Pal (2009) conducted a study on the perception of organic farmers regarding introduction of ICT in organic farming. Pal found that age had no significant relationship with farmers' perception.

Majlish (2007) conducted a study regarding perception of participant women on social forestry program of BRAC. The study revealed that the relationship between age and perception of social forestry program was negatively significant.

Afique (Z006) mentioned that there was no significant relationship between the age of the rural women and their perception of benefits of involvement in agricultural model farm project activities of Sabalamby Unnayan Samity (SUS).

Islam (2005) found that age of the farmers had no significant relationship with their perception of causes under remedies of Monga in Kurigram district.

Sharmin (2005) stated that age of the rural women had no significant relationship with the perception of benefits of involvement in IGAs under an NGO.

Uddin (2004) conducted a study on perception of sustainable agriculture. The findings revealed that age of the respondents had negative significant relationship with their perception of sustainable agriculture.

Sayeed (2003) found that age had negative relation with farmers‟ perception of benefit from using manure towards INM for sustainable crop production by the farmers.

Ismail, (1979) Chowdhury (2001) and Alom (2001) obtained similar type of findings in their respective studies.

Kabir (2002) studied perception of farmers on the effects of integrated area development project towards environmental upgradation. The study revealed that there was no significant relationship between age and perception of environmental upgradation. Similar finding was obtained by Fardous (2002) in his study.

Islam (2000) stated that age of farmers had no significant relationship with their perception of the harmful effect of agrochemical with regard to environmental pollution. Hossain (2000) and Parveen (1995) obtained similar result in their studies.

2.3.2 Education and farmers' perception

Kabir (2002) conducted a study on farmers' perception on the adverse effects of pesticides on environment: the case of Bangladesh. They found that education had a significant influence on the farmers' perception.

Adeola (2012) conducted a study on perceptions of environmental effects of pesticides use in vegetable production by farmers in Ogbomoso, Nigeria. The study revealed that education had a significant influence on the farmers' perception.

Pal (2009) conducted a study on the perception of organic farmers regarding introduction of ICT in organic farming. The study revealed that education had a positive significant influence on the farmers' perception.

Majlish (2007) Found that the relationship between education of participant women and their perception of social forestry program of BRAC was positively significant.

Afique (2006) mentioned negatively significant relationship between personal education of the rural women and their perception of benefits of involvement in agricultural model farm project activities of Sabalamby Unnayan Snmity, (SUS).

Sharmin (2005) found that personal education of the rural women had significant positive relationship with their perception of benefits of involvement of IGAs under NGOs.

Uddin (2004), concluded that the level education of the farmers had a significant positive relationship with their perception of sustainable agriculture.

Sayeed (2003), revealed that the education of the respondents had significant positive relationship with their perception from using manure towards Integrated Nutrient Management (INM) for sustainable crop production.

Fardous (2002) found a significant positive relationship between education of the farmers‟ and their perception of the forestry development activities of Village and Farm Forestry Program (VFFP) towards sustainable forestry development.

Alam (2001) found that education of farmers „had a significant and positive relationship with their perception of Binamoog-5 as a summer crop.

Majydyan (1996) and Sarker (1999) and Islam (2001) found similar type of result. But, Kashem and Mikuni (1998) did not find any relationship between education of farmers and their perception about benefit of using Indigenous Technical Knowledge (ITK).

Wasihun *et. al* (2014), showed that farmers in Soddozuria Woreda perceived their status level of participation to be low, and had significant correlation with educational status.

2.3.3 Family size and farmers' perception

Oladele (2017) discovered that machinery equipment fabrication, improved varieties of arable crops and agroforestry technologies are significantly related to family size and their perception. However, the awareness, the land evaluation techniques was not significant.

Farouque (2007) mentioned that the overall perception of farmers in the study areas revealed that a significant proportion (78%) had either a low or a very low level of perception because family size while 22% had a medium to high level of perception.

Rahman (2004) found in his study that family size of the farmers had no significant relationship with their perception on boro rice cultivation practices.

Hossain (2003) found that family size of the farmers was not significantly related to farmers' perception on modern Boro rice cultivation practices.

Farhad (2003) found that family size of rural women farmer had no significant relationship with their perception in using IPM in vegetable cultivation.

Sana (2003) revealed that family size of the farmers was not related to their perception of shrimp culture.

Sutradhar (2002) found that family size of the respondents had a significant positive relationship with their awareness on environmental degradation.

Hanif (2000) found that in his study there was a positive insignificant relationship between family size of the respondents and their awareness on environmental pollution.

Hossain (2000) found that family size of the farmers had significant positive relationship with their perception on Binadhan-6.

Parveen (1995) revealed that family size of the farm women had a positive significant relationship with their perception on the use of fertilizer, pesticides and irrigation water.

Kashem (1987) in his study, however, did not find any significant relationship between family size and perception of the farmers.

Shidhu (1980) found that family size was not associated with the level of perception toward dairying.

2.3.4 Farm size and farmers' perception

Adeola (2012) conducted a study on perceptions of environmental effects of pesticides use in vegetable production by farmers in Ogbomoso, Nigeria. The study revealed that household size had a non-significant influence on the farmers' perception.

Pal (2009) conducted a study on the perception of organic farmers regarding introduction of ICT in organic farming. The study revealed that farm size had no significant relationship with farmer‟s perception.

Majlish (2007) revealed from her study that the relationship between farm size of participant women and perception of social forestry program of BRAC was non-significant and followed a positive trend.

Farouque (2007), examined that the different categories of farmer indicated that landless, marginal and small farmers had a low level of awareness when compared with medium and large farm holders. The overall perception of farmers in the study areas

revealed that a significant proportion (78%) had either a low or a very low level of perception while 22% had a medium to high level of perception. Findings from individual interviews with farmers indicated that they perceived themselves as having a low perception of preparation of farm yard manure and the role of organic matter as well as the beneficial aspect of ISF and NM for sustainable crop production.

Afique (2006) stated that there was no significant relationship between family farm size of the rural women and their perception of benefits of involvement in agricultural model farm project activities of Sabalamby Unnayan Samity (SUS).

Islam (2005) found that farm size of farmers had no significant relationship with their perception of both causes and remedies of Monga in Kurigram district.

Sharmin (2005) found in her study that farm size of the rural women had no significant relationship with their perception of benefits of involvement in IGAs under a NGO. Uddin (2004) found that farm size of the farmers had significant and positive relationship with their perception of sustainable agriculture.

Sayeed (2003) observed that farm size of the farmers had a significant positive relationship with their perception of benefit from using manure towards Integrated Nutrient Management (INM) for sustainable crop productions.

Fardous (2002) found that there was no significant relationship between farm size of the farmers and their perception of Village and Farm Forestry Program (VFFP) towards sustainable forestry development. Hossain (2001), Hossain (1999) and Majydyan (1996) found similar findings in their respective studies.

2.3.5 Annual family income and farmers' perception

Pal (2009) conducted a study on the perception of organic farmers regarding introduction of ICT in organic farming. The study showed that annual family income had no significant relationship with farmers' perception.

Majlish (2007) found that the relationship between family income of participant women and perception of social forestry program of BRAC was non-significant but followed a negative trend.

Afique (2006) found no significant relationship between annual family income of the rural women and their perception of benefits of involvement in agricultural model farm project activities of Sabalamby Unnayan Samity (SUS).

Islam (2005) found that annual income of the farmers had positive significant relationship with their perception regarding causes and remedies of Monga in Kurigram district. Uddin (2004) concluded that annual family income of the farmers had significant and positive relationship with their perception of sustainable agriculture.

Sayeed (2003) found that annual family income of the farmers had a significant relationship with their perception of benefit from using manure towards Integrated Nutrient Management (INM) for sustainable crop production.

Kabir (2002) found that there was non-significant relationship between annual family income of the farmers and their perception of the effects of BIADP towards environmental upgradation.

2.3.6 Extension media contact and farmers' perception

Islam (2005) observed in his study that media contact of the farmers had no significant relationship with the perception of both causes and remedies of monga.

Sharmin (2005) in her study that extension media contact of the rural women had a significant relationship with their perception of benefits of involvement in IGAs under an NGO.

Aphunu (2008) indicated that there was a significant association between the effectiveness of extension agents and the adoption of technologies.

Sayeed (2003) reported that extension media contact of the farmers was a significant positive relationship between media contact of the farmers and their perception of benefit from using manure towards INM for sustainable crop production.

Fardous (2002) conducted a study and found that there was no significant relationship between knowledge of forestry of farmers and their perception of VFFP towards sustainable forestry development.

Islam (2020) mentioned that training provision, motivational programmes and extension contact should be properly implemented by the government as well as non-

government organizations to aware the farmers about pros and cons of land conversion and to choose the best land use decision for livelihood improvement.

Kabir (2012) found that extension media contact of the farmers had a significant positive relationship with their perception of the effects of BIADP on environmental up gradation. Sarker (1999) conducted a study on perception regarding environmental degradation due to use agrochemicals and found that media contact of the farmers had a significant relationship with their perception.

Rahman (1995) observed a positive relationship between extension media contact of the farmers and their awareness on the environment pollution.

Rahman (2020), increased investment in extension services is recommended to increase awareness. Moreover, modifying the current extension approach by targeting not just the primary farmers, but also members of their families also.

Patidar (2015) conducted in Madhya Pradesh, India. The state of Madhya Pradesh consists of 39 districts; out of these is a convenient and purposive sampling technique was used to select 100 respondents from 50 villages of Khargone district of Nimar region. Descriptive statistics and factor analysis were used to present the findings of the study while the Chi-square analysis was used to test the study hypotheses. Study revealed that 67% of respondents have positive perception towards organic farming.

Section 4: The conceptual framework of the study

The contribution between the experimental variables and the main focus of the study can be clearly delineated with the help of conceptual framework of the study. The researcher was made an attempt to ascertain harmful effects of agricultural land fragmentation on crop productivity of Matlab Dakshin upazila under Chandpur district as the main focus of the study. It was conceptualized in the research that the harmful effects of agricultural land fragmentation on crop productivity. It may be influenced and affected by the interacting forces of many socio-economic and others characteristics of the farmers. To make the process conspicuously interpretable a conceptual framework has been presented in a schematic Figure 2.1

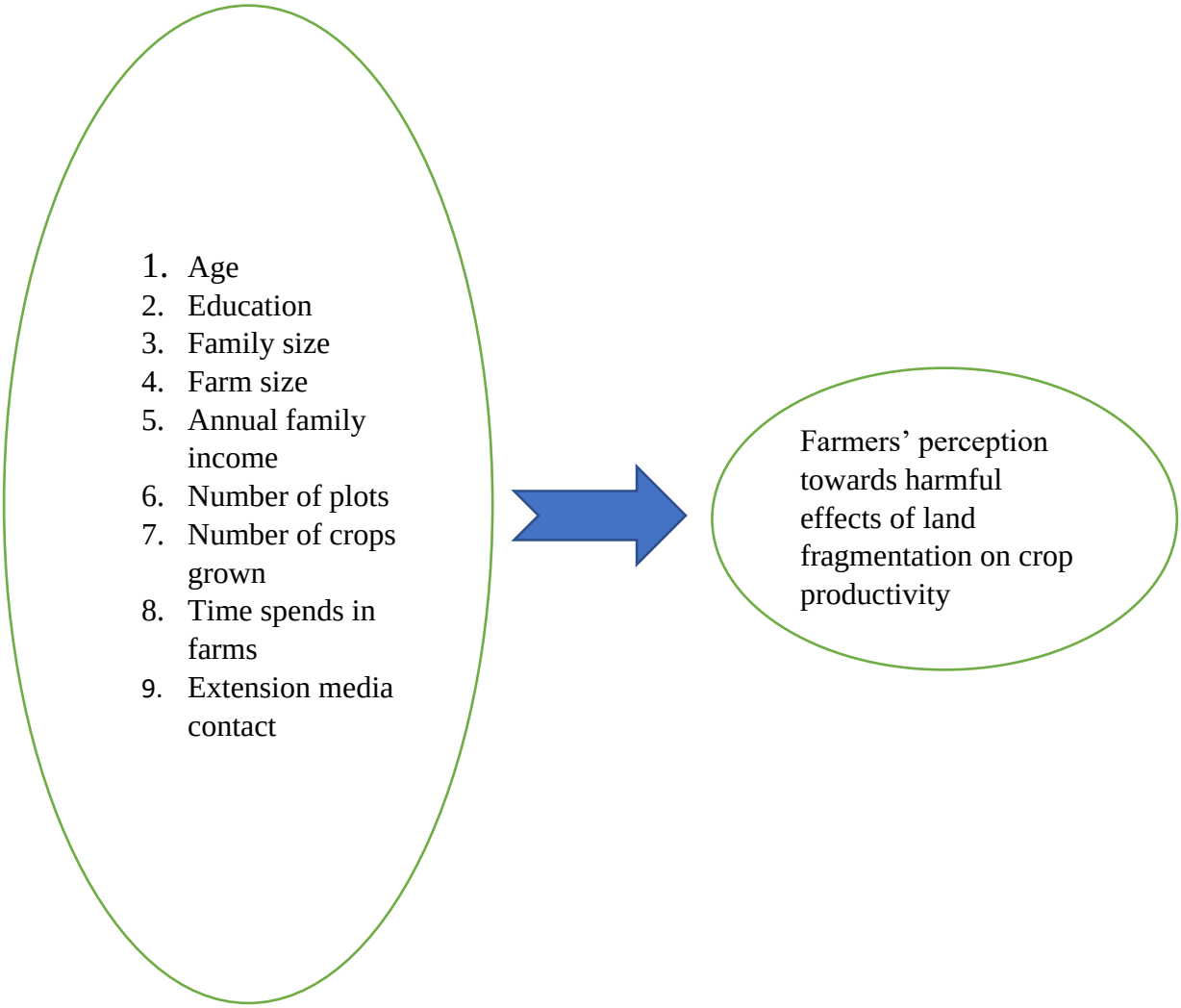

Figure 2.1: A conceptual framework of the study

CHAPTER III

METHODOLOGY

The method and procedure used in the study are presented in this chapter. The principal method used in this study was field survey using structured interview schedule. In any scientific research methodology plays an important role. To perform a research work systematically, careful consideration of appropriate methodology must be needed. the researcher to collect valid and reliable information to reach at correct decisions. The methods and procedures followed in conducting this study have been described in this chapter in the following sections.

3.1 Study Area

The study was conducted at Nayergaon Dakshin Union in Matlab Dakshin Upazila under Chandpur district of Bangladesh. Four village namely, Nayergaon, Horian, Shahpur and Tatkhana under Matlab Dakshin Upazila under Chandpur district were selected randomly. Four villages from each union were selected randomly as the locale of the study. A purposive sampling procedure was followed to selected one district from all over the Bangladesh. A map of Chandpur district showing the Matlab Dakshin Upazila and a map Matlab Dakshin Upazila showing the village of the study area are presented in Figure 3.1 and 3.2.

3.2 Population and sampling Design

The study conducted in Matlab Dakshin Upazila. A list of farmers of the study villages were prepared by the researcher with the help of Sub-Assistant Agriculture Officer (SAAO) of Matlab Dakshin Upazila agriculture Office. The lists comprised of 708 famers which considered as population of the study. Among 708 farmers, 106 farmers were selected following 15% of the population. Proportionate random sampling technique was used in order to select the respondent size in each village. An appropriate sample reserve list was determined to avoid the uncertainty related with the availability of sample during data collection.

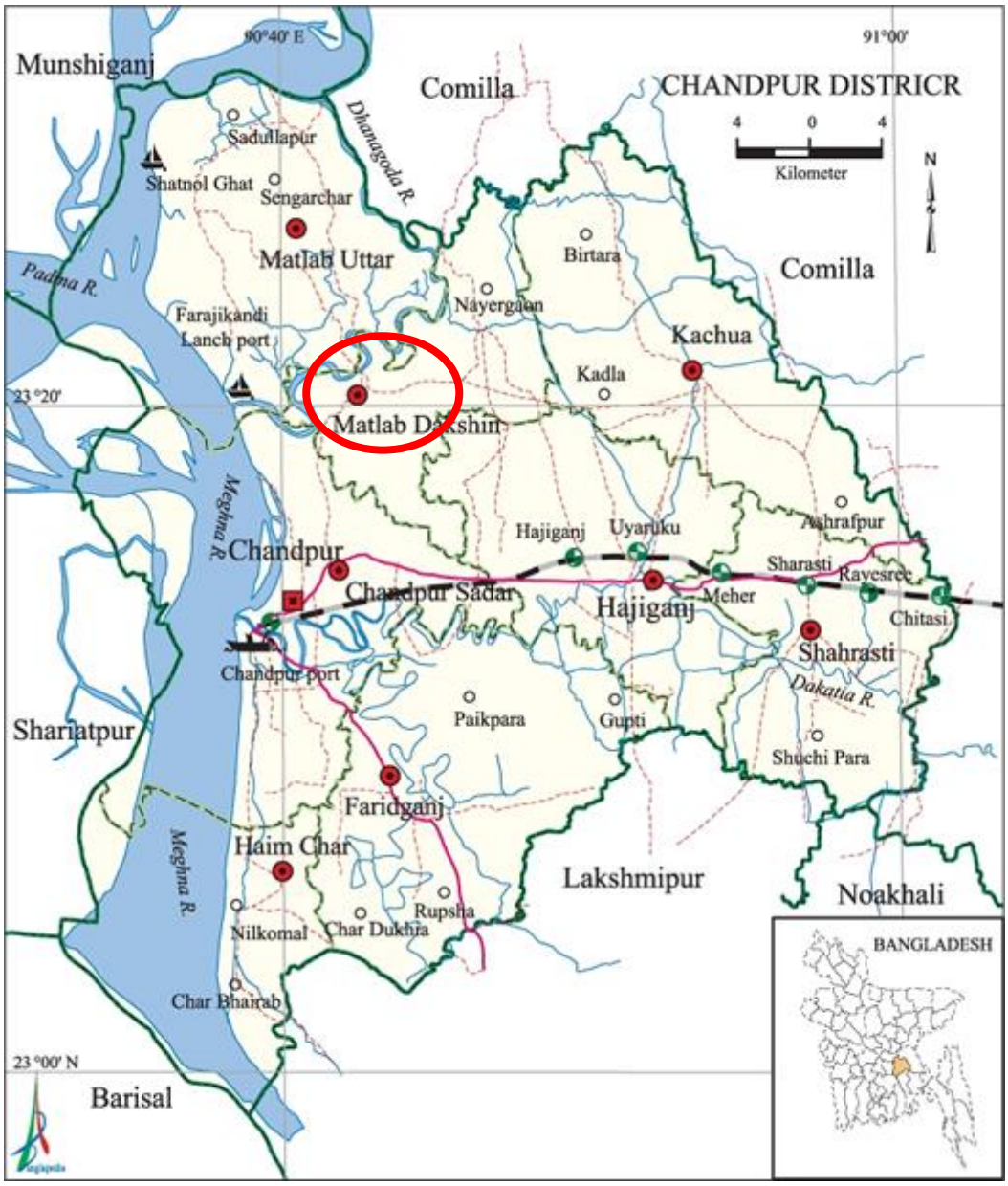

Figure 3.1. Map of MAtlab Dakshin Upazila Under Chandpur District

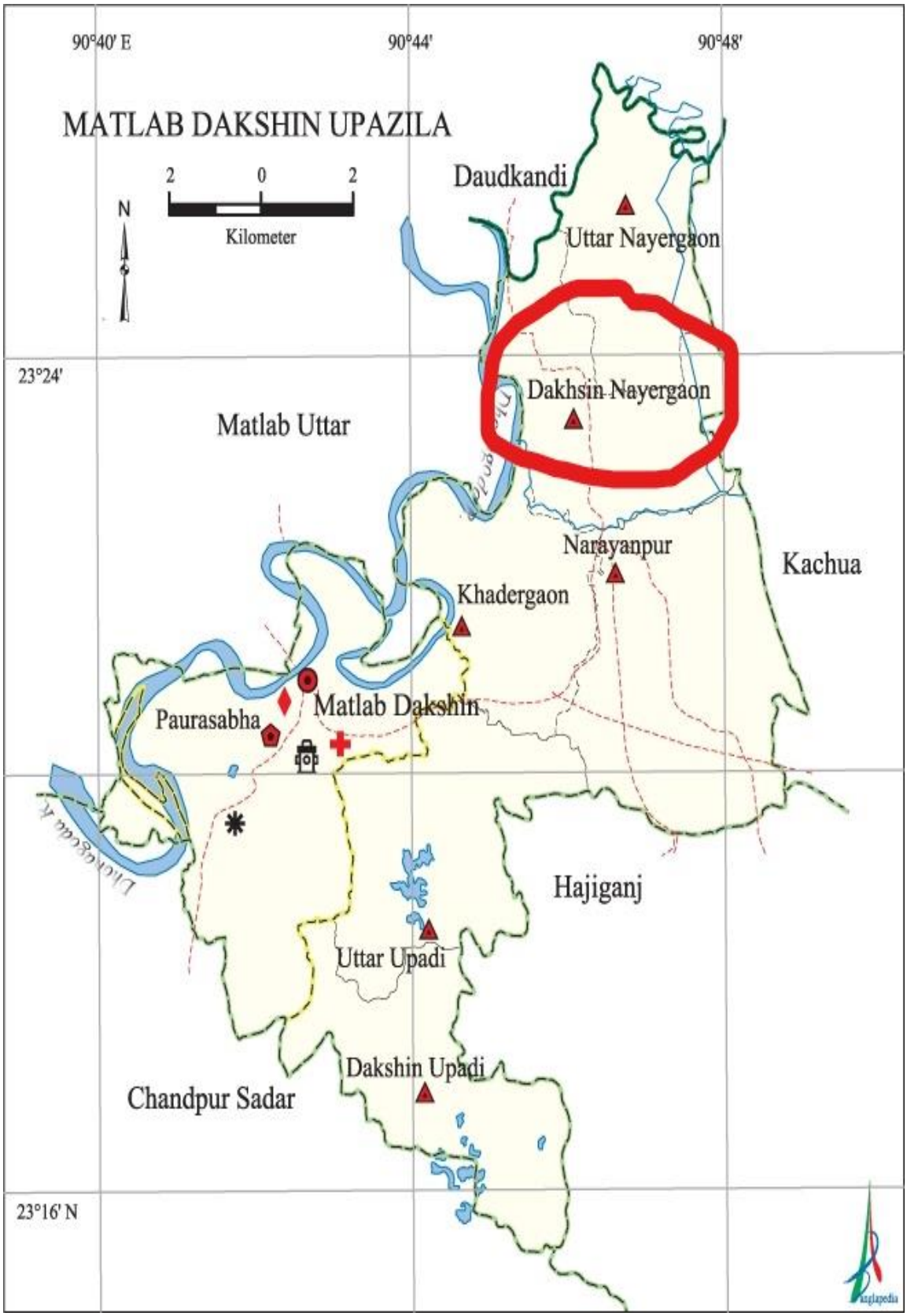

Figure 3.2: Map of Matlab Dakshin Upazila showing the study area- Dakshin Nayergaon Union

Then 106 farmers were selected from the population by using proportionate random sampling technique. A reserve list of 11 (10% of total sample size) farmers was also prepared. Farmers in the reserve list were used only when a respondent in the original list was not available.

The distribution of the sample farmers and those in the reserved list from the villages is shown in the table 3.1.

SI. No.	**Village name**	**Total population**	**Sample size**	**Reserve list**
1	Nayergaon	201	30	3
2	Horian	246	37	4
3	Shahpur	174	26	3
4	Tatkhana	87	13	1
Total		708	106	11

3.3 Development of data collection

The face-to-face interviewing method was used for data collection. A structured interview schedule containing both closed and open form questions was prepared in this purpose. The question included was simple and direct to ascertain the opinion of the farmers. Pre-test with the draft interview schedule with 10 farmers was accomplished. Data was collected by face-to-face interviewing of the respondents. The duration for this imposed in January, 2021. Based on the pre-test result, necessary corrections, modifications, addition, alternation were made in the interview schedule and then finalized it.

3.4 Data Collection Procedure

Data were collected from the selected 106 farmers by face-to-face interview following structured questionnaire. Questions were asked systematically and explanation was made whenever necessary. The respondents were interviewed at their leisure time so that they can give accurate information in a cool mind. The researcher faced no serious problems. To build rapport and motivation in the interview situations, the researcher attempered to provide conditions that maximum trust maintained each respondent's

interest and reduced status difference. The final data were collected during January, 2021.

3.5 Variables to be used

A variable is any characteristics, which can simulate varying or different values in successive individual cases, an organized piece of research usually contains at least two important variables viz., dependent and independent variables.

3.6.1 Dependent variable

Dependent variable is the variable that is being measured in an experiment. Or the variables those are affect during research are called dependent variable. In this study the dependent variable that is farmers' perception towards harmful effects of land fragmentation on crop productivity was measured based on farmers agree or disagree on some statements related to effects of crop productivity.

3.6.2 Independent variables

Independent variables are the variables that the researcher changes to test their dependent variables. Or the variables that can take different values and can cause corresponding changes in other variables. In this research, the researcher selected nine characteristics of the respondent as the independent variables. The independent variables for this study are- age, education, farm size, annual family income, number of plots, number of crops grown, time spend in farms, extension media contact.

3.6.3 Measurement of Independent Variables

For conducting the study in accordance with the objectives it was essential to measure the independent variables. The independent variables for this study are- age, education, family size, farm size, annual family income, number of plots, number of crops grown, time spend in farms, extension media contact. Farmers' perception towards harmful effects of land fragmentation on crop productivity described below:

3.6.3.1 Age

Age of the farmers was measured in terms of actual years from his birth to the time of interview, which was found on the basis of the verbal response of the rural people (Rashid, 2014). A score of one (1) was assigned for each year of one’s age. This variable appears in item number 1 in the interview schedule as presented in Appendix-I.

3.6.3.2 Level of education

Level of education was measured as the knack of an in individual respondent to read and write or the formal education received up to a certain standard. If a respondent did not accomplish formal education, his score was assigned as zero (0). A score of 0.5 was given to a respondent who only could sign his/her name. A score of one (1) was assigned for each year of schooling. If a respondent passed the S.S.C examination, his education score was given as 10, 12 for H.S.C., and so on. This variable appears in item number 2 in the interview schedule as presented in Appendix-I.

3.6.3.3 Family size

Family size was measured as the knack of an in individual respondent to number divided in three categories. Such as 1-5 number is ranged as small family size, 6-10 number is ranged by medium family size and above 10 number is ranged by large family size. This variable appears in item number 2 in the interview schedule as presented in Appendix-I.

3.6.3.4 Farm Size

Farm size of the respondents' farmer was measured using the following formula. The farm size was expressed in hectare.

Farm size = A+B+1/2(C+D) +E

Where, A= Homestead area including pond

B= Own land under own cultivation

C= Land given to others as borga

D = Land taken from others as borga

E=Land taken from others as lease

Total farm size of each respondent was categorized into 4 types (Islam, 2007). The farmers who had land bellow 0.20 hectare were considered as marginal farmer. The farmers who had land between >0.20 to 1.00 hectare were considered as small farmers; the farmers who had land 1.00 to 3.00 hectare were considered as medium farmers. the farmers who had land above 3.00 hectare were considered as large farmers. This

variable appears in item number 3 in the interview schedule as presented in Appendix-I.

3.6.3.5 Annual family income

Annual family income indicates total earning of a farmer and the members of his family both from agriculture and other socially acceptable regular means such as business, service, remittance etc. during a year. The value of all the agricultural products encompassing crops, fisheries, livestock, vegetables, etc. were taken into consideration. For calculation, a score of one (1) was assigned for each one thousand (1000) takas of the annual income of a family. According to their annual income, farmers' income was categorized as low income, medium income and high income. This variable appears in item number 4 in the interview schedule as presented in Appendix-I.

3.6.3.6 Number of plots

Number of plots are mentioned how many plots did they have. This number of plots from including homestead, own land under own cultivation, land taken from others as borga, land taken from others as lease.

3.6.3.7 Number of crops grown

Number of crops grown referred how many crops did they cultivate on a year. This number of crops from including homestead, own land under own cultivation, land taken from others as borga, land taken from others as lease.

3.6.3.8 Time spends in farms

Time spends in farms referred how much time did they spend in their farm hour per week. Proper utilization and better outcome from the farm spending time is significant. Management of farm in a daily basis can bring better result for the farmers to be self-sufficient.

3.6.3.9 Extension media contact

The extension media contact of a respondent was measured on the basis of the response of the media contact user farmers against the extent of his using of selected seven media by putting tick mark against any one of the five responses: regularly, frequently, occasionally, rarely, not at all. The responses were scored as 4, 3, 2, 1 and 0 respectively. The use of extension media contact score of the respondents ranged from

0 to 28 where, 0 indicates no use and 28 indicates very high use. Based on their extension media contact, the respondents were classified into three categories as low contact, medium contact, and high contact. This variable appears in item number 7 in the interview schedule as presented in Appendix-I.

3.6.4 Measurement of Farmers' perception towards harmful effects of land fragmentation on crop productivity

Farmers' perception towards harmful effects of agricultural land fragmentation on crop productivity was the dependent variable of the study. It was measured on the basis of 10 statements relevant to the harmful effects of land fragmentation such as land fragmentation decreases agricultural productivity, it diminishes economic opportunity, it increases cost of production , it makes difficulties to allocate resources, problem in using farm machineries, prevents the adoption of high profit crops, inability to apply modern agricultural technology, disparity and irregular shapes of land, decreases the arable plot size, problems in managing, supervising and securing scattered plots. These statements were collected through review relevant literature.

A respondent was asked to indicate his/her degree of agreement about each of the statements along with a five-point Likert scale as, strongly agree, agree, no oponion, disagree and strongly disagree. Scores were assigned to these five alternate responses as 4, 3, 2, 1, and 0 respectively for each 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 40, where, 0 indicated highest levels disagree with the harmful effects of agricultural land fragmentation on crop productivity and 40 indicated highest level of agree with harmful effects of agricultural land fragmentation on crop productivity. This variable appears in item number 10 in the interview schedule as presented in Appendix-I.

3.7 Statement of the Hypothesis

It represents a declarative statement of the relations between two or more variables. Hypothesis is not meant to be haphazard guesses, but should reflect the depth of knowledge, imagination and experience of the researcher. In the process of formulating the hypothesis, all variables relevant to the study must be identified.

characteristics of the farmers have significant contribution to their perception towards harmful effects of land fragmentation on crop productivity

media contact. Farmers' perception towards harmful effects of land fragmentation on crop productivity.

"Each of the selected characteristics of the farmers had no significant contribution to their perception towards harmful effects of land fragmentation on crop productivity.

3.7.1 Null hypothesis

In order to conduct statistical tests, the research hypothesis was converted to null form. Hence, the null hypotheses were as follows:

The null hypothesis reflects that there will be no observed effects of a research or it states that there is no contribution between the concern variables. Therefore, in order to conduct tests, the previously formed research hypothesis was converted into null form as given below:

There is no contribution of the selected characteristics (age, education, family size, farm size, annual family income, number of plots, number of crops grown, time spend in farms, extension media contact). Farmers' perception towards harmful effects of land fragmentation on crop productivity

Each of the selected characteristics of the farmers had no significant contribution to their perception towards harmful effects of land fragmentation on crop productivity.

3.8 Data Processing and Analysis

3.8.1 Compilation of data

After completion of field survey, data from all the interview schedules were coded, compiled, tabulated and analyzed in accordance with the objectives of the study. In this process, all responses in the interview schedule were given numerical coded values. Local units were converted into standard units and qualitative data were converted into quantitative data by assigning suitable scores whenever necessary. The responses of the questions in the interview schedule were transferred to a master sheet to facilitate tabulation.

3.8.2 Categorization of data

For describing the different characteristics and their farmers' perception towards harmful effects of land fragmentation on crop productivity, the respondents were classified into several categories. These categories were developed by considering the nature of distribution of data, general understanding prevailing in the social system and possible observed scoring system. The procedure for categorization of data in respect of different variable is elaborately being discussed.

3.9 Statistical Technique

The analysis was performed using Statistical Package for Social Sciences (SPSS V 20) computer package. Descriptive statistics such as range, number, percentage, mean, standard deviation was used whenever possible. To find out the contribution of identified characteristics of the farmers' perception towards harmful effects of land fragmentation on crop productivity linear regression was run. Throughout the study, at least five percent (0.05) level of probability was used as basis of rejecting a null hypothesis.

CHAPTER IV

RESULTS AND DISCUSSION

The findings of the study and their interpretation have been presented in this chapter. According to the objectives of the study, collected data were surveyed, analyzed, tabulated and statistically treated which were obtained from the respondents. These are presented in three sections according to the objectives of the study. The first section deals with the farmers' perception towards harmful effects of land fragmentation on crop productivity and the second level describe selected characteristics of the farmers and third section deals with the relationships between the farmers' selected characteristics and their extent perception towards harmful effects of land fragmentation on crop productivity has been discussed.

4.1 The salient features of the selected characteristics of the farmers

This section deals with the classification of the farmers according to their various characteristics. Perception and practice of an individual largely depends on these characteristics. These characteristics of an individual contribute largely in the matter of shaping harmful effects of land fragmentation on crop productivity. 10 selected characteristics have been discussed from the findings in this chapter. These selected characteristics are age, education, farm size, annual family income, number of plots, number of crops grown, time spend in farms, extension media contact, farmers' selected characteristics and their extent perception towards harmful effects of land fragmentation on crop productivity. Therefore, the major hypothesis was perception of the farmer that would also be influenced by various characteristics of the farmers. Measuring unit, range, mean and standard deviations of these characteristics of the farmers have been described in the following sub-sections.

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

Categories	Minimum	Maximum	Mean	SD
Age	26	78	52.28	11.79
Education	00	14.00	3.80	4.28
Family size	2	17	5.63	2.04
Farm size	.12	3.30	.59	0.46
Annual family income	90	963	329.64	178.80
Number of plots	1	14	5.02	2.58
Number of crops grown	1	6	2.35	0.97
Time spends in farms	10	56	24.62	10.12
Extension media contact	3	21	8.34	3.23
Farmers' perception	`15	37	31.65	5.39

4.1.1 Age

The age of the farmers has been varied from 26 to 78 years with a mean and standard deviation of 52.78 and 11.794 respectively. Based on their age, the farmers were classified into three categories namely 'young'; 'middle' and 'old' aged. The distribution of the farmers in accordance of their age is presented in Table 4.2.

Category	Range (Years)		Respondents		Mean	SD
	Score	Observed	Number	Percent		
Young aged	Up to 35	28-83	10	9.4	52.78	11.974
Middle aged	36-50		37	34.9		
Old aged	Above 50		59	55.7		
Total			106	100		

Data presented in table 4.2 indicated that the highest proportion (55.7 percent) of the respondents was in old aged category compared to (9.4 percent) young aged and (10 percent) young aged category. The findings indicated that a large proportion (55.7 percent) of the farmers were old aged. It also found that, old aged farmers are proportionately higher than two other categories. The results showed that 90.6% farmers were middle to old aged. It express that mostly do not change farming activities.

4.1.2 Education

The level of educational scores of the farmers ranged up to 14 with a mean and standard deviation of 3.80 and 4.28 respectively. Based on the educational scores, the respondents were classified into five categories such as Illiterate (0), can sign only (0.5), primary education (1 to 5), secondary education (6 to 10), higher secondary (above 10). The distributions of the respondents according to their level of education are presented in Table 4.3.

Table 4.3 Distribution of the farmers according to their Education

Category	Range (School Years)		Respondents		Mean	SD
	Score	Observed	Number	Percent		
Illiterate	00	0-14	21	19.8	3.80	4.28
Can sign only	0.5		36	34		
Primary education	1-5		14	13.2		
Secondary Education	6-10		26	24.5		
Higher secondary	> 10		9	8.5		
Total			106	100		

Table 4.3 shows that respondent under secondary education category constitute the highest proportion (34 percent) followed by can sign only (36 percent), secondary education (24.5 percent) primary education (13.2 percent), Illiterate (19.8 percent) higher secondary (8.5 percent). More than half of respondent education level was illiterate to can sign only. The study found that education had a significant influence on farmers' perception (Kabir, 2012).

4.1.3 Family size

The family size of the farmers' scores ranged from 2 to 17 with a mean and standard deviation of 5.63 and 2.049 respectively. Based on their family size, the respondents were classified into three categories which is presented in Table 4.4.

Table 4.4 Distribution of the farmers according to family size

Category	Range		Respondents		Mean	SD
	Score (Number)	Observed	Number	Percent		
Small family	Up to 5	2-17	64	60.4	5.63	2.04
Medium family	6-10		38	35.8		
Large family	Above 10		4	3.8		
Total			106	100		

Table 4.4 indicates that the small family sized holder constitutes the highest proportion (60.4 percent) followed by large family sized holder (3.8 percent), whereas (35.8 percent) was medium family sized holder. The findings of the study reveal that majority of the farmers were small to medium family sized holders. The average family size is higher than the national average of 4.2 (BBS, 2021).

4.1.4 Farm size

The farm size of the farmers' scores ranged from 0.12 ha to 3.30 ha with a mean and standard deviation of 0.59 and 0.46 respectively. Based on their farm size, the respondents were classified into three categories which is presented in Table 4.4.

Table 4.5 Distribution of the farmers according to farm size

Category	Range (Hector)		Respondents		Mean	SD
	Score (Ha)	Observed	Number	Percent		
Small farm	1	0.12-3.30	91	85.8	0.59	0.46
Medium farm	2-3		14	13.3		
Large farm	Above 3		1	0.9		
Total			106	100		

Table 4.4 indicates that the small farm holder constitutes the highest proportion (85.8 percent) followed by medium farm holder (13.3 percent), whereas (.90 percent) was large farm holder. The findings of the study reveal that majority (99.1 percent) of the farmers were small to medium sized farm holder. The number of the small farmers was higher than the national average of 0.41 hectare (BBS, 2021)

4.1.5 Annual family income

Annual family income of the respondent ranged from 90 to 963 thousand taka. The mean was 329.64 thousand taka and standard deviation was 178.809. On the basis of annual income, the respondents were categorized into three groups as shown in Table 4.7.

Table 4.6 Distribution of the farmers according to their annual family income

Category	Range		Respondents		Mean	SD
	Score (000 tk.)	Observed	Number	Percent		
Low income	Up to 177	90-963	13	12.3	329.64	178.8
Moderate income	178-354		74	69.8		
High income	Above 354		19	17.9		
Total			106	100		

Data shown in the Table 4.5 indicated that (12.3 percent) of the farmers had low income where 69.8 percent) farmers had Medium and (17.9 percent) had high family income. That is also indicate that the majority of the farmers has medium family income. Overwhelming majority (82.1 percent) farmers have low to medium level annual family income. The mean value was 329.64 thousand taka that indicated farmers income sufficient. Farmers are involving in off farm income besides on farm income.

4.1.6 Number of plots

The number of plots of the farmers' scores ranged from 1to14 with a mean and standard deviation of 5.02 and 2.58 respectively. Wadud (2000), indicated that on average farmers with larger plots operated at higher levels of technical and allocative efficiency. Based on their plots number, the respondents were classified into three categories which is presented in Table 4.5.

Table 4.7 Distribution of the farmers according to number of plots

Category	Range (Hector)		Respondents		Mean	SD
	Score	Observed	Number	Percent		
Small	Up to 4	1-14	56	52.8	5.02	2.582
Medium	5-8		39	36.8		
Large	Above 8		11	10.4		
Total			106	100		

Table 4.6 indicates that the small number of plots embedded the highest proportion (52.8 percent) followed by large number of plots (10.4 percent), whereas (36.8 percent) was medium number of plots. The findings of the study reveal that majority of the farmers were small to medium number of plots owner.

4.1.7 Number of crops grown

The Computed scores of the farmers number of crops grown ranged from 1 to 6 with a mean of 2.35 and standard deviation of .976. On the basis of number of crops grown, the respondents were classified into three categories as follows in Table 4.8

Table 4.8 Distribution of the farmers according to their number of crops grown

Category	Range (No. of crops grown)		Respondents		Mean	SD
	Score	Observed	Number	Percent		
Lower number	Up to 2	1-6	80	75.5	2.35	0.976
Moderate number	3 to 4		19	17.9		
High number	Above 4		7	6.6		
Total			106	100		

Data contained in Table 4.8 showing that (75.5 percent) of the farmers had grown lower number of crops on last year. Whereas (17.9 percent) had grown medium number of crops and (6.6 percent) had grown higher number of crops on last year. The results showed that 93.4% farmers produced lower to moderate number of crops due to land fragmentation problem in study area.

4.1.8 Time spends in farms

The score of time spends in farms of the farmers ranged from 10-56 hours in a week with a mean and standard deviation of 24.62 and 10.122. On the basis of time spends in farms the respondent farmers were classified into three categories namely, lower number, medium number, higher number. The scale used for computing the use of modern technology score is presented in the Table 4.9.

Table 4.10 Distribution of the farmers according to time spends in farms

Category	Range		Respondents		Mean	SD
	Score (hour)	Observed	Number	Percent		
Low	Up to 20	10-56	24	22.6	24.64	10.122
Moderate	21-40		61	57.6		
High	Above 40		21	19.8		
Total			106	100		

Data presented in Table 4.10 indicate that the highest proportion (22.6 percent percent) of the farmers Up to 20 hours had worked per week compared to (57.6 percent) had worked 21 to 40 hours and (19.8 percent) had worked Above 40 hours per week. The majority (57.6 percent) of the farmers were worked 21 to 40 hours per week. The results indicated that 77.4% farmers are moderate to high. So, we can say that maximum farmers actively involved in farming activities.

4.1.9 Extension Media contact

An extension contact score was computed for each respondent on his extent of contact with 6 selected media. Each respondent was asked to mention the frequency of his contact with each of the 6 selected media. Extension media contact scores of the farmers ranged from 3 to 22 with an average of 8.34 and standard deviation of 3.239. It was measured as one's extent of exposure with different information sources. On the basis of their extension media contact, the respondents were classified into three categories (Mean ± SD) namely, low contact, medium contact and high contact. The scale used for computing the extension contact score of a respondent is given table 4.10.

Table 4.10 Distribution of the farmers according to their extension media contact

Category	Range		Respondents		Mean	SD
	Score	Observed	Number	Percent		
Low contact	Up to 7	3-21	50	47.2	8.34	3.239
Moderate contact	7-14		51	48.1		
High contact	Above 14		5	4.7		
Total			106	100		

Data contained in the Table 4.10 indicated that the highest proportion (48.1 %) of the respondents had medium extension media contact as compared to (47.2 %) and (4.7 %) having high and low extension media contact respectively. It was assumed that the more contact an individual would have with different information sources, the more he becomes educated and knowledgeable. Extension Media Contact of the rural women had significant relationship with their perception of benefit of involvement in IGAs under an NGO (Sharmin, 2005).

4.1.10 Farmers' perception towards harmful effects of land fragmentation on crop productivity

Farmers' perception was categorized into two groups such as favorable and unfavorable perception. A score of ≥ mean is considered as favorable and a score of < mean is considered as unfavorable perception (Mishuk et al., 2021). The mean and SD of perception was 31.65 and 5.39. The distribution of the findings based on perception shown in table 4.11.

Table 4.11 Distribution of the farmers according to their perception towards harmful effects of land fragmentation on crop productivity

Category	Range		Respondents		Mean	SD
	Score	Observed	Number	Percent		
Favorable perception	≥Mean	15-37	89	84	31.65	5.39
Unfavorable perception	<Mean		17	16		
Total			106	100		

Findings showed that majority (84 percent) of the farmers possessed favorable perception towards harmful effects of land fragmentation on crop productivity. The study showed that farmers of the study area favorable perception was higher than unfavorable perception. This indicates farmers are agree and aware about the harmful effects of land fragmentation system.

4.2 Relationship between the selected characteristics of the farmers and their perception on harmful effects of land fragmentation on crop productivity

The purpose of this section is to explore the contributing relationships of the selected characteristics of the farmers with their perception towards harmful effects of land fragmentation on crop productivity. Regression analysis was used to test a null hypothesis concerning the contributing relationship between any two variables. Five percent (0.05) level of probability was used as the basis for rejection of a null hypothesis. Results of the analysis regarding contributing relationship between each of the selected characteristics of the farmers and their perception towards harmful effects of land fragmentation on crop productivity are shown in table 4.12

Table 4.12 The Regression coefficients of the contributing variables related to the farmers perception towards harmful effects of land fragmentation on crop productivity

Dependent variable	Independent variable	β	P	R^2	Adj. R^2	F
Farmers' perception towards harmful effects of land fragmentation on crop productivity	Age	.107	.323	0.281	0.260	2.028
	Education	.275	.010*			
	Family size	.004	.966			
	Farm size	-.243	.115			
	Annual family income	.050	.680			
	Number of plots	.405	.007**			
	Number of crops grown	0.103	.313			
	Time spends in farms	-0.012	.918			
	Extension media contact	0.274	.013*			

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

Table 4.12 shows that there is a significant contribution of the respondents, Education, Number of plots and extension media contact. Of these number of plots were the most important contributing factors (significant at the 1% level of significant) education and extension media contact perception towards harmful effects of land fragmentation on crop productivity (significant at the 5% level of significant) while coefficients of other selected variables don't have any contribution on farmers perception towards harmful effects of land fragmentation on crop productivity. 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 $R^2 = 0.260$ means that independent variables account for 26% of the

variation in farmers perception towards harmful effects of land fragmentation on crop productivity. The F ratio is 2.028 which is highly significant ($\rho<0$).

However, each predictor may explain some of the variance in perception towards harmful effects of land fragmentation on crop productivity simply by chanced. The adjusted R^2 value penalizes the addition of extraneous predictors in the model, but values 0.260 is still show that variance is perception towards harmful effects of land fragmentation on crop productivity can be attributed to the predictor variables rather than by chanced the suitable model (Table 4.12). In summary, the models suggest that the respective authority should be consider the farmers education, number of plots and extension media in this connection some predictive importance has been discussed below:

4.3.1 Significant contribution of farmers' education and perception towards harmful effects of land fragmentation on crop productivity

The contribution of education to farmers' perception towards harmful effects of land fragmentation on crop productivity was measured by the testing the following null hypothesis; "There is no contribution of education to the farmers' perception towards harmful effects of land fragmentation on crop productivity". 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 1% significance level (p=0.010).
b) So, the null hypothesis could be rejected.
c) The b-value of level education was (0.275). So, it can be stated that as education increased by one unit, farmers' perception towards harmful effects of land fragmentation on crop productivity increased by 0.275 units. Considering the effects of all other predictors are held constant.

Based on the above finding, it can be said that farmers have more education increased the favorable perception towards harmful effects of land fragmentation on crop productivity. This may be due to the fact that education help people to increase

knowledge and awareness on a specific issue. The findings consistent with the findings of Adeola (2012).

4.3.2 Significant contribution of number of plots the farmers' and their perception towards harmful effects of land fragmentation on crop productivity

From the multivariate regression, it was concluded that the contribution of number of plots to the farmers' perception towards harmful effects of land fragmentation on crop productivity was measured by the testing the following null hypothesis;

"There is no contribution of number of plots on the farmers' perception towards harmful effects of land fragmentation on crop productivity".

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 number of plots on land fragmentation was significant at 5% level (0.007).
b. So, the null hypothesis could be rejected.
c. The b-value of number of plots was (0.846). So, it can be stated that as number of plots increased by one unit, farmers' perception towards harmful effects of land fragmentation on crop productivity increased by 0.846 units. Considering the effects of all other predictors are held constant.

Linear regressions showed that the number of plots on land fragmentation of the farmers was second highest positive contribution to their perception towards harmful effects of land fragmentation on crop productivity. This implies that with the increase of the number of plots will also increase their perception towards harmful effects of land fragmentation on crop productivity.

4.3.3 Significant contribution of extension media contact to the farmers' perception towards harmful effects of land fragmentation on crop productivity

The contribution of extension media contact to the farmers' perception towards harmful effects of land fragmentation on crop productivity was measured by the testing the following null hypothesis;

"There is no contribution of extension media contact to the farmers' perception towards harmful effects of land fragmentation on crop productivity".

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

a) The contribution of extension media contact was significant at 5% level (0.013).
b) So, the null hypothesis could be rejected.
c) The b-value of extension media contact was (0.456). So, it can be stated that as extension media contact increased by one unit, farmers' perception towards harmful effects of land fragmentation on crop productivity increased by 0.456 units. Considering the effects of all other predictors are held constant.

From the linear regressions, it was observed that extension media contact of the farmers had third highest positive contribution to their perception towards harmful effects of land fragmentation on crop productivity. The farmers who had more contact had favorable perception towards harmful effects of land fragmentation on crop productivity. The findings are similar with the study of Sayeed (2003).

CHAPTER V

SUMMARY OF FINDINGS, CONCLUSIONS AND RECOMMENDATIONS

The study was conducted in the Nayergaon Dakshin union of Matlab Dakshin Upazila under Chandpur district to find out the farmers' perception towards harmful effects of land fragmentation on crop productivity. Total 708 farmers were selected from the study area as the population. The respondents comprised of 106 constituted the sample of the study. A well-structured interview schedule was developed based on objectives of the study for collecting information. The independent variables were: age, education, farm size, annual family income, number of plots, number of crops grown, time spend in farms, extension media contact. Data collection was started from January, 2021. Various statistical measures such as frequency counts, percentage distribution, mean and standard deviation were used in describing data. In order to estimate the contribution of the selected characteristics of the respondents to their perception towards harmful effects of land fragmentation on crop productivity, linear regression analysis was used. The major findings of the study are summarized below:

5.1 Major findings

5.1.1 Selected characteristics of the respondents

Age

The highest proportion (60.4%) of the respondents was in small family size category, compared to (35.8%) and (3.8%) of them being medium family size and large family size category, respectively.

Level of education

Can sign only constituted the highest proportion (34%) and the lowest 8.5% in above secondary.

Family size

The highest proportion (55.7%) of the respondents was in old aged category, compared to (34.9%) and (9.4%) of them being middle aged and young aged category, respectively.

Farm size

The highest proportion (85.8%) of the farmers had small farm size, while (13.3%) and (0.9%) belonged to the medium farm and large farm respectively.

Annual family income

The highest proportion of the farmers' (64.6%) had low income; whereas, (23.0%) and (12.4%) of them had medium and high income respectively.

Number of plots

Showing that the highest proportion (52.8 percent) of the farmers had lower number of plots whereas (36.8 percent) had grown medium plots and (10.4 percent) had grown large number of plots.

Number of crops grown

Showing that the highest proportion (75.5 percent) of the farmers had lower number of crops on last year whereas (17.9 percent) had grown medium crops and (6.6 percent) had grown high number of crops on last year.

Time spends in farms

Findings revealed that the highest proportion (57.6 percent) of the farmers medium time gave in farms had worked per week compared to (22.6 percent) had worked lower time gave in farms and (19.8 percent) had worked higher time gave per week.

Extension media contact

The most astounding extents (48.1%) of the farmers had medium extension media contact, whereas (47.2%) and (4.7%) had high and low extension media contact.

5.1.2 Farmers' perception towards harmful effects of land fragmentation on crop productivity

Indicate that the highest proportion (84 percent) of the farmers had favorable perception while and (16 percent) had unfavorable perception towards harmful effects of land fragmentation on crop productivity. Findings showed that majority (84 percent) of the farmers possessed favorable perception on harmful effects of land fragmentation on crop productivity. The study showed that most of the farmers of the study area have favorable perception which higher than unfavorable perception.

5.1.3 Contribution of the selected characteristics of the farmers' perception towards harmful effects of land fragmentation on crop productivity

Level of education, extension media contact and number of plots had significant positive contribution to their perception towards harmful effects of land fragmentation on crop productivity. Other characteristics like farmers age, farm size, annual family income, number of crops grown, time spend in farms, had no contribution to their perception towards harmful effects of land fragmentation on crop productivity.

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. It presents the direct answers of the research objectives, or it relates to the hypothesis (Labon, 1990). The findings and relevant facts of research work prompted the researcher to draw following conclusions.

i. The findings revealed that an overwhelming majority (84%) of the respondents had favorable perception towards harmful effects of land fragmentation on crop productivity. Still there is a scope to improve farmers' perception through various activities or program.

ii. Education had highest contribution to the farmers' perception towards harmful effects of land fragmentation on crop productivity. It also showed that majority of the respondents had lower level of education. The result concluded that initiative for improving educational level will increase the farmers' perception towards harmful effects of land fragmentation on crop productivity.

iii. Number of the plots had a significant contribution to the farmers' perception towards harmful effects of land fragmentation on crop productivity, consequently. Higher number of the plots help the farmers to make favorable perception towards harmful effects of land fragmentation on crop productivity.

5.3 Recommendations

5.3.1 Recommendation for policy implications

On the basis of the observation and conclusions drawn from the findings of the study following recommendation is made:

i. Education was an important factor to make farmers favorable perception through more than half of the farmers education level was illiterate to can sign only. Therefore, DAE and NGOs should take steps to increase their formal education. At the same time some contents regarding harmful effects of land fragmentation may include.

ii. Extension media contact increases farmers' diversified knowledge and make them able to cope with adverse situations. So, policies should be taken to engage farmers with diversified extension media to broaden their outlook and to develop favorable perception towards harmful effects of land fragmentation on crop productivity. GOs and NGOs can also play a vital role in this regard.

iii. Number of plots positively influenced farmers' perception towards harmful effects of land fragmentation on crop productivity. Therefore, SAAO and other related extension agent should contact more with the farmers having lower number of plots to aware about the importance of cultivation together or avoid land fragmentation.

5.3.2 Recommendations for further research

A single research work is very inadequate to have in-depth understanding of the farmers' perception towards harmful effects of land fragmentation on crop productivity. Further studies should be undertaken covering more dimensions of the same issue.

Therefore, the following suggestions are made for further research work:

i. The present study was conducted in Matlab Dakshin upazila under Chandpur district. It is recommended that similar studies should be conducted in other areas of the country.

ii. This study investigated the relationship of only nine characteristics of the farmers with their perception towards harmful effects of land fragmentation on crop productivity. Therefore, it is recommended that further study should be conducted with other independent and dependent variables.

iii. In this research the author conducted his survey in all category farmers who were affected by land fragmentation. So, further study can be taken with specific farmer.

iv. 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-A

Department of Agricultural Extension and Information System

Sher-E-Bangla Agricultural University, Dhaka-1207

An interview schedule for a research study entitled:

Farmers' perception towards harmful effects of land fragmentation on crop productivity

Sl. No. …….

Name of the respondent:

Village: Union:

Upazila: District:

Mobile number:

(Please answer the following questions)

1. Age

Q; How old are you? Answer: ……Years.

2. Education

a) Illiterate……
b) I can sign only……...
c) I read up to class……

3. Family size

Q: How many members do you have in your family?

Answer: ……

4. Farm size

Please furnish information about your firm size:

Sl. No.	Land type	Area	
		Local unit (Decimal)	Acre
1.	Homestead area including pond(A)		
2.	Own land under own cultivation(B)		
3.	Land given to others as borga(C)		
4.	Land taken from others as borga (D)		
5.	Land taken from others as lease(E)		
Total=A+B+1/2(C+D) +E			

5. Annual family income

Please state the income from different sources during the last year:

Sl. No.	Sources of income	Total price (Tk)
On farm income		
1	**Agriculture**	
	Vegetables	
	Rice	
	Potato	
	Maize	
	Mustard	
	Wheat	
2	Fisheries	
3	Livestock	
Off farm income		
1	Business	
2	Services	
3	Daily labor	
4	Remittance	
5	Others (if any)	
Total=A+B		

Total annual income=A+B= .....Tk

6. Number of plots

Question. How many Plots do you have?

Answer: …….

7. Number of crops grown

Q. How many crops did you cultivate on last year?

Answer: …….

8. Time spends in farms

Q. How much time (hours) do you spend at your farms in a week?

Answer: …….

9. Extension media contact

Please indicate the nature of your contact to the following media

Communication media	**Extent of Communication**				
	Regularly (4)	**Frequently (3)**	**Occasionally (2)**	**Rarely (1)**	**Not at all (0)**
Meet with SAAOs					
Meet with UAO/AEO					
Meet with Model farmers					
Participation of farmers field day					
Watching agricultural program on television					
Reading agricultural features from printed Media (Newspaper, leaflet, booklet, magazine etc.)					

10. Farmers' perception towards harmful effects of land fragmentation on crop productivity

SL NO	Statements	Strongly Agree (4)	Agree (3)	No opinion (2)	Disagree (1)	Strongly Disagree (0)
1	Land fragmentation decreases agricultural productivity					
2	It diminishes the economic opportunities					
3	It increases the cost of production					
4	It makes difficulties to allocate resources					
5	Problem in using farm machineries					
6	Prevents the adoption of high profit crops					
7	Inability to apply modern agricultural technology					
8	Disparity and irregular shapes of land					
9	Decreases the arable plot size					
10	Problems in managing, supervising and securing scattered plots					

Thank you for your cooperation

……..…

Signature of the interviewer