FARMERS' USE OF INFORMATION AND COMMUNICATION TECHNOLOGIES: A STUDY IN KESHABPUR, JASHORE

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FARMERS' USE OF INFORMATION AND COMMUNICATION TECHNOLOGIES: A STUDY IN KESHABPUR, JASHORE

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CERTIFICATE

This is to certify that the thesis entitled "FARMERS' USE OF INFORMATION AND COMMUNICATION TECHNOLOGIES: A STUDY IN KESHABPUR, JASHORE" submitted to the 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 SAROWARUDDIN AHMED, Registration No. 11-04580 under my supervision and guidance. No part of the thesis has been submitted for any other degree or diploma.

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

Dated:
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Dedicated
To
My Beloved Parents

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The Author

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ACRONYMS AND ABBREVIATIONS

AICC	=	Agriculture Information and Communication Centers
AIS	=	Agricultural Information Service
BAU	=	Bangladesh Agricultural University
BARI	=	Bangladesh Agricultural Research Institute
BBS	=	Bangladesh Bureau of Statistics
BARC	=	Bangladesh Agricultural Research Council
BRRI	=	Bangladesh Rice Research Institute
BIID	=	Bangladesh Institute of ICT for Development
CTA	=	Technical Centre for Agricultural and Rural Cooperation
DAE	=	Department of Agricultural Extension
FAO	=	Food and Agriculture Organization
GO	=	Government Organization
GoB	=	Government of Bangladesh
GIS	=	Geographic Information System
GPCIC	=	Grameenphone Community Information Centre
GPS	=	Global Positioning System
HYV	=	High Yielding Variety
ICT	=	Information and Communication Technologies
ICTA	=	Information and Communication Technology Agency
ITU	=	International Telecommunication Union
MoA	=	Ministry of Agriculture
NGO	=	Non-Government Organization
NS	=	Non-significant
r	=	Coefficient of correlation
SD	=	Standard Deviation
SMS	=	Short Message Service
SAAO	=	Sub-Assistant Agriculture Officer
SAU	=	Sher-e-Bangla Agricultural University
UNDP	=	United Nations Development Program
UISC	=	Union Information Service Centre

FARMERS' USE OF INFORMATION AND COMMUNICATION TECHNOLOGIES: A STUDY IN KESHABPUR, JASHORE

ABSTRACT

The specific objective of the study was to determine the extent of use of Information and Communication Technology (ICT) by the farmers. Attempts were also made to determine twelve selected socio-economic characteristics of the farmers and their relationships with the extent use of ICT and to identify problems faced by the farmers in using ICT. The study was confined at Keshabpur upazila of Jashore district of Bangladesh. Data were collected using structured interview schedule from February 05 to March 05, 2018. Two unions of Keshabpur upazila were purposively selected for the study. The study was conducted randomly in two villages of Keshabpur and Sagardari union. The total households of these villages were 431 and from each household one farmer was considered for interview. Thus, 107 respondents (25% of the population) were selected for the interview by using proportionate random sampling technique. Pearson's correlation co-efficient (r) was used to determine the relationships between the selected socio-economic characteristics of the farmers and their extent use of ICT. The study revealed that highest proportion (37.4 percent) of the farmers had low use of ICT in receiving agricultural information contrasted with 32.7 and 29.9 percent having medium use and high use. Among twelve characteristics farmers' age, farming experience and problem faced in using ICT in agriculture showed significant and negative relationships with the extent use of ICT. Farmers' education, annual family income, agricultural knowledge, innovativeness and cosmopoliteness showed positive and significant trend. The other characteristics viz. family size, effective farm size, agricultural training and organizational participation did not show any significant relationship with farmers' use of ICT.

CHAPTER 1
INTODUCTON

1.1 Background of the Study

In Bangladesh, the agricultural sector is one of the main contributors to the national GDP. An amount of 14.74% (including fisheries) of the total GDP in the fiscal year 2016-2017 of our country has come from the agricultural sector (BER, 2017). The challenge of feeding the increasing population from the shrinking land and water resources is a great task. Many agencies are working to support the farmers to produce food materials and related products. A number of approaches are taken to provide farmers required information to support their farming operation. But, most of the farmers of Bangladesh are still in lack of modern agricultural knowledge and information. Information and Communication Technology (ICT) is the most important development factor in the modern world, supporting the flow of data, services and people. The role of ICT in rural areas is significant but more importantly, may in the near future become crucial. Any changes in the function, improvement in social and economic situation of particular areas are not possible without the use of the Internet, the infrastructure of the 21st century, which is a form of access to infinite resources of data deposited around the world and enables communication. People having internet facilities have better access to information, which help them to acquire better position in economic activities. The challenge is to reach farmers with information and advice that could help them improve their condition. All countries, whether developed or developing are attaching much importance to the implementation of modern technologies in the phase of development. Because of that all countries are trying to put emphasis on integrating technology in agricultural productivity of farmers which we can be described as technology oriented farming.

ICT is an acronym that stands for Information and Communication Technologies, which can broadly be interpreted as technologies that facilitate communication, processing and transition of information by electronic means (CTA, 2003). In other

words ICTs are the tools that help build human network, increase public awareness and provide access to information and knowledge for the use of people (Lieshout, 2011). Again, FAO (1993) defines ICT as technologies involved in collecting, processing, storing, retrieving, disseminating and implementing data and information using microelectronics, optics and telecommunications and computers. Under the umbrella of these definitions, any communication technologies like radio, community radio, television, audio-visuals, mobile phone, telephone, computer, internet, call centre, Geographic Information System (GIS), Global Positioning System (GPS) etc. denote ICT in a broad sense.

According to FAO (2011), exchanging information is critical for the stakeholders in agriculture value chain in order to reduce the asymmetries in information and communication as well as to reduce the vicious circle of poverty. Further, the role of ICTs in accessing more information in order to enhance food security and support rural livelihoods has also been increasingly recognized and officially endorsed at the World Summit on the Information Society (WSIS) 2003-2005 (IICD, 2007). Since agricultural extension depends to a large extent on information exchange on the one hand and a broad range of other actors on the other (Mabe and Oladele, 2012), ICTs therefore can be used as a medium in bridging the information gap. There is also a growing recognition of farmers and members of rural communities realizing the importance of knowledge, information and appropriate learning methods (Greenridge 2003, Lightfoot 2003) in order to move towards development. Therefore, in order to benefit the rural people, extensionists are grappling with the question of how to harness ICTs to improve rural livelihoods in order to contribute towards better information exchange and access. In this regard, extension practitioners are also interested in experimenting with innovative e-extension initiatives (Saravanan, 2010).

Improved technologies are the means for increasing yield and thereby agricultural production. Proper utilization of agricultural information and technologies is the way to increase agricultural production. The present population of Bangladesh is approximately 160 million (BBS, 2016a) and it is likely to reach 218 million by 2050 (Streatfield and Karar, 2008). Utilization of all available technologies including

ICTs will be helpful to face the challenges of supplying agricultural products to the increasing population when land resources are diminishing continuously.

Different Government Organizations (GOs) and Non-Government Organizations (NGOs) are trying with diverse initiatives for strengthening the agriculture sector of Bangladesh. Though various efforts of improvement are in there, but the agriculture sector is facing a range of challenges for its development like over population, political instability, climate change, loss of agricultural land, infertile land, use of excessive pesticides, lack of inputs, improper irrigation etc.

The e-agriculture revolution started in Bangladesh from 2007 led by government agencies, but championed by private sector in support from various international development organizations. The Government of Bangladesh has established Agricultural Information Service (AIS) through which training guides, newsletters, radio & TV programs, films etc. are arranged for disseminating information. In 2003, the Ministry of Agriculture launched ICT taskforce program. It would be the first initiative to set up an Agricultural Information network. National Agriculture Technology Project (NATP) has been one of the early initiatives to capitalize the use of ICT by setting up necessary ICT infrastructure country wide. This project has been implemented by Department of Agricultural Extension (DAE) and funded by World Bank. D.Net, (2005) a private initiative, developed an idea of "Pallitathaya Help Centre'' to promote the e-Agriculture. In 2009, Ministry of Agriculture (MoA) in Bangladesh with support from UNDP Bangladesh has initiated Agriculture Information and Communication Centers (AICC) in 20 areas. Around 2010, DAE has also taken an ICT Development Program to strength the ICT infrastructure capacity to ensure better service delivery. As part of the process, various ICT based training centers are being developed to train the agriculture officers on ICT. DAE has also ensured majority of sub-district office has computer facility with an access to internet either through 3g modems or broadband.

Banglalink, one of the largest telecom operators in Bangladesh provided SIM cards to all the 14,000 extension agents in Bangladesh around 2008 in collaboration with Agriculture Information Services (AIS) which paved the way to use mobile technology at farmers' level. Farmers' with an access to phone can directly dial to

the official number given to the corresponding extension agent. AIS have been in the forefront of using ICT for agriculture. In 2007, funded by DANIDA, they have started creating telecenters that focuses on providing latest agro information directly at farmers' level.

Similarly, Batighar, an Initiative by Bangladesh Institute of ICT for Development (BIID), in collaboration with Grameenphone started providing information to farmers using their e-Krishok platform through the GrameenPhone Community Information Center in 2012. Access to Information (A2I), a program under Prime Minister's Office, also joined force by introducing various entrepreneurship driven ICT initiatives for rural people by setting up more than four thousands telecenters called Union Digital Centers (UDG) that focuses on providing various citizen information to farmers. This initiative known as "e-Krishok" has been using ICTs to deliver information and advisory services to farmers in rural and remote locations at a lower cost.

From 2012, Infomediary-driven information flow to farmer has been introduced to strengthen remote problem diagnosis by government call center, telecom operators and USAID Ag Extension Project. The concept of self-employed rural entrepreneurs sending farmers' queries regarding various cultivation challenges through a smartphone based mobile application named 'Farmer Query System' is also being tried out. Through this application, an agro expert sitting remotely in the call center provides response by viewing the agriculture challenges with image and other irrelevant information. mPower, the ICT partner of this particular project has provided 30,000 agro-advisory to farmers using this model. mPower, under the auspices of the USAID Ag. Extension Project, has developed an agro knowledge bank which aims to disseminate information for rural people developed by various research institutes such as BRRI, BARI, BARC. Agriculture Call Center has been introduced by telecom operators and the government. Telecom operators such as Grameenphone, Banglalink, Robi and private sector companies like WinMiaki and Government Agencies such as AIS in collaboration with Practional Action Bangladesh have setup dedicated call centers for farmers to connect them to experts.

Despite those initiatives, most of the farmers of Bangladesh are still in lack of information and modern agricultural knowledge. They need an easy access point to get and meet their information need. Information need has three basic elements: availability, access and utilization. But the GOs and NGOs initiatives are hard to reach and they lack ease of use by the farmers. Under the above circumstances, this study has tried to measure the usage of ICT in disseminating agricultural information in Bangladesh.

Bangladesh has stepped into the new era of Digital World with a spectacular vision for making Digital Bangladesh. This vision would be saddled by ICT involving multidisciplinary initiatives of Agricultural Informatics, Agricultural Development, and Entrepreneurship towards building a hunger-free, efficient and resourceful Bangladesh. The findings of the study will be helpful to accelerate the development in Agriculture, farmers' logistic supports, information needs and the way of dissemination especially tuned to key role players in the society and in empowering the farmers. The findings might also be helpful to the researchers, planners and policy makers, extension workers and beneficiaries of the ICT service.

1.2. Significance of the Study

The overall aim of using ICTs is to enable farmers to exchange opinions, experiences, good practices and resources related to agriculture, and to ensure that the knowledge created is effectively shared and used local, regional, national and worldwide. Among the various ICT media the cell phone based agricultural information services are now rapidly getting popular. These services, through Voice call or SMS provide a variety of agriculture related information on crop cultivation, fertilizer use, plant-diseases, pesticides, market prices, weather and important Government policy decisions. It is very much important for the policy makers of MoA and DAE to know the real scenario of root level farmers and effectiveness of their policies for ICT based agricultural activities. Private sectors also take many steps to increase the usage of ICTs by the farmers. These facts indicate the significance of the present study.

1.3. Statement of the Problem

Agriculture sector is a dynamic sector especially in Bangladesh. The rapidly emerging ICT sector in Bangladesh is playing significant role in the development of the whole country in many ways. Radical Agricultural development is also taking place due to use of ICT in agriculture. In this research, radio agricultural programs, TV agricultural Programs, mobile phone/smart phone, computer/Internet, Krishi Call Centre/Farmers help Line and agricultural assistance services e.g. Banglalink Krishi Jigyasha/ Banglalink Krishibazaar/ Grameenphone Krishi Tatthya Sheba/ Robi Haat-bazaar were taken as ICT media for examining the usage of ICT by the farmers. In the context of the above circumstances the researcher intended to find out the answers of the following research questions:

1. What are the selected characteristics of the farmers?
2. To what extent farmers use ICTs in receiving agricultural information?
3. What are the relationship between selected characteristics of the farmers and their use of ICTs in receiving agricultural information?

1.4. Specific Objectives of the Study

The following specific objectives were formulated in order to give proper shape to the research work:

I. To describe the following selected characteristics of the farmers' :
    1) Age
    2) Education
    3) Family size
    4) Farm size
    5) Farming experience
    6) Annual family income
    7) Agricultural training
    8) Agricultural knowledge
    9) Organizational participation
    10) Innovativeness
    11) Cosmopoliteness
    12) Problems faced in using ICTs

II. To assess the extent of using ICTs by the farmers where the ICT Media are:

- Radio agricultural programmes
- TV agricultural Programmes
- Mobile phone/smart phone/telephone
- Computer/laptop/tablet/multimedia/Internet
- Krishi Call Centre/Farmers help Line
- Agricultural assistance services e.g. Banglalink Krishi Jigyasha/ Banglalink Krishibazaar/ Grameenphone Krishi Tatthya Sheba/ Robi Haat-bazaar

III. To explore the relationship between each of the selected characteristics of the farmers and their use of ICTs.

1.5 Assumption 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.

1. The respondents were capable of furnishing proper responses to the questions contained in the interview schedule.
2. The information furnished by the farmers was valid and reliable.
3. Views and opinions provided by the respondents included in the sample were representative of the whole population of the study area.
4. The data collected by the researcher were free from bias.
5. The findings of the study would give a clear concept of farmers' usage of ICTs.
6. The finding of the study will be useful for planning and execution of the extensive and more helpful effective use of ICTs by the farmers in receiving agricultural information.

1.6 Limitations of the Study

In order to conduct the research in effective and manageable way, it becomes necessary to impose certain limitations as noted below:

1. The study was conducted in only Mulgram and Sagardari villages of Keshabpur upazila of Jashore district.
2. Population of the study was limited to 107 ICTs user farmers of the selected village only.
3. It is difficult to get accurate information regarding usage of ICTs from the respondents as many of them are illiterate.
4. Characteristics of the farmers were many and varied, but only twelve characteristics were selected for the research work.
5. The researcher was dependent on the data furnished by the selected famers during their interviews.

It is expected however, that the findings may applicable to other areas of Bangladesh where the physical, socio-economic and cultural conditions do not differ much with those of the study area.

1.7 Definition of related Terms

Age: Age of a respondent referred to the span of life and it was measured by the number of years from his/her birth to the time of interviewing.

Agricultural knowledge: It referred to the extent of basic understanding of the agricultural subject matters like crops, livestock, fisheries, agro-forestry, insect and diseases of crops, fertilizer etc.

Annual income: Annual income referred to the total earnings of a respondent and his/her family members from agricultural and non-agricultural sources (business, services, daily labor etc.) during the previous year. In this research, one score was assigned for each thousand taka.

Family size: Family size referred to the number of members of the respondent's family including himself/herself.

Farm size: It referred to that land area from which farmers may gain through effective use of that target land such as homestead land including pond area, own land under own cultivation, land taken from others on sharecropping, land given to others on sharecropping, land taken on lease etc.

Farming experience: Farming experience refers to how many years are engaged in agricultural farming.

ICTs: ICTs stand for Information and Communication Technologies and is defined as technologies involved in collecting, processing, storing, retrieving, disseminating and implementing data and information using microelectronics, optics and telecommunications and computers. (Wikipedia)

Innovativeness: Innovativeness is the degree to which an individual adopts an innovation relatively earlier than other members in a social system.

Krishi Call Centre: Krishi Call Centre is an initiative of Ministry of Agriculture (MoA) which is run with the direction of Agriculture Information Service (AIS) in Bangladesh where agricultural experts are engaged to provide immediate and effective solution of any problem concerned with livestock, fisheries and agricultural production asked by the farmers over phone. The hotline is 16123.

Level of education: Level of education referred to the formal education received up to a certain level in a formal educational institution e.g. school, college or university.

Organizational participation: Organizational participation of a farmer referred to his taking part in different social organizations either as an ordinary member, executive committee member or an executive officer along with duration.

Problem: Problem was defined as any difficult situation which requires some action to minimize the gap between "what ought to be" and "what is".

Training exposure: Training exposure referred to the time spent in receiving agricultural training by the respondents. It was measured in number of days of training received by the respondents.

UISC/Union Digital Centre: UISC stands for Union Information and Service Centre. It referred to a place for providing digital support service where farmers and other person can get any digital service.

CHAPTER 2
REVIEW OF LITERATURE

The purpose of this chapter is to review the past studies and opinions of experts and social scientists having relevance to this investigation based on the objectives of the study. There is scarcity of studies pertaining to the systematic analysis of ICT uses on different agricultural aspects of the farmers. Besides, only some limited studies investigating the relationships of the characteristics of individuals with the impact of ICTs came into observation of the researcher. The researcher, therefore, made exhaustive effort to review the previous research works directly or indirectly related to the present study in home and abroad. Hence, relevant literatures directly depicting the present research was not readily available. Only a few studies relevant with the present research has been presented in this chapter under the heads of general review of uses of ICT and relationship of selected characteristics of the farmers with the use of ICTs.

2.1 General review on usage of ICT

2.1.1 Usage of TV and radio

Nataraju and Channegowda (1985) found in a study that respondents used radio (54 percent) newspaper (46 percent) neighbours (23.3 percent) demonstrations (10.6 percent) and group meetings (6 percent) in receiving information on improved dairy management practices. More likely, Mekabutra (1985) conducted a study in Thailand and reported that among the mass media that offered more knowledge in agriculture was radio, followed by television and newspaper respectively. Considering knowledge gained from mass media that were applicable to their work, farmers opined that television provided about 83.5 percent, radio 78 percent and newspaper 77 percent.

De la Vega (1990) conducted a study in philippiens and found that in terms of availability of mass communication media channels, radio and TV were the most available. A great majority of the respondents listen the radio every day and consider it is their main source of news. The communication channels they preferred as

credible were radio, interpersonal source and TV. Similarly, Sauquet (1990) based on the experience of Brazilian extension service reported that television plays an important role, where in every Sunday morning, an agricultural program is watched by millions of farmers.

Wate and Rivera (1991) in their study examined the application of new technologies in agricultural information transfer process and explored future perspectives of new technologies as a force of change in developing countries. They found that print media, electronic media, radio, television, satellite computers and mobile audio-visual media were the important sources of spreading information. Moreover , in another study Galindo (1994) in his study in Mexico on communication media used by farmers revealed that television and radio were the most widely used communication media and talks, demonstration and training courses were the preferred media for receiving information.

Khan and Paracha (1994) conducted a study in two villages in Pakistan, one innovative and other non-innovative, among the farmers of a cotton producing district and reported that the main channel of communication. The mass media were centrally organized and included radio, television and newspapers. Ahmed *et. al.* (1994) conducted that farmers received more amount of information from radio than TV. It may be due to the reason that farmers have more access exposure to radio because numbers of farm broadcasting programmes were more in radio than of TV.

It was revealed in a study that agricultural productivity was increased because of radio programmes in the Philippines (UNESCO, 1996). In another study, it was revealed by Dodds (1999) that more than 50% of the 21,000 farmers experienced increase in crop yields through extension and education by radio programmes in Zambia. Shepherd (2000) reported that the vegetable farmers could fix their price according to the rate of vegetable price being broadcast by their local radios and at lower prices than that of the farmers who did not accept the broadcast in Indonesia. The broadcast prices were the starting point in negotiating with traders the following day. It was also observed from the study that price differences were also reduced across markets due to availability of information to different markets in Albania. Moreover, in another study Djankov *et. al.* (2001) reported that independent radio broadcasting services were found to be positively and significantly correlated with a

range of development outcomes which included improved lives and better functioning markets. But the results are not always similar. Different finding was observed by Glendenning *et. al.* (2010) who reported that despite farmers' greater use of TV and radio than KVKs and extension workers, the empirical impact of these services on farm household income was not known.

2.1.2 Usage of mobile Phone/telephone

Bayes *et. al.* (1999) reported that in case of Village Pay Phones in Bangladesh livestock mortality rates were decreased due to the farmers' better access to extension officers through the use of mobile phones. In a different study, ITU (1999) found that the farm income of the farmers was doubled as they were able to check prices regularly by telephones in rural Thailand and Columbia.

There was a great impact of mobile phone services on production, marketing, and other important economic issues that were related to rural households in Bangladesh (Bayes, 2001). It was also shown in the study that farm income were increased and farm input prices were decreased due to the mechanism of information diffusion with the help of mobile phones.

The price dispersion and wastage was dramatically reduced through introduction of mobile phones to Kerala fishermen by facilitating the spread of information which led to more efficient market through risk and uncertainty reduction (Jensen, 2007; Abraham, 2007). In another study, Mangstl (2008) also reported that information regarding weather forecasts, where to get the best catch, local market information was communicated through mobile phone among the fishermen in Tanzania.

Aker (2008) reported that significant reductions in grain-price dispersion net of transport costs across markets was observed because of use of mobile phones among the grain sellers in Niger. However, there are different results also. Alenea *et. al.* (2008) carried out a study on the maize market in Kenya and observed that access to communication assets had positive but insignificant effects on market participation. In a different study, the dairy farmers could connect to FoodNet, a service that supplies up-to-date price information for agricultural commodities, as well as contact details for interested buyers via SMS through mobile phones and thus became able to

sell their milk without spoilage in the Bugerere District in central Uganda (Karamagi and Nalumansi, 2009).

It was reported that the farmers who used prepaid credit system through mobile phone were able to change their life better by minimizing distance (Aloyce, 2005). It was also shown in another study that farmers got access to valuable market data through the use of mobile phones and messaging technology (Campbell, 2005). Souter *et. al.* (2005) found significant correlations between telecommunications and indicators of socio-economic development in another study conducted in three countries (India, Tanzania and Mozambique).

In another study, Kumar (2011) also revealed that the farmers were able to reduce their use of pesticides by 50 percent that lowering the costs and improving the crop productivity by receiving information about when the pests might attack via their cell phones from the agricultural department in Turkey. Again, in a study conducted by Mittal and Tripathi (2009) on the use and impact of mobile phones and mobile-enabled services on agricultural productivity it was found that some of the farmers who used mobile phones for at least some agricultural activities reported about significant productivity gains. Again, it was reported by all interviewees that positive economic benefits were generated by the mobile phone.

More likely, it was reported that nearly half of the respondents (49%) indicated impacts of use of mobile phone on effectiveness, or increased productivity in rural Uganda (Martin and Abbott, 2011). Access to agricultural advice, as well as access to agricultural inputs, such as labour, seeds, plant cuttings, livestock, loans from VEDCO or NAADS; consultation with veterinarians; and increased access to market information resulted in increased production. Moreover, nearly 22% of respondents indicated the impact of mobile phones during agriculture emergencies. The overall health and productivity of the livestock and crops of the respondents was increased due to continuous consultation with veterinarians and agricultural experts through mobile phones. Besides, about 53% respondents reported about their increase in income.

Forestier *et. al.* (2002) showed that the farmers received better prices for their crops with the help of rural telephony which led to significant increase in their earnings. Another study carried out by De Silva (2008) revealed that a project in Maharashtra,

India named “Warana Unwired” where the small but relevant information was sent to the sugarcane farmers via SMS on mobile phones had created a significant change in the incomes of the sugarcane farmers in the area. Again in another research it was revealed that the farmers’ income and access to finance were increased and they were more benefitted than the other players through supply chain efficiencies because of use of several m-ARD apps (Qiang *et. al.*, 2012). Mittal *et. al.* (2010) found that income impact of 5–25 percent of income was observed among the farmers in India due to the SMS service Reuters Market Light (RML) which provided personalized information to subscribed farmers on daily spot market prices, localized weather forecasts, and agro advisories tailored for one crop and the stage in the crop cycle.

2.1.3 Usage of Internet

UNDP (2001) carried out a study and found that farmers' incomes were dramatically increased by receiving information about crop status, weather, global market prices and training through an internet network among the farmer organizations in Chile. Again, in another study it was found that regional market price fluctuations were reduced and average yields were increased due to information providing on market prices and cropping techniques through the Internet kiosks established by the public sector in India (Goyal, 2010). In a different study, it was reported by ICTA (2009) that dairy farmers were helped to achieve self-sufficiency in milk production by introducing web and mobile technologies in Sri Lanka.

Smith *et. al.* (2004) conducted a research to explore the adoption, usage patterns, and perceived benefits of computers and the Internet among the Great Plains farmers. The study revealed that about half of those farmers who used the Internet for farm-related business had reported zero economic benefits from it.

2.1.4 Usage of Call Centre

AIS (2013) reported that the farmers are provided with the instant solutions to their problems related to agriculture, fisheries and livestock by the specialists in the relevant fields in Krishi Call Centre over phone in Bangladesh. Again, it was reported by Banglar Krishi (2015) that the farmers are benefited by the instant solutions to their different problems regarding diseases and insects of crop, cultivation practices, fertilizer management, different agricultural aspects, livestock

and fisheries from the experts and field level specialists over phone from Krishi Call Centre operated by AIS. In a different study conducted by McGuire (2015) it was reported that the farmers are benefited by e-krishok created by BIID in Bangladesh where the services based agriculture information are transferred to the farmers over mobile phones through the government infrastructures which are already in existence. Farmers are also benefited by the agricultural information provided by Miaki, a private entity in Bangladesh.

Ashraf *et. al*. (2015) conducted a research to find out the impact of ICT on indigenous peoples' quality of life at Ruma village of Bandarban district in Bangladesh. They found that positive contribution was made by ICTs as perceived by the participants of Grameenphone Community Information Centres (GPCIC), a shared ICT access facility where participants can access a wide range of ICT services, e.g. Internet, voice communication, video conferencing, and locally relevant and customized information services on topics such as agriculture, education, health, legal, environment and politics. In another study, it was reported by Katalyst (2012) that the farmers were able to access the timely and accurate information and become more knowledgeable about opportunities to improve agricultural practices, production, and farm investment decisions with the help of Grameenphone Community Information Centre (GPCIC) and the helpline services in Bangladesh. It was observed that the vast majority (90%) of the beneficiaries were benefitted by preventing near-certain losses through the access to information which assisted them to counter and remedy the identified pest, disease, and animal health concerns. It was also revealed that farmers achieved benefits ranging from BDT 1,000 (approximately USD 12) to upwards of BDT 20,000 (USD 240). Again, Dey *et. al.* (2008) conducted a research in two telecentres: one of them was Palli Tathya Kendra at Joyag, Noakhali initiated by D-Net and another one was GPCIC located at Shaturia upazila, Manikganj in Bangladesh. It was observed that farmers' information needs could be made through the use of mobile phones and telecentres by them. Use of mobile phone by some of the farmers enabled them to get cheaper fertilizers.

Ramasubbian *et. al.* (2015) found in their study that Uttar Pradesh, Madhya Pradesh, Maharashtra, Rajasthan, West Bengal were in the first five places benefited by the Kishan Call Centre (KCC) among 32 states on the basis of call received by the KCC related to agricultural information in India. On the contrary, Andhra Pradesh, Goa, Diu & Daman, Nagaland, Lakshadweep and Dadra & Nagar Haveli were the states in the least five place those who were making use of KCC service. Again, in a different study it was observed that Lifeline (a mobile and Internet based ICT project in agriculture which provides answers to farmer queries based on their demand) had impact on their productivity estimated to be around 20 percent as perceived by the farmers in India (Glendenning and Ficarelli, 2012).

Arfan *et. al.* (2013) conducted another study to investigate the comparative effectiveness of Punjab Agriculture Helpline (PAH) and other information sources for meeting information needs of farming community. It was observed that all respondents (100%) were getting information regarding agricultural technology from Punjab Agriculture Helpline. In a different study, Fawole (2006) reported that agriculture helpline was very beneficial for farmers but if the solution is not implemented accordingly the information needs of the farmers would not be fulfilled.

2.1.5 Effectiveness of using ICTs

Islam and Gronlund (2010) found that the need for market information of the farmers of Natore district in Bangladesh was fulfilled by the contents of Pallinet (an agricultural market information service) and they were in general satisfied with the service. It was observed in the research that the farmers were empowered as the Pallinet service enabled them to know the conditions in the surrounding markets more confidently than before. It was also revealed from the research that they were benefited through realizing higher income, either by relocating to other markets or by gaining improved bargaining power over the middlemen. Again, in another research it was revealed that the farmers of Kapasia and Ekhlaspur in Bangladesh could become sure about the important issues for semi-organic cultivation and apply that knowledge into their cultivation watching the video contents in the Income Generation Project for Farmers using ICTs (Ozaki *et. al.*, 2013).

Again, another study was carried out by Ogutu *et. al.* (2014) to evaluate the impact of an ICT-based market information services (MIS) project on farm input use and productivity in Kenya using Propensity Score Matching (PSM) technique. It was revealed from the study that there was a positive and significant impact of the intervention on the use of seeds, fertilizers, land, and labour productivity. However, Dhaka and Chayal (2010) conducted research in Bundi district of Rajasthan, India to analyze experience of farmers using ICT services for agricultural information. It was revealed in the study that direct access to information was considered as important benefit and it was given the highest priority by the farmers. It was perceived by the farmers that the ICT services were able to disseminate knowledge intensive information like market intelligence, weather forecast, early warning, management of disease and pests, production practices, post-harvest management etc.

It was found in a study conducted by Munyua *et. al.* (2009) that the use and application of modern ICTs could contribute in the development of small-scale agriculture in Africa. Some emerging ICTs such as Geographic Information Systems (GIS) and decision support systems, mobile mapping and hand-held personal computers (personal digital assistants/PDAs), precision agriculture and mobile (cellular) phone applications, community radio stations, radio frequency identification tags, World Space satellite radio and access to the Internet and web-based applications facilitated the farmers to concentrate on high-value agricultural (HVA) products, to focus on improvement in productivity, to consider the options for commercial agriculture, to pay increased attention to new markets and marketing strategies, and to increase agricultural production through biotechnology.

Again, Lio and Liu (2006) revealed in a study that there was a significant positive impact of ICT on agricultural productivity. It was also observed that information and communication infrastructure influenced the adoption of modern industrial inputs in agricultural production in that study. It was observed by Mwakaje (2010) that the ICT user farmers obtained higher prices than the farmers who did not use ICT for accessing market information in Rungwe District, Mbeya Region, Southwest Tanzania. It was revealed in a study that the farmers were able to improve their production, linkages to profitable markets, and reduce poverty by accessing agricultural knowledge and information through ICTs (such as, telecenters, cell phones and radio) in Tanzania (Lwoga and Ngulube, 2008).

2.2 Relationship between Farmers' Characteristics and Their Use of ICTs

2.2.1 Age and use of ICT

Bhuyian (1988) found in his study that age of the farmers had a significant negative correlation with the communication media.

Kafura (2015) reported that there was a negative significant relationship between the age of the farmers and the level of use of different ICT tools for agricultural purposes by them.

Nuruzzaman (2003) led that age of the farmers had a significant negative relations with the utilization of communication media.

Ndag *et. al.* (2008) reported that the younger farmers had more exposure to ICT usage and courses than the older farmers.

2.2.2 Level of education and use of ICT

Reza (2007) reported that there was a positive significant relationship between the level of education of the farmers and the impact of use of ICT as perceived by them.

Kafura (2015) that there was a positive significant relationship between the level of education of the farmers and the level of use of different ICT tools for agricultural purpose by them.

Ahmed (2012) that there was no significant relationship between education of the farmers and ICT utilization in agriculture by them.

Nuruzzaman (2003) in his study observed that education of the farmers had a significant positive relationship with their use of mass media.

Roy (2006) in his study observed that education of the farmers had a highly significant and positive relationship with the effectiveness of mass media.

2.2.3 Family size and use of ICT

Kafura (2015) observed that there was no significant relationship between the family size of the farmers and the level of use of different ICT tools for agricultural purpose by them.

Ogutu *et. al.* (2014) revealed that there was no significant relationship observed between the household size of the farmers and their participation in ICT based market information service projects.

Ahmed (2012) reported that family size of the farmers had no significant relationship with ICT utilization in agriculture.

2.2.4 Farm size and use of ICT

Anisuzzaman (2003) found that the farm size of the respondents had no significant relationship with their use of communication media.

Nuruzzaman (2003) in his study conducted that farm size of the farmers had no significant relationship with the use of mass media.

Kafura (2015) reported that the farm size of the farmers had no significant relationship with the level of use of different ICT tools for agricultural purpose.

Ahmed (2012) revealed that farm size of the farmers had no significant relationship with utilization of ICT in agriculture.

Meera *et. al.* (2004) also observed that there was no association between the landholding of the farmers and the frequency of using ICT services by them which depicted that irrespective of the landholding size.

Bhuiyan (1988) found that the farm size of the farmers had positive and significant effect on the use of communication media.

2.2.5 Farming experience and usage of ICT

Islam (1998) observed that the farming experience of the farmers had no significant relationship with their opinion on the effectiveness of the communication media.

Rahman (2003) observed that farming experience of the farmers had no significant relationship between farming experience of the farmers and their adoption of selected technologies by using TV.

2.2.6 Annual income and use of ICT

Reza (2007) noticed that annual income of the farmers had a positive significant relationship with their perceived impact of ICT use.

Kafura (2015) revealed that there was positive significant relationship between the annual income of the farmers and the level of use of different ICT tools for agricultural purposes.

Ahmed (2012) reported that there was no significant relationship between the annual income of the farmers and utilization of ICT in agriculture by them. Anastasios *et. al.* (2010) observed that the annual income was the most influential factor predicting the adoption of ICT by the farmers.

Mwakaje (2010) reported that significant difference was observed between ICT use and the level of income of the respondents.

Lio and Liu (2006) revealed that the farmers in richer countries began to utilize new ICT (especially the Internet) much more effectively to get enhanced agricultural productivity.

2.2.7 Agricultural training exposure and use of ICT

Kafura (2015) observed that there was no significant relationship between the training exposure of the farmers and the level of use of different ICT tools for agricultural purposes by them.

Das (2014) that formal training of a member of household engaged in agriculture positively influences the use of ICTs to access agricultural information by them.

Meera *et. al.* (2004) and Ndag *et. al.* (2008) revealed in different studies that farmers' exposure to the ICT usage and courses had contribution to the use of ICT.

2.2.8 Agricultural knowledge and use of ICT

Reza (2007) found that there was positive significant relationship between agricultural knowledge of the farmers and the impact of use of ICT as perceived by them.

Anisuzzaman (2003) found that the agricultural knowledge of the respondent had positive significant relationship with their use of communication media.

Nuruzzaman (2003) in his study observed that agricultural knowledge of the farmers had positive and significant relationship with their use of mass media. Roy (2006) in his study observed that knowledge on agriculture of the farmers had a positive and significant relationship with the effectiveness of mass media.

Ahmed (2012) observed that agricultural knowledge of the farmers had no significant relationship with the utilization of ICT in agriculture.

Qiang *et. al*. (2012) revealed that farmers' access to knowledge and information had contribution to the expansion of their capacity through the use of ICT media.

Karim (2005) observed that knowledge of the farmers had a significant positive relationship with the use of communication sources improving agricultural practices.

2.2.9 Organizational participation and use of ICT

Bhuiyan (1988) in a study found that organizational participation of the farmers had no significant effect on the use of communication media.

Rahman (1991) found that organizational participation and credibility of Sub-Assistant Agriculture Officers showed insignificant relationship.

Nuruzzaman (2003) found that organizational participation of the farmers had positive and significant relationship with their use of mass media.

Roy (2006) in his study concluded that organizational participation of the farmers had a positive and significant relationship with the effectiveness of mass media.

2.2.10 Innovativeness and use of ICT

Rahim (1963) concluded in his study that adoption improved farming practices and the agricultural technologies adopted by the farmers were positively related to their contact with communication media.

Beal and Sibley (1967) found that there was a positive relationship between communication behaviour of the Indian Guatemala and their adoption of agricultural technology.

Kashem and Halim (1991) found in their study that innovativeness of the farmers had significant positive correlation with their (farmers) self-confidence.

2.2.11 Cosmopoliteness and use of ICT

Bhuiyan (1988) in a study observed that the relationship between cosmopoliteness and use of communication media was not significant.

Latif (1974) found that the relationship between the cosmopoliteness and the communication media was positively significant.

Kadam and Sabale (1983) observed that cosmopoliteness of the farmers was significantly associated with the extent use of communication media.

2.2.12 Problems faced by the farmers of using ICTs in receiving

Ullah (1996) in a study observed that farmers had lack of knowledge about use of information sources.

Hossain and Crouch (1992) reported that there is little response of information service provider to providing their service to farmers about new technologies.

Mwakaje (2010) found that the spread of ICT technology among the farmers were hindered by a number of factors namely cost, availability, knowledge and reliability. Another problem namely lack of electric power in many rural areas was a dictating factor regarding the spreading of ICT among the farmers.

Hassan *et. al.* (2009) found that the five main problems in their study less affected the entrepreneurs who were more exposed to ICT usage and *courses*.

Lwoga (2010) reported that the better dissemination of agricultural knowledge in the local communities through community radio and thereby the improvement of agricultural activities of the farmers was constrained by language restriction.

Chilimo (2008) revealed that a number of problems in using ICT media like telecenters and rural radio in dissemination of information and knowledge for sustainable agricultural practices in Tanzania constrained the farmers from meeting their information needs which specially included high cost of ICTs, illiteracy, distance to the telecentre, language barrier, lack of electricity, frequent power cuts,

sustainability issues and lack of awareness of most of the telecenter managers about the farmers' information needs.

2.3 Conceptual framework of the study

The conceptual framework of Rosenberg and Hovland (1960) was kept in mind while framing the structural arrangement for the dependent and independent variables of the study. The hypothesis of a research while constructed properly contains at least two important elements i.e. a dependent variable and independent variables. A dependent variable is that factor which appears, disappears or varies as the research introduces, removes or varies the independent variables (Townsend, 1953). Here, farmers' use of ICT has been selected as dependent variable and the characteristics of the farmers were considered as the independent variables. It is not possible to deal with all characteristics in a single study. It was therefore, necessary to limit the characteristics, which include age, education, family size, farm size, farming experience, annual family income, agricultural training, agricultural knowledge, organizational participation, innovativeness, cosmopoliteness and problems faced in using ICT media are independent variables. Based on the above discussions and major findings from review of literature, the researcher constructed a conceptual framework of the study which is presented in Figure 2.1.

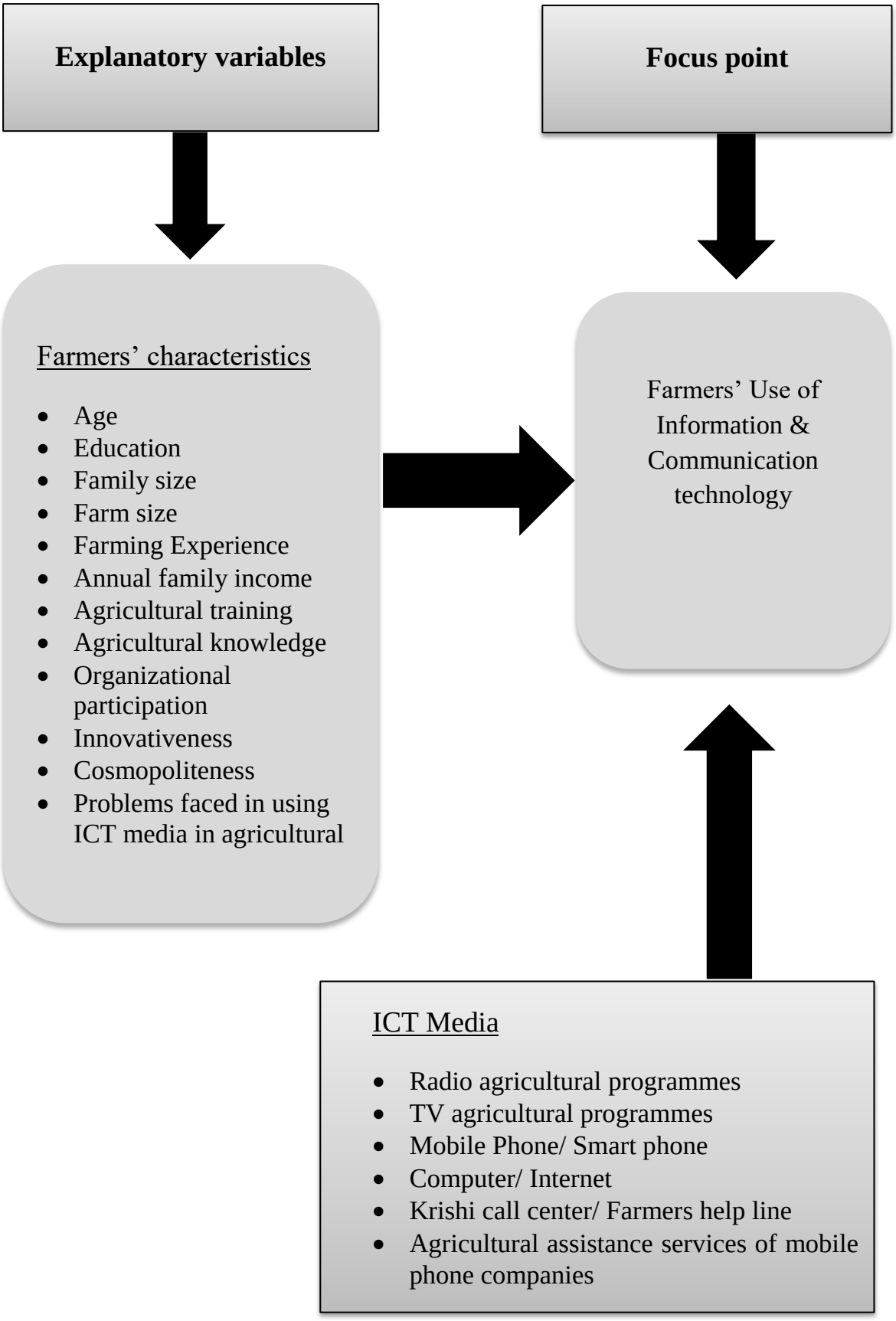

Figure 2.1 The conceptual frame work of the study

CHAPTER 3
MATERIALS AND METHODS

Methodology plays an important role in a scientific research. To fulfill the objectives of the study, a researcher should be very careful while formulating methods and procedures in conducting the research. The methods and operational procedures followed in conducting the study e.g. selection of study area, sampling procedures, instrumentation, categorization of variables, collection of data, measurement of the variables and statistical measurements. A chronological description of the methodology followed in conducting this research work has been presented in this chapter.

3.1 Locale of the Study

The study was conducted in Keshabpur upazila of Jashore district. The researcher selected ICT user farmers of the Keshabpur and Sagardari union in this upazilla. Mulgram village from Keshabpur and Sagardari Village of Sagardari union constituted the locale of the study. The physical, social and cultural heritages of the people of this area were similar in many cases with other central areas of the country. A map of Bangladesh showing Jashore district, a map of Jashore district showing the Keshabpur upazila and a map of Keshabpur upazila showing the study unions are shown in figure 3.1, 3.2 and 3.3 respectively.

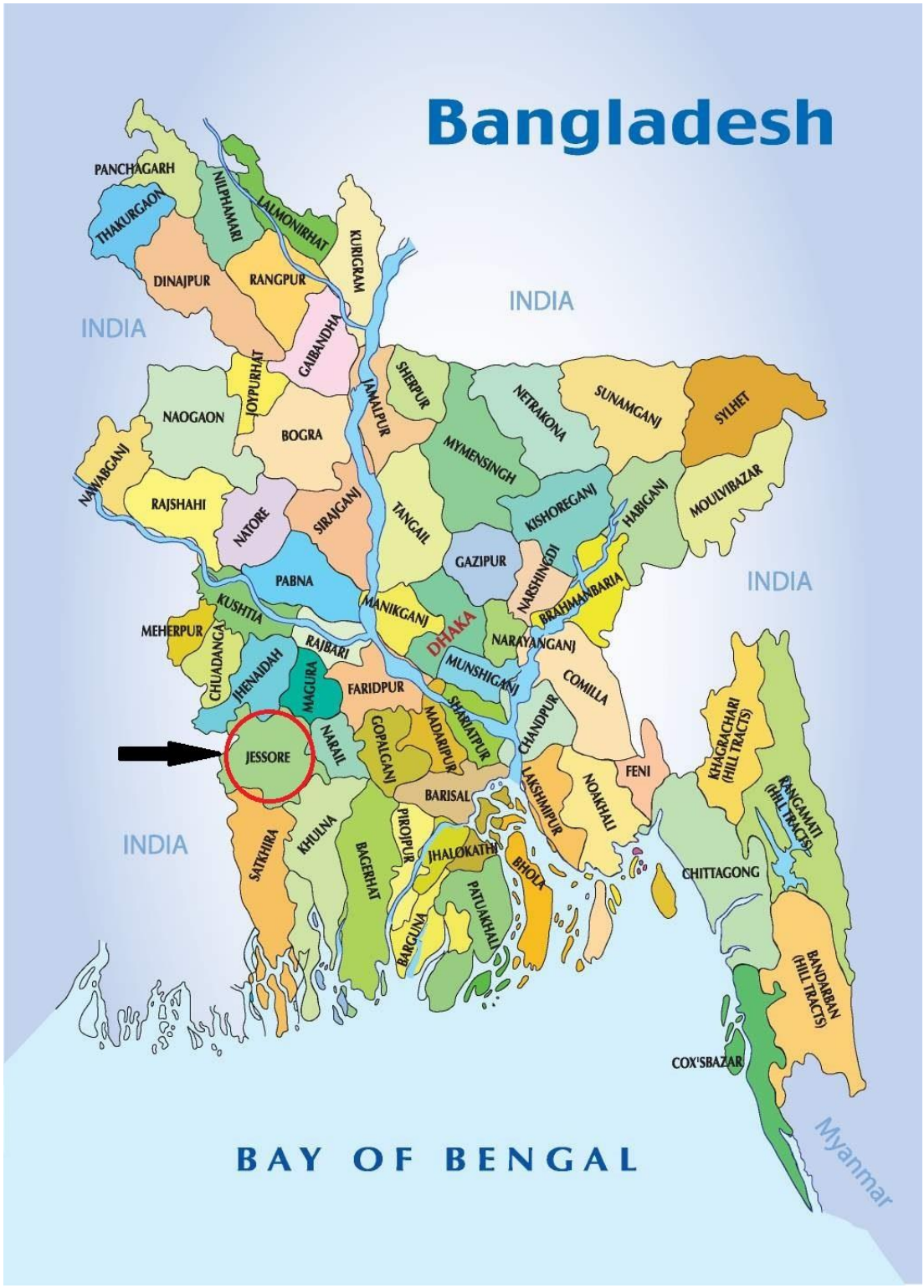

Figure 3.1 A Map of Bangladesh showing Jashore District

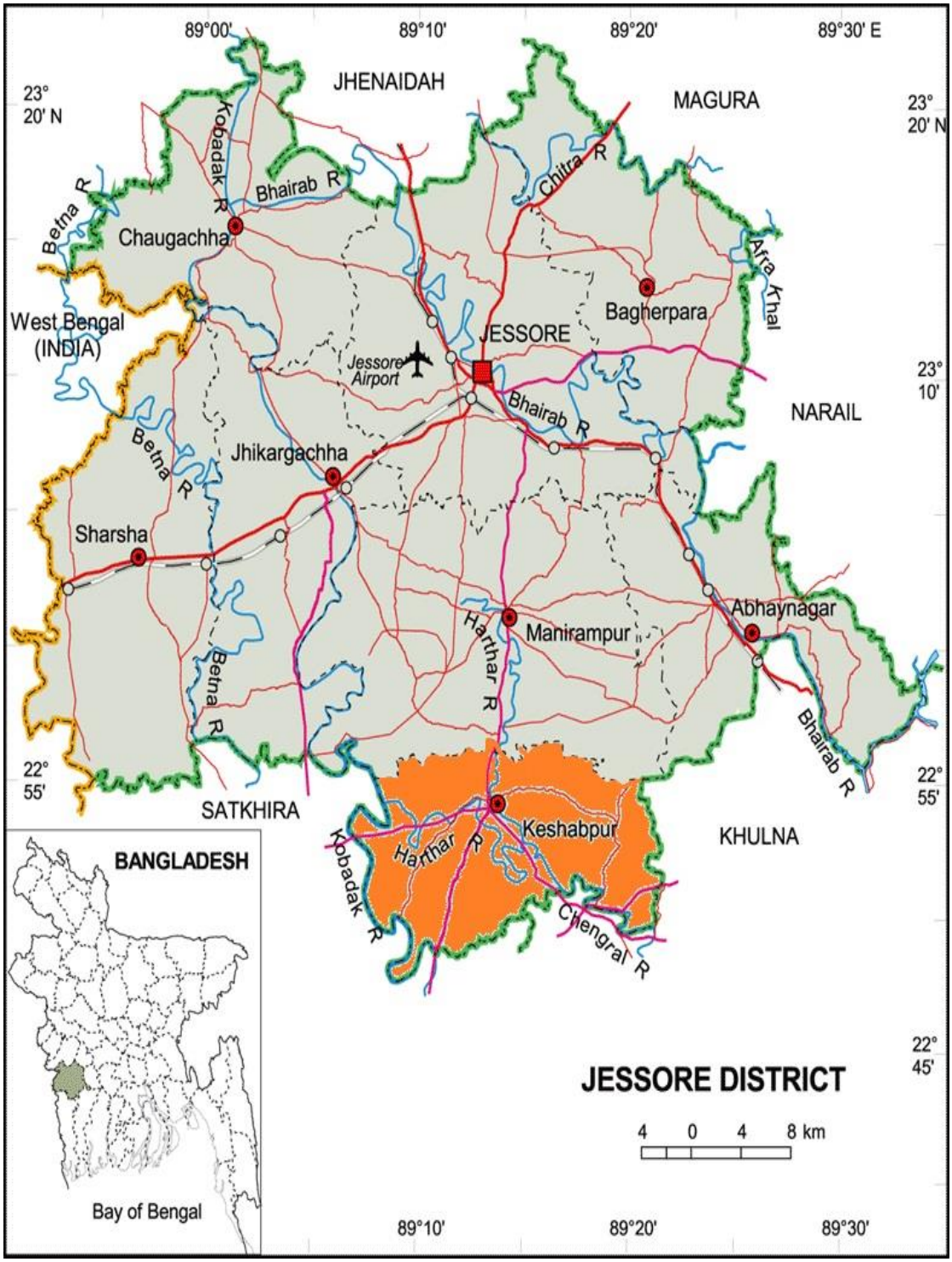

Figure 3.2 A Map of Jashore District showing Keshabpur upazila

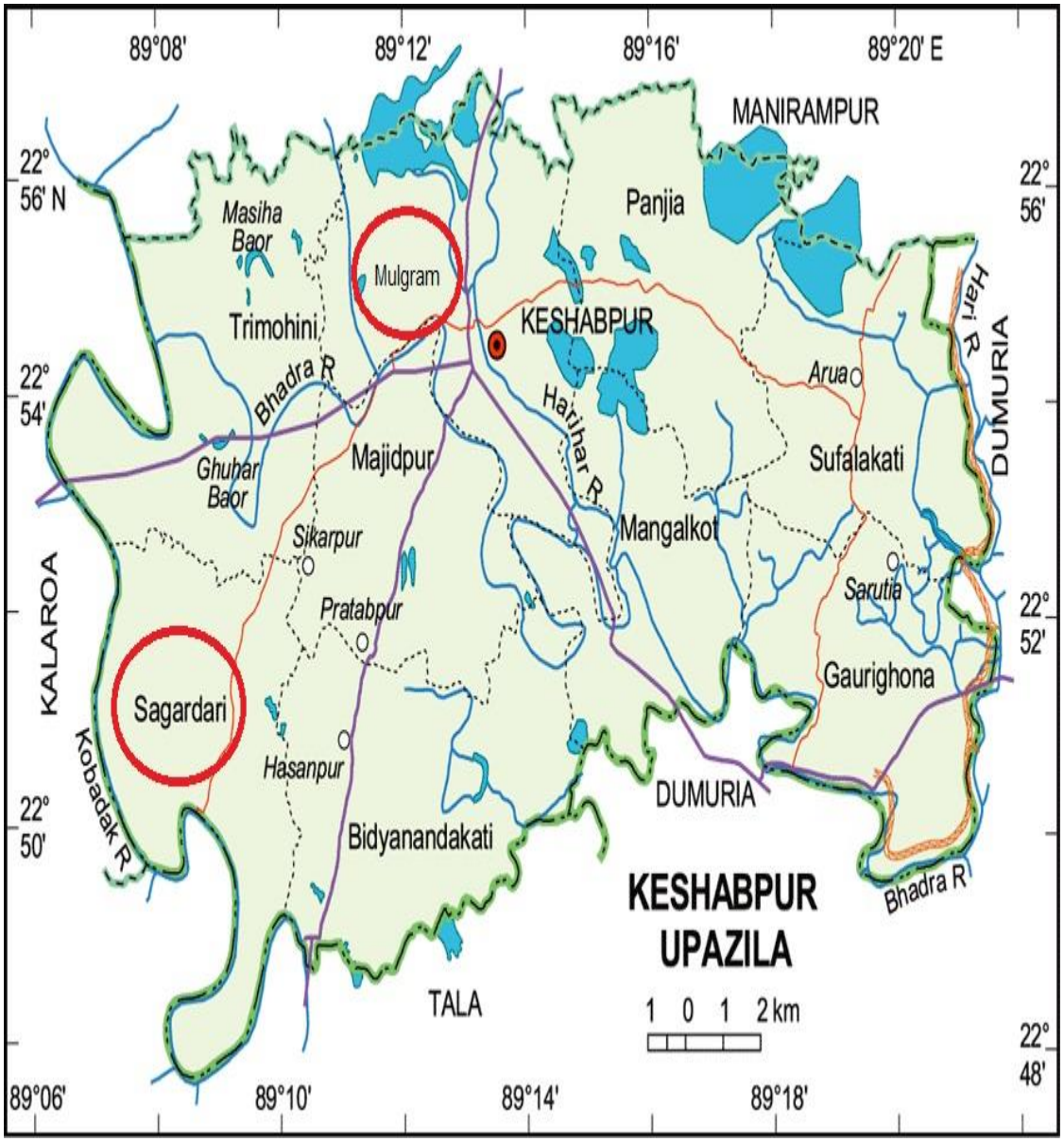

Figure 3.3 A map of Keshabpur upazila showing the study area

3.2 Population and Sampling Design

All the farmers of the Mulgram and Sagardari village of Keshabpur upazila of Jashore District constituted the population of the study. For this purpose, an up-to-date list of farmers was prepared with the help of the Sub-Assistant Agricultural Officer (SAAO) of that respected union. The total number of farmers in these villages was 431. These 431 farmers constituted the population for this study. Data were collected from the sample rather than whole population due to time and fund constraints. About 25 percent of the farmers were selected randomly and proportionately from the villages as the sample by using a random number table. Thus, 107 farmers were selected as the sample for this study. However, a reserve list of 12 farmers was also prepared. Farmers in the reserve list were used only when a respondent in the original list was not available. Distribution of population, sample size and reserve list are shown in Table 3.1.

Table 3.1 Distribution of population, sample size and reserve list

Name of Villages	**Name of Union**	**Total Population**	**Sample Size**	**Reserve List**
Mulgram	Keshabpur	223	55	7
Saragdari	Saragdari	208	52	5
Total		431	107	12

3.3 Instrument for Collection of Data

In order to collect relevant information an interview schedule was carefully prepared and designed in keeping the objective of the study in view. The statements and questions were set with wide revision and they were made simple and easily understandable to the farmers. It contained both open and closed form questions. It contained twelve independent variables. The questions were arranged systematically. The interview schedule was pretested with 10 ICT user farmers and then final shape was given to the interview schedule according to the experience of pre-test. The pre-test facilitated the researcher to examine the suitability of different questions and status of the instrument in general. An English version of interview schedule is enclosed in Appendix-A.

3.4 Measurement of Variables

3.4.1 Age

Age of the farmer referred to the period of time from his/her birth to the time of interview. It was measured in terms of actual years on the basis of his response to the interview schedule (Appendix-A).

3.4.2 Education

The education of a respondent was measured by the number of years of successful schooling. A score of one (1) was assigned for each year of schooling completed. For example, if a respondent completed study up to class five, his education score was assigned as 5.

The knowledge status of a respondent who could sign only was assigned a score of 0.5 while illiterate farmers were assigned a score of 0. Besides, if a respondent did not go to school but studied at home and if his knowledge status was equivalent to the student of class five, then he was assigned a score of 5.

3.4.3 Family size

Family size of the respondent farmers was measured by counting the total number of family members of the respondent on the basis of his/her response. The head of the household, his wife, children, parents and other dependents who jointly lived and ate together during interview was considered as the family members. One score was given for each family member.

3.4.4 Farm size

Land possession refers to the physical control over land provides one a possession of that thing. The land possession of the respondent was computed by using following formula:

Land Possession = A+B+1/2(C+D) +E

Where,

A = Homestead land including pond area

B = Own land under own cultivation

C = Land taken from others on sharecropping

D = Land given to others on sharecropping

E = Land taken from others on lease

3.4.5 Farming experience

Farming experience refers to how many years are engaged in agricultural farming. The farming experience of a farmer means the experience he/she gained directly by performing various farming activities and it was expressed in year.

3.4.6 Annual family income

Annual income of the respondents was measured on the basis of total yearly income of the respondent himself/herself plus other family members. One score was assigned to each '1000' taka annual income of a respondent. The annual income was measured by using the following formula:

Total annual family income = A+B

Where,

A = Annual income from crops, livestock, poultry and fisheries

B = Annual income from service, business, labour and others

3.4.7 Agricultural training

It was measured by the total number of days that a respondent has undertaken training on agriculture in his/her entire life time from different organizations. A score of one (1) was assigned for each days of training received.

3.4.8 Agricultural knowledge

A set of 11 questions was constructed in the interview schedule to measure agricultural knowledge of the respondents. A score of two (2) was assigned against each question. All the 11 questions were asked to each respondent. If the respondent could answer the question fully he was given the full marks (2) and if he/she could answer the question partially he/she was given the half marks (1). If he/she could not answer the question, he/she was given zero (0) mark. The agricultural knowledge score was measured by the summation of obtained scores against the 11 questions. The agricultural knowledge score could range from 0 to 22, where, '0' indicates no agricultural knowledge and '22' indicates very high agricultural knowledge.

3.4.9 Organizational participation

The organizational participation score was computed for each respondent on the basis of his/her membership with different types of organizations. The following scale was used for computing the organizational participation score.

Categories of Participation	Score
a. Participation as executive officer	3
b. Participation as executive member	2
c. Participation as ordinary member	1
d. No participation	0

Organizational participation score of a respondent was obtained by multiplying the score of his participation status with the corresponding duration (in year) in all the organizations and then added together. The duration was scored by assigning 1 for each year of participation in an organization.

3.4.10 Innovativeness

According to Rogers (1995) innovativeness is the degree of adoption a new technology to which an individual or other unit of adoption is relatively earlier than the other member of the social system. Innovativeness of a respondent was measured by computing a innovativeness score on the basis of his/her extent of use 15 selected modern Agricultural practices. Scores were assigned on the basis of time dimension in the following manner.

Extent of adoption	Score
Never used	0
After 3 years of hearing	1
Within >2-3 years of hearing	2
Within >1-2 years of hearing	3
Within 1 year of hearing	4

Innovativeness score of a respondent was obtained by adding his/her score for all the items. Therefore, the possible innovativeness score of the respondents could range from 0 to 60, ‘0’ indicating no innovativeness and ‘60’ indicating very high innovativeness.

3.4.11 Cosmopoliteness

Cosmopoliteness of a respondent was measured in terms of his or her nature of outside visit (Seven different places) external to his own social system. For this purpose, five- point rating scale was used as follows:

Place of visit	Nature of visit	Score
1. Visit to other villages	Regularly (≥ 7 times/ month)	4
	Often (5-6 times/ month)	3
	Occasionally (3-4 times/month)	2
	Rarely (1-2 times/month)	1
	Not at all (0 time/month)	0
2. Visit to other union	Regularly (≥ 7 times/ month)	4
	Often (5-6 times/ month)	3
	Occasionally (3-4 times/month)	2
	Rarely (1-2 times/month)	1
	Not at all (0 time/month)	0
3. Visit to own upazila sadar	Regularly (≥ 7 times/ month)	4
	Often (5-6 times/ month)	3
	Occasionally (2-3 times/month)	2
	Rarely (1 time/month)	1
	Not at all (0 time/month)	0
4. Visit to other upazila sadar	Regularly (≥ 4 times/ year)	4
	Often (3 times/ year)	3
	Occasionally (2 times/year)	2
	Rarely (1time/year)	1
	Not at all (0 time/year)	0
5. Visit to own district town	Regularly (≥ 5 times/ month)	4
	Often (4 times/ month)	3
	Occasionally (2-3 times/month)	2
	Rarely (1 time/month)	1
	Not at all (0 time/month)	0
6. Visit to other district town	Regularly (≥ 4 times/ year)	4
	Often (3 times/ year)	3
	Occasionally (2 times/ year)	2
	Rarely (1 time/ year)	1
	Not at all (0 time/ year)	0
7. Visit to Capital city (Dhaka)	Regularly (≥ 4 times/ year)	4
	Often (3 times/ year)	3
	Occasionally (2 times/ year)	2
	Rarely (1-time/ year)	1
	Not at all (0 time/ year)	0

Cosmopoliteness score of a respondent was obtained by adding his/her score for all the items. Therefore, the possible innovativeness score of the respondents could range from 0 to 28, '0' indicating no cosmopoliteness and '28' indicating very high cosmopoliteness.

3.4.12 Problems faced in using ICT in agriculture

Problem faced in using ICT media in agriculture was measured by using a scale of 12 problems and asking the respondent to show their responses as 'not at all', 'low', 'medium', 'high' and 'very high' against each problem according to their extent of problem facing in using ICT in agriculture. The weighted score of the five responses were assigned as 0, 1, 2, 3 and 4 respectively. The problems faced in using ICT media in agriculture score ranged from 0 to 48, where, '0' indicated no problem and '48' indicate the highest problems faced in using ICT in agriculture.

3.4.13 Use of ICT in agriculture

The use of ICT in agriculture was measured on the basis of the response of the ICT user farmers against the extent of his/her use. The selected six ICTs are radio agricultural programs, TV agricultural programs, mobile Phone/ smart phone, computer/ internet, Krishi call center/ farmers help line and agricultural assistance services of mobile phone companies. By putting tick mark against any one of the five responses-'regularly', 'most often', 'occasionally', 'rarely', 'not at all'. The responses were scored as 4, 3, 2, 1 and 0 respectively. The use of ICT in agriculture score of the respondent ranged from 0 to 24, where, '0' indicates no use and '24' indicates the highest use.

3.5 Statement of Hypotheses

3.5.1 Research hypotheses

The following research hypotheses were put forward to test the relationship of the selected characteristics of the farmers and their use of ICT media.

"*There is a relationship between each of the selected characteristics of the farmers and their extent of use of ICTs."*

The selected characteristics include: age, education, family size, effective farm size, farming experience, annual family income, agricultural training, agricultural

knowledge, organizational participation, innovativeness, cosmopoliteness and problems faced in using ICT media in agricultural.

3.5.2 Null hypotheses

For statistical test of the research hypotheses they were converted to null form. The null hypotheses were as follows:

"*There is no relationship between each of the selected characteristics of the farmers and their extent of use of ICTs.''*

3.6 Collection of Data

Data for this study were collected through personal interview by the researcher himself during February 5 to March 5, 2018. The interview schedule prepared earlier by the researcher was used to gather information. All possible efforts were made to explain the purpose of the study to the respondents in order to get valid and pertinent information from them. Interviews were conducted with the respondents at their residents. While starting interview with any respondent, the researcher took all possible care to establish a good rapport with them so that they did not feel uneasy or hesitation to furnish proper responses to the questions and statements in the schedule. The questions were explained and clarified whenever any respondent felt difficulty in understanding properly. None of the farmers was interviewed from the reserve list during final collection of data.

3.7 Data Processing

3.7.1 Editing

The collected raw data were examined thoroughly to detect errors and omissions. As a matter of fact the researcher made a careful scrutiny of the completed interview schedule to make sure that necessary data were entered as complete as possible and well arranged to facilitate coding and tabulation. Very minor mistakes were detected by doing this, which were corrected promptly.

3.7.2 Categorization of data

Following coding operation, the collected raw data as well as the respondents were classified into various categories to facilitate the description of the independent and dependent variables. These categories were developed for each of the variables by

considering the nature of distribution of the data and extensive literature review. The procedures for categorization have been discussed while describing the variables under consideration in Chapter 4.

3.8 Statistical analysis

The statistical measures such as range, percentage, mean, standard deviation were used for describing the variables. Tables were also used in presenting data for clarity of understanding. Pearson Product Moment Correlation Co-efficient (r) was run to determine the relationship between each of the selected characteristics of the farmers with their use of ICT in receiving agricultural information. Five percent (0.05) level of probability was used as the basis for rejection of any null hypothesis throughout the study.

CHAPTER 4

RESULTS AND DISCUSSION

The findings of the study and interpretation of the results are presented below according to the objectives of the study. Necessary explanations and appropriate interpretations have also been made showing possible and logical basis of the findings.

4.1 Selected Characteristics of the Farmers

In this section the findings of the farmers' selected characteristics have been discussed. The selected characteristics are 1) age, 2) education, 3) family size, 4) farm size, 5) farming experience, 6) annual family income, 7) agricultural training received 8) agricultural knowledge, 9) organizational participation, 10) innovativeness, 11) cosmopoliteness and 12) problems faced in using ICT in agricultural**.** Measuring unit, range, mean, standard deviations of those characteristics of the farmers were described in this section. Table 4.1 provides a summary profile of the farmers' characteristics.

Table 4.1: Salient features of the selected characteristics of ICT user farmer

Characteristics (measuring unit)	Possible score	Observed score	Mean	SD
Age (Year)	Unknown	22-65	41.06	10.20
Education (Years of schooling)	Unknown	0-17	7.55	3.95
Family size (Number)	Unknown	2-12	5.75	1.80
Farm size (ha)	Unknown	0.06-2.06	0.44	0.32
Farming experience (Years)	Unknown	5-36	20.13	11.41
Annual family income ("000"Tk.)	Unknown	30-400	169.75	65.48
Agricultural training (Days)	Unknown	0-18	4.61	3.32

Agricultural knowledge (Score)	0-22	14-22	18.67	3.91
Organizational participation (Years)	Unknown	0-6	1.39	1.18
Innovativeness (Score)	0-60	29-51	46.84	8.003
Cosmopoliteness (Score)	0-28	8-25	15.23	3.98
Problems faced in using ICT (Score)	0-48	6-46	26.21	11.62

4.1.1 Age

Age of the farmers ranged from 22 to 65 years with the mean of 41.06 years and standard deviation of 10.20. However, based on their age the farmers were classified into three categories as young, middle-aged and old as shown in Table 4.2.

Table 4.2 Distribution of the farmers according to their age

Categories	Basis of categorization (Years)	Farmers		Mean	Standard deviation
		Number	Percent		
Young aged	Up to 35	38	35.5	41.06	10.20
Medium aged	36-50	46	43		
Old aged	Above 50	23	21.5		
Total		107	100.0		

Table 4.2 revealed that majority (43 percent) of the farmers were middle aged, while 35.5 percent of the farmers were young and the rest 21.5 percent of the farmers were old. The findings again revealed that overwhelming majority (78.5 percent) of the farmers were young or middle age. Generally young and middle aged farmers are more likely to use ICTs.

4.1.2 Level of education

The education of the respondents ranged from 0 to 17, the average being 7.55 with the standard deviation of 3.95. On the basis of their education score, the farmers were classified into five categories, namely “illiterate”, “can sign only”, “primary

education", "secondary education" and "above secondary education". The distribution of the farmers according to their education is shown in Table 4.3.

Table 4.3 Distribution of the farmers according to their education

Categories	Basis of categorization (Years of schooling)	Farmers		Mean	Standard deviation
		Number	Percent		
Illiterate	0	2	1.9	7.55	3.95
Can sign only	0.5	12	11.9		
Primary	1-5	22	20.6		
Secondary	6-10	52	48.6		
Above secondary	Above 10	19	17.8		
Total		107	100.0		

It was found that 48.6 percent of the farmers had secondary education compared to 20.6 percent of the farmers had primary education, 17.8 percent of the farmers had higher education, 11.9 percent of the farmers can sign only and 1.9 percent of the farmers were illiterate. From the findings of the study, it reveals that 98.1 percent of the respondents were literate which is higher than the national average literacy rate 63.6 percent (BBS, 2017). As the major part of the farmers under the study area is literate, it can be said that education of the farmers was relatively higher compared to typical rural area in Bangladesh.

4.1.3 Family size

The observed family size scores of the farmers ranged from 2 to 12 having an average of 6.27 and standard deviation of 2.29. On the basis of their family size scores, the farmers were classified into the following three categories: "small family", "medium family" and "large family". The distribution of the farmers according to their family size is shown in Table 4.4.

Table 4.4 Distribution of farmers according to their family size

Categories	Basis of categorization (Number)	Farmers		Mean	Standard deviation
		Number	Percent		
Small family	2-4	25	23.4	5.75	1.80
Medium family	5-6	47	43.9		
Large family	Above 6	35	32.7		
Total		107	100.0		

Findings reveal that 43.9 percent of the farmers had medium family compared to 23.4 and 32.7 percent having small and large family respectively. Based on the above data it can be concluded that the average family size of the farmers is larger than the national average family size of Bangladesh which is equivalent to 4.06 (BBS, 2016b). It is expected that the family having more number of people are more aware about ICTs than those of the farmers having small size family. Because they have diversified connections with various people and organizations. More the family member more the knowledge gathering and sharing. Majority (76.6 percent) of the farmers having medium to large sized families.

4.1.4 Farm Size

Effective farm size of the respondents ranged from 0.06 to 2.06 ha having an average of 0.44 ha and standard deviation of 0.33. The farmers were classified into following three categories based on their farm size scores: “marginal farm size”, “small farm size”, “medium farm size”. The distribution of the farmers according to their land possession is shown in Table 4.5. This categorization was given by DAE.

Table 4.5 Distribution of the farmers according to effective farm size

Categories	Basis of categorization (ha)	Farmers		Mean	Standard deviation
		Number	Percent		
Marginal	Up to 0.20	17	15.9	0.44	0.33
Small	0.21-1.00	82	76.6		
Medium	1.01-2.5	8	7.5		
Total		107	100.0		

It was found that majority (76.6 percent) of the farmers possessed small farm size compared to 15.9 and 7.5 percent of them having marginal and medium farm size respectively. It is expected that farmers having small amount of farm size are less aware about the positive side of ICTs.

4.1.5 Farming Experience

The observed farming experience scores of the farmers ranged from 3 years to 50 years. The average farming experience was 20.13 years and the standard deviation was 11.40. The farmers were classified into the following three categories based on their farming experience scores: “Low”, “medium”, “High”. The distribution of the farmers according to their farming experience is shown in the table 4.6.

Table 4.6 Distribution of the farmers according to their farming experience

Categories	Basis of categorization (Years)	Farmers		Mean	Standard deviation
		Number	Percent		
Low	Up to 14	36	33.6	20.13	11.40
Medium	15-26	38	35.5		
High	Above 26	33	30.8		
Total		107	100.0		

It was found that 35.5 percent farmers possessed medium farming experience compared to 33.6 and 30.8 percent of them having low and high farming experience respectively. Low and medium experienced farmers are more aware about the ICTs rather than the high experienced farmers.

4.1.6 Annual family income

The observed annual family income of the farmers ranged from 30-400 having an average of 169.75 with a standard deviation of 65.48. Based on their annual income score, the farmers were classified into three categories: “low annual income”, “medium annual income”, “high annual income”. The distribution of the farmers according to their annual family income is shown in Table 4.7.

Table 4.7 Distribution of the farmers according to annual family income

Categories	Basis of categorization ("000" Tk.)	Farmers		Mean	Standard deviation
		Number	Percent		
Low	Up to 137	28	26.2	169.75	65.48
Medium	138-203	49	45.8		
High	Above 203	30	28.0		
Total		107	100.0		

It was found that the highest proportion of the respondents (45.8 percent) had medium annual family income while 26.2 and 28.0 percent of them had low and high annual family income respectively. Most of farmers in that respected area belongs in medium to high annual income category.

4.1.7 Agricultural training

The observed agricultural training scores of the farmers ranged from 0 to 18 having an average of 4.61 and a standard deviation of 3.32.On the basis of their agricultural training exposure scores, the farmers were classified into three categories: "no", "low" and "medium". The distribution of the farmers according to their Agricultural training exposure is shown in Table 4.8.

Table 4.8 Distribution of the farmers according to agricultural training

Categories	Basis of categorization (Days)	Farmers		Mean	Standard deviation
		Number	Percent		
No	0	23	21.5	4.61	3.32
Low	1-6	61	57.0		
Medium	Above 6	23	21.5		
Total		107	100.0		

Finding reveals that majority (57 percent) of the respondents had low agricultural training. And 21.5 percent respondents had both no and medium agricultural training.The maximum respondents have low amount of agricultural training due to lack of their willingness.

4.1.8 Agricultural knowledge

The observed knowledge on agriculture scores of the farmers ranged from 14 to 22 against the possible range of 0 to 22 having an average of 18.67 and a standard deviation of 3.91. Based on the Agricultural Knowledge scores, the farmers were classified into the three categories: "poor knowledge", "medium knowledge" and "high knowledge". The distribution of the farmers according to their knowledge on agriculture is shown in Table 4.9.

Table 4.9: Distribution of farmers according to Knowledge on agriculture

Categories	Basis of categorization (Score)	Farmers		Mean	Standard deviation
		Number	Percent		
Poor (<Mean-0.5 SD)	Up to 16	23	21.5	18.67	3.91
Medium (Mean±0.5 SD)	17-20	29	27.1		
High (>Mean+0.5 SD)	Above 20	55	51.4		
Total		107	100.0		

Findings indicate that the highest proportion (51.4 percent) of the farmers had high knowledge on agriculture compared to 21.5 and 27.1 percent having poor knowledge and medium knowledge on agriculture respectively. It can be shown from Table 4.9 that almost half of the farmers (51.4 percent) had high agricultural knowledge. It is found that more than half of the farmers have high agricultural knowledge in that respected area because of the DAE personnel activities.

4.1.9 Organizational participation

The observed organizational participation scores of the farmers ranged from 0 to 6 with an average of 1.39 and a standard deviation of 1.18. On the basis of their organizational participation scores, the farmers were classified into three categories: "no", "low" and "medium" organizational participation. The distribution of the farmers according to their organizational participation is shown in Table 4.10.

Table 4.10 Distribution of farmers according to organizational participation

Categories	Basis of categorization (Years)	Farmers		Mean	Standard deviation
		Number	Percent		
No	0	21	19.7	1.39	1.18
Low	1-2	47	43.9		
Medium	Above 2	39	36.4		
Total		107	100.0		

Finding shows that the majority (43.9 percent) of the farmers had low organizational participation compared to 19.7 percent and 36.4 percent of total farmers having no and medium organizational participation, respectively. It was observed that most of the farmers (80.3 percent) of that area had low to medium organizational participation.

4.1.10 Innovativeness

The observed innovativeness scores of the farmers ranged from 29 to 60 having an average of 46.84 and a standard deviation of 8.004 against the possible range of 0-60. On the basis of their innovativeness scores, the farmers were classified into three categories: "low innovativeness", "medium innovativeness" and "high innovativeness". The distribution of the farmers according to their innovativeness scores is shown in Table 4.11.

Table 4.11 Distribution of the farmers according to their innovativeness

Categories	Basis of categorization (Score)	Farmers		Mean	Standard deviation
		Number	Percent		
Low	Up to 42	33	30.8	46.84	8.004
Medium	43-50	27	25.3		
High	Above 50	47	43.9		
Total		107	100.0		

Finding reveals that 43.9 percent of the farmers had high innovativeness compared to 30.8 percent and 25.3 percent having low innovativeness and medium innovativeness

respectively. DAE and private sector are working shoulder to shoulder in that study area, so the majority of the farmers had high innovativeness.

4.1.11 Cosmopoliteness

The observed cosmopoliteness scores of the farmers ranged from 8-25 against the possible range of 0 to 28 having an average of 15.23 with a standard deviation of 3.98. Based on the cosmopoliteness scores, the farmers were classified into three categories: “low”, “medium” and “high”. The distribution of the farmers according to their cosmopoliteness scores is shown in Table 4.12.

Table 4.12 Distribution of the farmers according to their cosmopoliteness

Categories	**Basis of categorization (Score)**	**Farmers**		**Mean**	**Standard deviation**
		Number	**Percent**		
Low (<Mean-0.5 SD)	Up to 14	49	45.8	15.23	3.98
Medium (Mean±0.5 SD)	15-18	33	30.8		
High (>Mean+0.5 SD)	Above 18	25	23.4		
Total		107	100.0		

The finding shows that the majority proportion (45.8 percent) of the farmers had low cosmopoliteness compared to 30.8 percent and 23.4 percent of total farmers having medium cosmopoliteness and high cosmopoliteness respectively. Thus, it can be revealed that more than half of the farmers (54.2 percent) of the farmers had medium to high cosmopoliteness. Farmers of the selected area are frequently moved in the country for entertainment and business, so cosmopoliteness is high.

4.1.12. Problems faced in using ICT media in agriculture

The observed problems faced scores of the farmers ranged from 6-46 having an average of 26.22 and a standard deviation of 11.62 against the possible range of 0-48. On the basis of their problems faced scores, the farmers were classified into three categories: “low”, “medium”, “high”. The distribution of the farmers according to their problems confronted in using ICT media for receiving agricultural information is shown in Table 4.13.

Table 4.13 Distribution of the farmers according to their problems faced in using ICT in agriculture

Categories	Basis of categorization (Score)	Farmers		Mean	Standard deviation
		Number	Percent		
Low	Up to 20	40	37.3	26.22	11.62
Medium	21-32	22	20.6		
High	Above 32	45	42.1		
Total		107	100.0		

The finding shows that 37.3 percent farmers were low problem facing and 20.6 percent of the farmers had medium problem faced. Besides 42.1 percent farmers had high types of problem faced in using ICT media in agriculture. There are many lacking in that selected area specially in technical sector, so the number of problem facing farmers is high.

4.2. Farmers' Use ICTs

The computed ICTs using scores ranged from 5-17 with an average of 10.11 and a standard deviation of 3.25 against the possible range of 0-24. Based on their ICTs using scores the respondents were classified into three categories as "low user", "medium user" and "high user". The distributions of the farmers according to the use of ICTs are shown in Table 4.14.

Table 4.14 Distribution of the farmers according to use of ICTs

Categories	Basis of categorization (Score)	Farmers		Mean	Standard deviation
		Number	Percent		
Low (<Mean-0.5 SD)	Up to 8	40	37.4	10.11	3.25
Medium (<Mean-0.5 SD)	9-12	35	32.7		
High (<Mean-0.5 SD)	Above 12	32	29.9		
Total		107	100.0		

The finding shows that 37.4 percent of the respondents had low use of ICT. It also shows 32.7 percent of the respondents had medium use of ICTs for receiving

agricultural information and 29.9 percent of the respondents had high use of ICT. Most of the farmers (70.1 percent) had low to medium use of ICTs. The findings clearly indicate the ignorance of the respondents about the use of ICTs in receiving agricultural information.

In order to identify the ICT usage, an ICT use index was computed. It was calculated by multiplying the frequency counts of each cell of scale of individual communication media with its corresponding weights such as 4 for "regularly", 3 for "most often", 2 for "occasionally", 1 for "rarely" and 0 for "not at all". The ICT use index was calculated by the following formula for particular medium:

ICT use Index = $ICT_R \times 4 + ICT_M \times 3 + ICT_O \times 2 + ICT_R \times 1 + ICT_N \times 0$

Where,

ICT_R = Number of respondents with "regularly"

ICT_M = Number of respondents with "most often"

ICT_O = Number of respondents with "occasionally"

ICT_R = Number of respondents with "rarely"

ICT_N = Number of respondents with "not at all"

Table 4.15 Rank order of the ICTs used by the farmers in receiving agricultural information

Sl. No.	ICTs	ICT use index	Rank order
1	Mobile Phone/ Smart phone	309	1
2	TV agricultural programs	290	2
3	Radio agricultural programs	229	3
4	Computer/Internet	72	4
5	Krishi call center/ Farmers helpline	65	5
6	Agricultural assistance services of mobile phone companies	30	6

Thus, ICTs use index of a particular medium for could range from 0 to 428, where "0" is indicating no use of ICTs and "428" indicating highest level of extent of use of ICTs.

4.3 Relationship between each of the Selected Characteristics of the ICT user Farmers and their Use of ICTs for Receiving Agricultural Information

The purpose of this section is to examine the relationships of each the twelve selected characteristics (as cited in the objectives) of the farmers with their use of ICT media in receiving agricultural information. Coefficient of correlation was computed in order to explore the relationship between each of the selected characteristics of the farmers and their use of information and communication technologies.

Pearson's Product Moment Coefficient of Correlation (r) was used to test the null hypothesis concerning the relationship between the variables. Five percent and one percent level of probability were used as the basis for rejection of a hypothesis. The tabulated value of "r" was calculated at 105 degrees of freedom. The summary of the results of correlation coefficient indicating the relationships between each of the selected characteristics of the respondents and their use of ICT for receiving agricultural information is shown in Table 4.15.

Table 4.15 Results of relationship between each of the selected characteristics of the ICT user farmers and their usage of ICTs

(N=107)

Dependent variables	Selected characteristics of the farmers	Observed correlation coefficient (r) values with df=N-2=105	5%	1%
Farmers' Use of ICTs	Age	-0.525**	0.191	0.249
	Education	0.573**		
	Family Size	0.091^{NS}		
	Effective farm Size	0.020^{NS}		
	Farming experience	-0.608**		
	Annual family income	0.197*		
	Agricultural training	0.004 ^{NS}		
	Agricultural knowledge	0.444**		
	Organizational participation	0.045 ^{NS}		
	Innovativeness	0.573**		
	Cosmopoliteness	0.297**		
	Problems faced in using ICT in agriculture	-0.613**		

NS= Non-significant

**.Correlation is significant at the 0.01 level (2-tailed)

*.Correlation is significant at the 0.05 level (2-tailed)

4.3.1 Relationship between age of the farmers and their use of ICT

The relationship between age of the farmers and their use of ICT media in receiving agricultural information was examined by testing the following null hypothesis:

"There is no relationship between age of the farmers and their use of ICT media in receiving agricultural information".

Computed value of the coefficient of correlation between age of the farmers and their use of ICT media was found to be -0.525** as shown in Table 4.15. The following observations were recorded regarding the relationship between the two variables on the basis of the co-efficient of correlation:

- The relationship showed a negative trend.
- The computed value of "r" (-0.525) was greater than the tabulated value with 105 degrees of freedom at 0.01 level of probability.
- The concerned null hypothesis was rejected.
- The coefficient of correlation between the concerned variables was negatively significant at 0.01 level of probability.

The findings demonstrate that age of the farmers had significant relationship with their use of communication media in receiving agricultural information. It means that the increase of age of the farmers, their use of ICT media was decreased. Young aged farmers are more interested of using ICTs in agriculture than the old aged farmers.

4.3.2 Relationship between education of the farmers and their use of ICT

The relationship between education of the farmers and their use of ICT media in receiving agricultural information was examined by testing the following null hypothesis:

"There is no relationship between education of the farmers and their use of different ICT media in receiving agricultural information".

Computed value of the coefficient of correlation between education of the farmers and their use of ICT media was found to be 0.573** as shown in Table 4.15. The following observations were recorded regarding the relationship between the two variables on the basis of the co-efficient of correlation:

- The relationship showed a positive trend
- The computed value of "r" (0.573) was greater than the tabulated value with 105 degrees of freedom at 0.01 level of probability.
- The concerned null hypothesis was rejected.
- The coefficient of correlation between the concerned variables was significant at 0.01 level of probability.

The findings demonstrate that education of the farmers had significant relationship with their use of ICTs in receiving agricultural information. Educated farmers are more familiar with ICTs rather than the uneducated farmers.

4.3.3 Relationship between family size and their use of ICT

The relationship between family size of the farmers and their use of ICT media in receiving agricultural information was examined by testing the following null hypothesis:

"There is no relationship between family size of the farmers and their use of different ICT media in receiving agricultural information".

Computed value of the coefficient of correlation between family size of the farmers and their use of ICT media was found to be 0.091 as shown in Table 4.15. The following observations were recorded regarding the relationship between the two variables on the basis of the co-efficient of correlation:

- The relationship showed a positive trend
- The computed value of "r" (0.091) was smaller than the tabulated value with 105 degrees of freedom at 0.05 level of probability.
- The concerned null hypothesis was accepted.
- The coefficient of correlation between the concerned variables was not significant at 0.05 level of probability.

The findings demonstrate that family size of the farmers had no significant relationship with their use of ICTs in receiving agricultural information.

4.3.4 Relationship between farm size of the farmers and their use of ICT

The relationship between farm size of the farmers and their use of ICT media in receiving agricultural information was examined by testing the following null hypothesis:

"There is no relationship between farm size of the farmers and their use of different ICT media in receiving agricultural information".

Computed value of the coefficient of correlation between farm size of the farmers and their use of ICT media was found to be 0.02 as shown in Table 4.15. The following observations were recorded regarding the relationship between the two variables on the basis of the co-efficient of correlation:

- The relationship showed a positive trend.
- The computed value of "r" (0.02) was smaller than the tabulated value with

105 degrees of freedom at 0.05 level of probability.

- The concerned null hypothesis was accepted.
- The coefficient of correlation between the concerned variables was not significant at 0.05 level of probability.

The findings demonstrate that farm size of the farmers had no significant relationship with their use ICTs in receiving agricultural information.

4.3.5 Relationship between farming experience of the farmers and their use of ICT

The relationship between farming experience of the farmers and their use of communication media in receiving agricultural information was examined by testing the following null hypothesis:

"There is no relationship between farming experience of the farmers and their use of different ICT media in receiving agricultural information".

Computed value of the coefficient of correlation between farming experience of the farmers and their use of ICT media was found to be -0.608** as shown in Table 4.15. The following observations were recorded regarding the relationship between the two variables on the basis of the co-efficient of correlation:

- The relationship showed a negative trend.
- The computed value of "r" (-0.608) was greater than the tabulated value with 105 degrees of freedom at 0.01 level of probability.
- The concerned null hypothesis was rejected.
- The coefficient of correlation between the concerned variables was negatively significant at 0.01 level of probability.

The findings demonstrate that farming experience of the farmers had significant relationship with their use of ICTs in receiving agricultural information. It means that the increase of farming experience by the farmers, their use of ICT media was decreased and vice-versa. Old aged farmers with more farming experience are less interested in ICTs rather than young aged less farming experienced farmers.

4.3.6 Relationship between annual family income of the farmers and their use of ICT

The relationship between annual income of the farmers and their use of communication media in receiving agricultural information was examined by testing the following null hypothesis:

"There is no relationship between annual income of the farmers and their use of different ICT media in receiving agricultural information".

Computed value of the coefficient of correlation between annual income of the farmers and their use of ICT media was found to be 0.197* as shown in Table 4.15. The following observations were recorded regarding the relationship between the two variables on the basis of the co-efficient of correlation:

- The relationship showed a positive trend
- The computed value of "r" (0.197) was greater than the tabulated value with 105 degrees of freedom at 0.05 level of probability.
- The concerned null hypothesis was rejected.
- The coefficient of correlation between the concerned variables was significant at 0.05 level of probability.

The findings demonstrate that annual income of the farmers had significant relationship with their use of ICTs in receiving agricultural information. The farmers whose annual income is high, can take risk easily than the poor farmers. So the rich farmers are more interested of using ICTs in agriculture.

4.3.7 Relationship between agricultural training of the farmers and their use of ICT

The relationship between agricultural training of the farmers and their use of communication media in receiving agricultural information was examined by testing the following null hypothesis:

"There is no relationship between agricultural training of the farmers and their use of different ICT media in receiving agricultural information".

Computed value of the coefficient of correlation between agricultural training of the farmers and their use of ICT media was found to be 0.004 as shown in Table 4.15. The following observations were recorded regarding the relationship between the

two variables on the basis of the co-efficient of correlation:

- The relationship showed a positive trend.
- The computed value of "r" (0.004) was smaller than the tabulated value with 105 degrees of freedom at 0.05 level of probability.
- The concerned null hypothesis was accepted.
- The coefficient of correlation between the concerned variables was not significant at 0.05 level of probability.

The findings demonstrate that agricultural training of the farmers had no significant relationship with their use of ICT media in agriculture.

4.3.8 Relationship between agricultural knowledge of the farmers and their use of ICT

The relationship between agricultural knowledge of the farmers and their use of ICT media in receiving agricultural information was examined by testing the following null hypothesis:

"There is no relationship between agricultural knowledge of the farmers and their use of different ICT media in receiving agricultural information".

Computed value of the coefficient of correlation between agricultural knowledge of the farmers and their use of ICT media was found to be 0.444** as shown in Table 4.15. The following observations were recorded regarding the relationship between the two variables on the basis of the co-efficient of correlation:

- The relationship showed a positive trend.
- The computed value of "r" (0.444) was greater than the tabulated value with 105 degrees of freedom at 0.01 level of probability.
- The concerned null hypothesis was rejected.
- The coefficient of correlation between the concerned variables was significant at 0.01 level of probability.

The findings demonstrate that agricultural knowledge of the farmers had significant relationship with their use of ICT media in receiving agricultural information. The farmers', whose knowledge is high, are more interested in using ICTs for agricultural purposes.

4.3.9 Relationship between Organizational Participation of the Farmers and their Use of ICT Media

The relationship between organizational participation of the farmers and their use of ICT media in receiving agricultural information was examined by testing the following null hypothesis:

"There is no relationship between organizational participation of the farmers and their use of different ICT media in receiving agricultural information".

Computed value of the coefficient of correlation between organizational participation of the farmers and their use of ICT media was found to be 0.045 as shown in Table 4.15. The following observations were recorded regarding the relationship between the two variables on the basis of the co-efficient of correlation:

- The relationship showed a positive trend.
- The computed value of "r" (0.045) was smaller than the tabulated value with 105 degrees of freedom at 0.05 level of probability.
- The concerned null hypothesis was accepted.
- The coefficient of correlation between the concerned variables was not significant at 0.05 level of probability.

The findings demonstrate that organizational participation of the farmers had no significant relationship with their use of ICT media in receiving agricultural information.

4.3.10 Relationship between innovativeness of the farmers and their use of ICT

The relationship between innovativeness of the farmers and their use of ICT media in receiving agricultural information was examined by testing the following null hypothesis:

"There is no relationship between innovativeness of the farmers and their use of different ICT media in receiving agricultural information".

Computed value of the coefficient of correlation between innovativeness of the farmers and their use of ICT media was found to be 0.573** as shown in Table 4.15. The following observations were recorded regarding the relationship between the two variables on the basis of the co-efficient of correlation:

- The relationship showed a positive trend.
- The computed value of "r" (0.573) was greater than the tabulated value with 105 degrees of freedom at 0.01 level of probability.
- The concerned null hypothesis was rejected.
- The coefficient of correlation between the concerned variables was significant at 0.01 level of probability.

The findings demonstrate that Innovativeness of the farmers had significant relationship with their use of ICT media in receiving agricultural information. The innovative farmers are more willing to take the new technologies than the others.

4.3.11 Relationship between cosmopoliteness of the farmers and their use of ICT

The relationship between cosmopoliteness of the farmers and their use of ICT media in receiving agricultural information was examined by testing the following null hypothesis:

"There is no relationship between cosmopoliteness of the farmers and their use of different ICT media in receiving agricultural information".

Computed value of the coefficient of correlation between cosmopoliteness of the farmers and their use of ICT media was found to be 0.297** as shown in Table 4.15. The following observations were recorded regarding the relationship between the two variables on the basis of the co-efficient of correlation:

- The relationship showed a positive trend.
- The computed value of "r" (0.297) was greater than the tabulated value with 105 degrees of freedom at 0.01 level of probability.
- The concerned null hypothesis was rejected.
- The coefficient of correlation between the concerned variables was significant at 0.01 level of probability.

The findings demonstrate that cosmopoliteness of the farmers had significant relationship with their use of ICT media in receiving agricultural information. The cosmopolite people are moving all around and gathering knowledge about the modern technologies.

4.3.12 Relationship between problems faced by farmers in using ICT and their use of ICT

The relationship between problems faced by farmers in using ICT and their use of ICT media in receiving agricultural information was examined by testing the following null hypothesis:

"There is no relationship between problems faced by farmers in using ICT and their use of different ICT media in receiving agricultural information".

Computed value of the coefficient of correlation between problems faced by farmers in using ICT of the farmers and their use of ICT media was found to be -0.613** as shown in Table 4.15. The following observations were recorded regarding the relationship between the two variables on the basis of the co-efficient of correlation:

- The relationship showed a negative trend.
- The computed value of "r" (-0.613) was greater than the tabulated value with 105 degrees of freedom at 0.01 level of probability.
- The concerned null hypothesis was rejected.
- The coefficient of correlation between the concerned variables was negatively significant at 0.01 level of probability.

The findings demonstrate that problems faced by farmers in using ICT of the farmers had negative significant relationship with their use of ICT media in receiving agricultural information. It means that the increase of problems faced by the farmers, their use of ICT media was decreased. There are various types of problems faced by the farmers in using ICTs. If the problems could be decreased by authorities then the use of ICTs for agricultural purposes will be increased.

CHAPTER 5

SUMMARY OF FINDINGS, CONCLUSION AND RECOMMENDATIONS

5.1 Summary of the Findings

The major findings of the study have been summarized in the following sections.

5.1.1 Selected characteristics of the farmers

Age: Most of the farmers were middle aged (43 percent) while 35.5 percent and 21.5 percent respondents are in the young and old age categories respectively.

Education: Most of the farmers had secondary level education (48.6 percent), 20.6 percent had primary education, 17.8 percent above secondary education, 11.9 percent can sign only and 8 percent were illiterate.

Family Size: Most of the farmers had medium sized family (43.9 percent) while 23.4 and 32.7 percent had small and large sized family respectively.

Farm Size: A majority 76.6 percent of the farmers possessed medium farm size compared to 15.9 and 7.5 percent of them having small farm size and large farm size respective.

Farming Experience: Finding reveals that 35.5 percent of the farmers had medium experience compared to 33.6 and 30.8 percent having low and high experience respectively.

Annual Family Income: Finding reveals that the highest portion (45.8 percent) of the farmers had medium annual income while 26.2 and 28 percent of them had low annual income and high annual income respectively.

Agricultural training: About 57 percent of the respondents' agricultural training exposure was under low category. About 21.5 percent of the respondents agricultural training exposure was no. And about 21.5 percent of the respondents agricultural training exposure was medium.

Agricultural Knowledge: Finding indicates that the highest proportion (51.4 percent) of the farmers had high knowledge on agriculture compared to 21.5 and 27.1 percent having poor knowledge and medium knowledge on agriculture respectively.

Organizational Participation: The finding indicates that majority (43.9 percent) of the farmers had low organizational participation compared to 19.6 and 36.4 percent having no organizational participation and medium organizational participation respectively.

Innovativeness: About 43.9 percent of the respondents had high innovativeness. About 30.8 percent of the respondents had low innovativeness. About 25.2 percent of the respondents had medium innovativeness.

Cosmopoliteness: Most of the respondents (45.8 percent) of the respondents had low cosmopoliteness. About 30.8 percent of the respondents had medium cosmopoliteness. About 23.4 percent of the respondents had high cosmopoliteness.

Problems Faced in Using ICT: About 37.4 percent of the respondents problem confrontation was low in receiving agricultural information. About 20.6 percent faced medium problem confrontation in using ICT. About 42.1 percent of the respondents faced high problem confrontation during receiving agricultural information.

5.1.2 Farmers use of ICTs for receiving agricultural information

About 37.4 percent of the respondents had low use of ICT for receiving agricultural information. About 32.7 percent of the respondents had medium use of ICT for receiving agricultural information. Beside these 29.9 percent of the respondents have high use of ICT media for receiving agricultural information. This was not a satisfactory scenario for using ICT media as a source of agricultural information.

5.1.3 Relationship between each of the selected characteristics of the farmers and their use of ICTs

Among 12 selected characteristics of the farmers, five characteristics namely education, annual family income, agricultural knowledge, innovativeness, cosmopoliteness showed significant and positive relationship with their use of ICT. Age, farming experience and problems faced by the farmers in using ICT showed significant negative relationship with their use of ICT. But family size, farm size, agricultural training and organizational participation of the farmers showed non-significant relationship with the use of ICT by the farmers.

5.2 Conclusion

On the basis of the findings of the research and logical interpretations of their meaning in the light of other relevant facts, the researcher drew the following conclusions:

1. The study shows that 29.9 percent of the total respondents are in the high use of ICTs category. Beside this mobile phone or smart phone is the most used ICT by the respondent farmers.
2. The study indicated that age of the farmers had significant relationship and a negative trend with their use of ICT. This means that young aged farmers were more influenced by the ICT in receiving agricultural information than the old aged farmers.
3. The statistical analysis showed a significant and positive relationship of education of the farmers with their use of ICT in receiving agricultural information. Therefore, it may be concluded that education plays an important role for using of ICTs.
4. Farming experience of the farmers had significant and negative relationship with their use of ICT for receiving agricultural information. As maximum experience holder respondents are middle and old aged and their educational qualification is not so high therefore, it may be concluded that farmers with more experience had less use of ICT.
5. Annual income of the farmers had positive significant relationship with the use of ICTs in receiving agricultural information. It leads to the conclusion

that income of the farmers had helped them to increase their use of ICTs in receiving agricultural information.

6. A significant positive relationship was found between knowledge on agriculture of the farmers and their use of ICT in receiving agricultural information, which implied that the knowledgeable farmers had the more use of ICT in receiving agricultural information.
7. Innovativeness of the farmers had positive significant relationship with their use of ICT for receiving agricultural information. So, it was concluded that increase of innovativeness, their use of ICT was also increased.
8. Cosmopoliteness of the farmers had significant positive relationship with their use of ICT. The cosmopolitan people moving many places and gather information about various modern technologies. This implies that increase of cosmopoliteness increase their use of ICT for receiving agricultural information.
9. The relationship between the problem confrontation in receiving agricultural information and use of ICT was significant and showed a negative trend. Therefore, it may be concluded that with the increase of problem confrontation of the farmers, their use of ICT was decreased.
10. Family size, Farm size, agricultural training and organizational participation had no significant relationship with the use of ICT.

5.3 Recommendations

5.3.1 Recommendations for policy implications

Based on the findings and conclusions of the study, following recommendations for policy implications were put forward:

- The finding shows that 37.4 percent of the respondents had low use of ICT and 32.7 percent of the respondents had medium use of ICT for receiving agricultural information. This was not a satisfactory scenario. As a result, policy should be taken for increasing extent of use of ICT for agricultural purposes through creating awareness and interest among the farmers.
- Age, education and annual income of the farmers had significant relationship with their use of ICT. Therefore, it may be recommended that attempts

should be taken by the concerned authority to increase the use of ICTs for specially the young and middle aged farmers having lower education and lower income for receiving agricultural information.

- Organizational participation the farmers had non-significant positive relationship with their use of ICT for receiving agricultural information. Therefore, group approach of extension programme could effectively be used by different extension agencies in disseminating information.
- Agricultural training exposure of the farmers had non-significant positive relationship with their use of ICT for receiving agricultural information. Therefore, it may be recommended that attempts should be taken by the agricultural extension service providers to arrange training for the farmers for increasing their use of ICT for receiving agricultural information.
- The relationship between the problem confrontation in receiving agricultural information and use of ICT was significant and showed a negative trend. Therefore, it may be recommended that attempts should be taken by the concerned authorities to solve the problems of the farmers.

5.3.1 Recommendations for further studies

- It is strongly felt that study of this nature be replicated in other parts of Bangladesh. This recommendation is made because the study area at Mulgram and Sagardari villages of Keshabpur Upazila of Jashore district is not typical of the situation in the entire country.
- This study was investigated the relationship of twelve characteristics of the farmers with their use of communications media in receiving agricultural information. Therefore, it is recommended that further study should be conducted involving other characteristics of the farmers.
- On the basis of the characteristics pattern of farming population, more researches should be conducted to investigate the comparative effectiveness of ICTs with other extension methods and also identify the factors influencing the use of ICTs, its utilization as well as effectiveness in receiving information by the farmers.

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APPENDIX-A

Department of Agricultural Extension and Information System

Sher-e-Bangla Agricultural University

Sher-e-Bangla Nagar, Dhaka-1207

English Version of Interview Schedule

On

Farmers' Use of Information and Communication Technologies: A Study in Keshabpur, Jessore.

Sl. No. ……..

Name of Respondent: ……..

Father's Name: ……

Village: …… Union: ……...

Upazila:…….. District: ……...

Mobile No: ……..

(Please answer the following questions)

1. **Age** ..... years
2. **Level of Education** :
   * Cannot read or write.....
   * Can sign name only.....
   * Studied up to class….....
3. **Family size**…….number
4. **Effective Farm Size :**

Sl. No.	Type of land	Area (Decimal)
A	Homestead land including pond area	
B	Own land under own cultivation	
C	Land taken from others on sharecropping	
D	Land given to others on sharecropping	
E	Land taken from others on lease	
	Total=A+B+1/2(C+D)+E	

5. **Farming Experience:** How many years you are engaged in agricultural farming?
..... Years

6. **Annual Family Income:** Please state your annual income from different sources:

(A) Agriculture

Sl. No.	Sources of income	Amount(Tk.)
1	Crops	
2	Livestock	
3	Fishes	
4	Poultry	
5	Others	
Total		

(B) Non-Agriculture

Sl. No.	Sources of income	Amount(Tk.)
1	Service	
2	Business	
3	Laboring	
4	Others	
Total		

Grand Total = A+B = ……Tk.

7. **Agricultural Training :**

Did you participate in any agricultural training program? .....Yes…….No

If yes, then please give the following information

Sl. No.	Name of the training courses	Duration of training(days)
1		
2		
3		
Total		

8. Agricultural Knowledge : Please answer the following questions

Sl. No.	Question	Marks	
		Total marks	Obtained marks
1	Mention the name of two high yielding varieties (HYV) of Boro rice	2	
2	Mention the name of two chemical fertilizers	2	
3	Mention the name of two harmful insects of crops	2	
4	Mention the name of two beneficial insects of crops	2	
5	Mention the name of two timber crops	2	
6	Mention the name of two insecticides	2	
7	Mention the name of two varieties of fruit	2	
8	Mention the name of two agricultural programmes broadcasted on TV	2	
9	Mention the name of two practices suitable for rodent killing/management	2	
10	Mention the name of two diseases of poultry	2	
11	Mention the name of two diseases of cattle	2	
Total		**22**	

9. Organizational Participation : Please mention the extent of participation in the following institutions

Sl. No.	Name of the Institution	Extent of Participation (Years)			
		Executive Officer	Executive Committee Member	Ordinary Member	No Participation
1	Farmers' Co-operative Society				
2	NGOs				
3	Village Club/IPM club				
4	Mosque/Bazar Committee				

10. Innovativeness: Please indicate the level of frequency of using of the following technologies:

Sl. No.	Name of the technology	Degree of Innovativeness				
		Within 1 year of hearing	Within >1-2 years of hearing	Within >2-3 years of hearing	After 3 years of hearing	Never Used
1	Use of Bio fertilizer					
2	Use of leaf color chart					
3	Use of perching in the field					
4	Use of tractor, power tiller and combine hervester					
5	Use of seed treatment with agrosan					
6	Use of bamboo booster in the rice field					
7	Use of plant extract(Neem oil)					
8	Use of light trap for insect control					
9	Artificial pollination					
10	Use of sex pheromone					
11	Collection and destroy of eggs and larvae of insects(Manual)					
12	Use of super granular urea and mixed fertilizer					
13	Use of sweeping net					
14	Use of hybrid rice variety					
15	Use of balanced fertilizer and vermicompost					

11. Cosmopoliteness: Please mention your frequency of visits to the following places:

Sl. No.	Places of visit	Frequency of visit				
		Regularly (4)	Often (3)	Occasionally (2)	Rarely (1)	Not at all (0)
1	Visit to other villages	≥7 times/ month	5-6 times/ month	3-4 times/ month	1-2 times/ month	0 times/ month
2	Visit to other union	≥7 times/ month	5-6 times/ month	3-4 times/ month	1-2 times/ month	0 times/ month
3	Visit to own upazila sadar	≥7 times/ month	5-6 times/ month	2-3 times/ month	1 times/ month	0 times/ month
4	Visit to other upazila sadar	≥4 times/ year	3 times/ year	2 times/ year	1 times/ year	0 times/ year
5	Visit to own district town	≥5 times/ year	4 times/ year	2-3 times/ year	1 times/ year	0 times/ year
6	Visit to other district town	≥4 times/ year	3 times/ year	2 times/ year	1 times/ year	0 times/ year
7	Visit to capital city (Dhaka)	≥4 times/ year	3 times/ year	2 times/ year	1 times/ year	0 times/ year

12. Problems faced in using ICT in agriculture: Please indicate the extent of problems you face in using ICT media in agriculture

Sl. No.	Problems	Extent of Problem				
		Very high (4)	High (3)	Medium (2)	Low (1)	Not at all (0)
1	Lack of formal training regarding use of ICT media					
2	Lack of awareness regarding the benefit of using ICT media in agriculture.					
3	Inadequate agricultural programmes of the radio and television.					
4	High cost of computer, radio, television, mobile phone, internet and agricultural services of the non-government mobile phone companies.					
5	Lack of adequate digital service centres for providing ICT facilities.					
6	The ICT media are difficult to use.					
7	Lack of enough time to spend on ICT media.					
8	Lack of necessary electricity facilities for using ICT					
9	Low speed internet facilities.					
10	Illiteracy					
11	Lack of confidence in operating ICTs					
12	Lack of knowledge in handling modern communication tools					

13. Use of ICT Media in Agriculture :

Sl. No.	Name of ICT Media	Extent of Use				
		Use regularly (4)	Use most often (3)	Use occasion ally (2)	Use rarely (1)	Do not use at all (0)
1	Radio agricultural programmes	1 time in a day or above (4)	1-6 times in a week (3)	1-3 times in a month (2)	1-11 times in a year (1)	Do not use at all (0)
2	TV agricultural programmes	1 time in a day or above (4)	1-6 times in a week (3)	1-3 times in a month (2)	1-11 times in a year (1)	Do not use at all (0)
3	Mobile phone/ smart phone	1 time in a day or above (4)	1-6 times in a week (3)	1-3 times in a month (2)	1-11 times in a year (1)	Do not use at all (0)
4	Computer/Internet	1 time in a day or above (4)	1-6 times in a week (3)	1-3 times in a month (2)	1-11 times in a year (1)	Do not use at all (0)
5	Krishi Call Center/ Farmers Help Line	1 time in a day or above (4)	1-6 times in a week (3)	1-3 times in a month (2)	1-11 times in a year (1)	Do not use at all (0)
6	Agricultural assistance services of mobile phone companies (Banglalink Krishi Jigyasha/ Banglalink Krishibazaar/ Grameenphone Krishi Taththya Sheba / Robi Haat-Bazaar)	1 time in a day or above (4)	1-6 times in a week (3)	1-3 times in a month (2)	1-11 times in a year (1)	Do not use at all (0)

Thank you for your kind cooperation

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Signature of the interviewer & date

APPENDIX-B

CORRELATION CO-EFFICIENT MATRIX OF THE INDEPENDENT AND DEPENDENT VARIABLES

Variable	X1	X2	X3	X4	X5	X6	X7	X8	X9	X10	X11	X12	X13
X1	1												
X2	-0.449**	1											
X3	0.081^{NS}	-0.066 ^{NS}	1										
X4	-0.149 ^{NS}	0.216*	-0.110^{NS}	1									
X5	0.866**	-0.609**	0.133^{NS}	-0.196*	1								
X6	-0.040 ^{NS}	0.391**	0.125^{NS}	0.192*	-0.158^{NS}	1							
X7	-0.025 ^{NS}	-0.035 ^{NS}	-0.109^{NS}	0.206*	0.006^{NS}	-0.03 ^{NS}	1						
X8	-0.369**	0.542**	0.019^{NS}	0.190*	-0.503**	0.426**	0.067^{NS}	1					
X9	0.001 ^{NS}	0.024 ^{NS}	0.069^{NS}	0.163^{NS}	0.028^{NS}	0.039^{NS}	0.333**	0.09^{NS}	1				
X10	-0.554**	0.463**	0.005^{NS}	0.309**	-0.587**	0.040^{NS}	0.026^{NS}	0.303**	0.111 ^{NS}	1			
X11	-0.350**	0.354**	-0.147^{NS}	0.382**	-0.374**	-0.037^{NS}	-0.063^{NS}	0.105^{NS}	-0.010^{NS}	0.516**	1		
X12	0.578**	-0.686**	0.045^{NS}	-0.090^{NS}	0.693**	-0.294**	-0.132^{NS}	-0.537**	0.023^{NS}	-0.438**	-0.16 ^{NS}	1	
X13	-0.525**	0.573**	0.091^{NS}	0.020^{NS}	-0.608**	0.201*	0.004^{NS}	0.444**	0.045^{NS}	0.573**	0.297**	-0.613**	1

NS = Non Significant
**. Correlation is significant at the 0.01 level (2-tailed).
*. Correlation is significant at the 0.05 level (2-tailed).

X1 = Age
X2 = Education
X3 = Family size
X4 = Farm size
X5 = Farming experience
X6 = Annual family income
X7 = Agricultural training
X8 = Agricultural knowledge
X9 = Organizational participation
X10 = Innovativeness
X11 = Cosmopoliteness
X12 = Problems Faced in Using ICT Media in Agriculture
X13 = Use of ICT Media in Agriculture