EMPOWERING FARMERS THROUGH e-AGRICULTURE

SHEIKH MOHAMMED MAMUR RASHID

DEPARTMENT OF

AGRICULTURAL EXTENSION & INFORMATION SYSTEM

SHER-E-BANGLA AGRICULTURAL UNIVERSITY

SHER-E-BANGLA NAGAR, DHAKA-1207.

DECEMBER, 2014

EMPOWERING FARMERS THROUGH e-AGRICULTURE

BY

SHEIKH MOHAMMED MAMUR RASHID

REGISTRATION NO. : 08-03060

A Thesis

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 (MS)

IN

AGRICULTURAL EXTENSION

SEMESTER: JULY - DECEMBER, 2014

Approved by

…….…….……..……

(Prof. M. Zahidul Haque)
Supervisor

……..……..……

(Prof. Dr. Md. Rafiquel Islam)
Co-Supervisor

……

(Dr. Mohummed Shofi Ullah Mazumder)
Assoc. Prof. & Chairman
Department of Agricultural Extension & Information System
Sher-e-Bangla Agricultural University, Dhaka

Department of Agricultural Extension and Information System

Sher-Bangla Agricultural University

Sher-e-Bangla Nagar, Dhaka-1207, Bangladesh.

Memo No.:SAU/AEIS Date:

CERTIFICATE

This is to certify that the thesis entitled, **"EMPOWERING FARMERS THROUGH e-AGRICULTURE"** 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 (MS) in Agricultural Extension,** embodies the result of a piece of bonafide research work carried out by **Sheikh Mohammed Mamur Rashid**, Registration No. 08-03060, under my supervision and guidance. No part of this thesis has been submitted for any other degree or diploma.

I further certify that any help or sources of information, as has been availed of during the course of investigation have been duly acknowledged.

Dated: December, 2014
Dhaka, Bangladesh

.....
(Prof. M. Zahidul Haque)
Supervisor
Dept. of Agricultural Extension and Info. System
Sher-e-Bangla Agricultural University
Sher-e-Bangla Nagar, Dhaka-1207.

Telephone: +88-02-9144270-8, Fax: +88-02-8155800, E-mail: prof_haque@hotmail.com

DEDICATION

DEDICATED TO

THIS THESIS IS LOVINGLY DEDICATED TO MY PARENTS AND RESPECTED TEACHERS FOR THEIR ENDLESS SUPPORTS, ENCOURAGEMENT THROUGHOUT MY LIFE.

ACKNOWLEDGEMENTS

All praises, thanks and gratitude are due to the Supreme Ruler of the Universe, the Almighty Allah for His grace bestowed upon the author for accomplishing this research study. With boundless love and appreciation, the researcher would like to extend his heartfelt gratitude and appreciation to all who helped him bring this study into reality.

In particular, the researcher takes the opportunity to express thanks to his respectable supervisor ***Prof. M. Zahidul Haque****,* Department of Agricultural Extension & Information System, Sher-e-Bangla Agricultural University, for his noble guidance, constructive criticism, constant stimulation and encouragement thorough supervision during the course of preparation of this thesis, without which this work would not have been possible. For his unwavering support, I am truly grateful. His insight and practical skill have left a distinct mark on this work.

The researcher also wishes to express sincere appreciation and heartfelt gratitude to his co-supervisor ***Prof. Dr. Md. Rafiquel Islam,*** Department of Agricultural Extension & Information System, Sher-e-Bangla Agricultural University, for his valuable suggestions, constant cooperation, inspirations and sincere advice to improve the quality of the thesis throughout the period of this research program.

The researcher takes an opportunity to express his boundless gratitude and heartfelt thanks to ***Dr. Mohummed Shofi Ullah Mazumder***, Assoc. Prof. & Chairman, Department of Agricultural Extension & Information System, Sher-e-Bangla Agricultural University, for his cognitive suggestions, unprecedented co-operation and inspiration throughout the course of this research work. The researcher likes to express cordial thanks, appreciation to all the respected teachers especially ***Prof. Dr. Md. Sekender Ali*** *and****Kh. Zulfikar Hossain, Assist. Prof.***, Department of Agricultural Extension & Information System, Sher-e-Bangla Agricultural University.

Heartfelt thanks and appreciations are also expressed to the Upazila Agriculture Officer and SAAO of Manikganj Sadar Upazila in the study area for their benevolent help and cooperation in data collection period. The researcher is especially grateful to all the respondents in the study area for their cooperation and help in accomplishing the objectives of this research work.

The researcher expresses heartfelt thanks and sincere appreciations to all other teachers of Sher-e-Bangla Agricultural University for their help and encouragement. Last but not the least, the author expresses his immense indebtedness, deepest senses of gratitude to his beloved mother, elder brother and sisters who sacrificed all their happiness during the whole study period especially during his MS study. Many thanks to my nephew ***Md. Rezwan Islam, BBA (Finance), Dhaka University*** for his assistance and dedication during the research work. Finally the wishes, heartfelt thanks and gratitude to extend to all his relatives, well-wishers especially friends for their inspiration, blessing, cooperation and encouragement in all phases of this academic pursuit from the very beginning to the end.

December, 2014 **The Researcher**

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ABBREVIATION AND GLOSSARY

Abbreviation	Acronyms
AIS	=Agriculture Information Service
Ag.Ext.Ed.	=Agricultural Extension Education
Ag.Ext. and Info. Sys.	=Agricultural Extension and Information System
ABD	=Asian Development Bank
BBS	=Bangladesh Bureau of Statistics
BIID	=Bangladesh Institute of Information Development
CG	= Control Group
CMD	= Changed Mean Difference
CMS	= Changed Mean Score
DAE	=Department of Agriculture Extension
ECI	= Empowerment Condition Index
et.al	=All Others
FAO	=Food and Agriculture Organization
MoA	=Ministry of Agriculture
ICT	=Information and Communication Technology
p.	=Page
SG	= Study Group
UNDP	=United Nations Development Program

EMPOWERING FARMERS THROUGH e-AGRICULTURE

ABSTRACT

Empowerment is being the utmost desire for the sustainable development all over the world. The research was designed to investigate the impact of e-Agriculture on empowerment stratified as economic, family and social, political, knowledge and psychological empowerment. The methodology of this study is an integration of quantitative and qualitative methods based on data collection in Bhatbour Block of Dhighi union under Sadar Upazila of Minikganj District. Data were collected from 133 e-Agriculture users and 45 controls from September 10 to October 25, 2015. Descriptive statistics, t-test, Multiple regression (B) were used for analysis. Most of the farmers (53.4 percent) gained low empowerment through e-Agriculture, while 46.6 percent of them had medium empowerment. None of the farmers were highly empowered. Among the influential variables- farm size, usages of e-Agriculture, attitude towards e-Agriculture, organizational participation, cosmopoliteness and availability of e-Agriculture were positively significant and provided 88.4 percent contribution on empowerment.

Key words: e-Agriculture, empowerment;

Chapter 1

INTRODUCTION

1.1. General background

In Bangladesh, the agricultural sector is one of the main contributors to the national GDP. An amount of 15.95 %(including fisheries) of the total GDP in the fiscal year 2014-2015 of our country has come from the agricultural sector (BER, 2015). But, most of the farmers of Bangladesh are still in lack of modern agricultural knowledge and information. 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 activities as well as e-Agriculture.

In the 70th assembly of the United Nations (UN, 2015) has adopted Development Agenda titled "Transforming our world: the 2030 Agenda for Sustainable Development" a set of global goals to end poverty**,** protect the planet**,** and ensure prosperity for all as part of a new sustainable development agenda. Each goal has specific targets to be achieved over the next 15 years. The first two agenda are "End poverty in all its forms everywhere" and "End hunger, achieve food security and improved nutrition and promote sustainable agriculture" respectively. To fulfill the requirements of the top two agenda, it is required to focus on the agricultural development. There is also the necessity to take action for the empowerment of the farmers. These globally recognized agenda can be achieved by one of the ways in practicing the modern agricultural production technologies. The farm people can be easily adopted the modern technologies by the service of e-Agriculture.e-Agriculture also plays a very important role for uplifting the socio-economic condition and empowering

farmers (Adhau, 2010). Increased productivity, higher income, better food consumption and participation in development activities aresome of the major pre-requisites for the overall economic development of Bangladesh. Most of the technology service providers are working to meet up the above requirements as the pre-requisites for socio-economic development of Bangladesh.e-Agriculture is not only a concept but it has a lot to offer, to leverage from the use of latest ICTs for the overall growth of agriculture domain. e-Agriculture is a global initiative to enhance sustainable agricultural development and food security by improving the use of information, communication and associated technologies in the related sector. The overall aim is to enable members to exchange opinions, experiences, good practices and resources related to e-agriculture, and to ensure that the knowledge created is effectively shared and used local, regional, national and international level.In 2005, the Food and Agriculture Organization (FAO, 2005) of the United Nations described the e-Agriculture as an emerging field in the intersection of agricultural informatics, agricultural development, and entrepreneurship, referring to agricultural services, technology dissemination, and information delivered or enhanced through the Internet and related technologies. More specifically, it involves the conceptualization, design, development, evaluation and application of new (innovative) ways to use existing or emerging information and communication technologies (ICTs). e-Agriculture goes beyond technology, to promote the integration of technology with multimedia, knowledge and culture, with the aim to improve communication and learning processes between various actors in agriculture locally, regionally and worldwide. Facilitation, support of standards and norms, technical support, capacity building, education, and extension are all key components to e-Agriculture.

There are several types of activity related to e-Agriculture applications that are recognized around the world today. The delivery of agricultural information and knowledge services (i.e. market prices, extension services, etc.) using the internet and related technologies falls under the definition of e-Agriculture. More advanced applications of e-Agriculture in farming exist in the use of sophisticated ICTs such as satellite systems, Global Positioning Systems (GPS), advanced computers and electronic systems to improve the quantity and quality of production.

Bangladesh has stepped into the new era of Digital World with a spectacular vision for making Digital Bangladesh. This vision would be saddled by e-Agriculture involving multidisciplinary initiatives of Agricultural Informatics, Agricultural Development, and Entrepreneurship towards building a hunger-free, efficient and resourceful Bangladesh. The history of ICT use in Bangladesh Agriculture is not so rich. In 2003, the Ministry of Agriculture (MoA) launched ICT taskforce program. It would be the first initiative to set up an Agricultural Information network. D.Net (2005) developed an idea of "Pallitathaya Help Centre" to promote the e-Agriculture.

Access to information and communication technology is an important mechanism for the farmers both men and women to improve the socio-economic condition and their standard of living. In Bangladesh, BIID (2015) has launched an e-Agriculture initiative known as "e-Krishok" has been using information and communication technologies (ICT) to deliver information and advisory services to farmers in rural and remote locations at a cost they can afford. The researcher took an effort to reveal how the farmers could uplift their socio-economic condition being in the vicinity of technologies service. 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 and the e-Agriculture.

The researcher intended to take an attempt to realize how the empowering farmers could uplift their socio-economic condition being in the vicinity of e-Agriculture. Appreciating and analyzing the aforesaid conditions the researcher has become interested in undertaking a research entitled, "Empowering farmers through e-Agriculture"

1.2. Statement of the problem

There are about 20,000 farmers' clubs around the country, working for the welfare of farmers (Alam, 2015). The Integrated Pest/Crop Management Clubs (DANINDA), Special Program Food Security Clubs (FAO), Farmers Information and Advice Centers (World Bank) are to name a few. The latest trend towards Union-Parishad based 4547 Union Digital Centers by USAID and UNDP, community-based Agriculture Information and Communication Center (AICC) by AIS a warehouse or cooking house of agricultural Information on behalf of Ministry of Agriculture sheds a new light into the conventional information delivery mechanism in the form of e-Agriculture. Availability and usages of need-based agricultural information promote the farmers' livelihood and subsequently improves their empowerment. In this regard, the answers to the following questions were supposed to be very much pertinent:

i. Is there really any change in socio-economic condition and empowerment of farmers after receiving the service from e-Agriculture?
ii. What are the personal characteristics of farmers?
iii. Is there any contribution of e-Agriculture on economic, political, social, knowledge, psychological empowerment of farmers?
iv. What contribution does exist of the selected characteristics of farmers to empower them through e-Agriculture?

The above-mentioned questions obviously inspired the researcher for conducting the present research entitled “Empowering farmers through e-Agriculture”.

1.3. Specific objectives of the study

The focal point of the research work was to explore the trends of empowering farmers through e-Agriculture. This is why the following objectives were framed out in order to provide an appropriate track to the research work:

1. To assess the extent of empowerment of farmers through e-Agriculture;
2. To determine and describe the selected socio-economic characteristics of farmers:
   - Age
   - Education
   - Farm size
   - Usages of e-Agriculture
   - Attitude towards e-Agriculture
   - Organizational participation
   - Cosmopoliteness
   - Availability of e-Agriculture;
3. To estimate the level of contribution of the selected characteristics of farmers in empowering them through e-Agriculture;

1.4. Scope or rationale of the study

i. The present study was designed to have an understanding of empowerment of farmers through e-Agriculture and to explore its relationship with their selected characteristics.

ii. The findings of the study will, in particular, be applicable to the study area at Bhatbour block under SadarUpazila of Manikganjdistrict. The findings

may also be applicable to other areas of Bangladesh where socio-cultural, psychological and economic status do not differ much than those of the study areas.

iii. The findings of the study may also be helpful to the field worker of extension service to improve their action strategies for empowering farmers.

iv. 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 as well as empowering of the farmers. The findings might also be helpful to the planners and policy makers, extension workers and beneficiaries of the ICTs service.

v. To the academicians, it may help in the further conceptualization of the systems model for analyzing the empowerment of farmers. In addition, the findings of this study may have other empirical evidence to all aspects of empowerment of farmers which may be used to build an adequate theory of empowerment.

1.5. Justification of the study

The Digital Bangladesh vision would achieve the target by e-Agriculture involving multidisciplinary initiatives of agricultural informatics, Agricultural development, and entrepreneurship towards building a golden Bangladesh. e-Agriculture is not only a concept but it has a lot to offer, to leverage from the use of latest ICTs for the overall growth of agriculture domain. The overall aim is to enable members to exchange opinions, experiences, good practices and resources related to e-agriculture, and to ensure that the knowledge created is effectively shared and used local, regional, national and worldwide. Some important steps have already been taken by both government and private entities. e-Agriculture pioneer in Bangladesh are D-Net (Development Research Network), WIN, Banglalink, Grameenphone, BIID (Bangladesh

Institute of ICT for Development), Practical Action under BTN (Bangladesh Tele-Network), IRRI, YPSA, Ahsania Mission. From the government side, AIS and some other organizations are doing in the same way. The e-Agriculture services at the root level provided by the mentioned ones and to ensure farmers empowerment.

Only a few researches have so far been conducted in Bangladesh on farmers' empowerment. From the extension and overall national development point of view, a research study on empowerment of farmers is important to understand and to get schematic knowledge about farmers' position in this society. The researcher intended to make an attempt to realize how the empowerment of farmers could uplift their socio-economic condition being in the vicinity of e-Agriculture. The researcher also aimed to know present impression of e-Agriculture by the farmers. Therefore the study "Empowering farmers through e-Agriculture" has been undertaken.

1.6. Assumptions of the study

An assumption is the supposition that an apparent fact or principle is true in the light of available evidence (Goode and Hatt, 1952).

The researcher had considered the following assumptions while undertaking the study:

i. The respondents were capable of furnishing proper responses to the questions contained in the interview schedule.

ii. The data collected by the researcher were free from bias and they were normally distributed.

iii. The responses provided by the respondents were valid and reliable.

iv. Information sought by the researcher revealed the real situation and was the representative of the whole population of the study area to satisfy the objectives of the study.

v. The researcher was well adjusted to himself with the social environment of the study area. Hence, the collected data from the respondents were free from interviewer's bias.

vi. The selected characteristics and the empowerment of the farmers of the study were normally and independently distributed with respective means and standard deviation.

1.7. Limitations of the study

Considering the time, respondents, communication facilities and other necessary resources available to the researcher and to make the study manageable and meaningful, it became necessary to impose certain limitations as mentioned bellow-

- The study was confined to one block calledBhatbour under SadarUpazila of Manikganj district.
- It is difficult to get accurate information regarding empowering indicator from the respondents as many of them are illiterate.
- Characteristics of the farmers were many and varied, but only eight characteristics were selected for the research work.
- The researcher was a male person and the respondents were both males and females. The researcher had to manage proper rapport with the respondents to collect maximum accurate information.

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 major objectives of the study. Attempts have been made in this chapter to review that finding of past researches having relevance to the present study. But unfortunately, very few studies have been obtained which were directly related with farmers' empowerment in general or which explain the factors that influence the farmers' empowerment through e-Agriculture. The researcher, therefore, made exhaustive effort to review the previous research works directly or indirectly related to the present study by different researcher in home and abroad. However, many studies could be found on agricultural problem confrontation and uses of e-technology research, the result of which were indirectly related to the present study, and also which focuses general behavior pattern of the farmers and their overall survive strategies.

This chapter comprises with four sections. The concepts of empowerment have been presented in the first section. As certain fundamental, general observations on e-Agriculture using and its relation to empowerment of farmers are presented in second and third section. At last conceptual model of the study is presented in the last sections of the study.

2.1. Dimensions of empowerment proposed by selected authors

Mazumder, M.S.U. & Lu Wencong (2015)	Economic empowerment
	Family and social empowerment
	Political empowerment
Sendilkumar, R. (2012)	Knowledge empowerment
	Economic empowerment
	Social empowerment
	Political empowerment
	Psychological empowerment
	Creativity empowerment
Kishor (2000)	Financial autonomy
	Participation in modern sector
Lifetime exposure to employment	
Sharing of roles and decision-making	
Family structure amenable to Empowerment	
Equality in marriage (lack of)	
Devaluation of women	
Women's emancipation	
Marital advantage	
Traditional mirage	

Sen (1999)	Absence of gender inequality ill
	Mortality rates
	Natality rates
	Access to basic facilities such as schooling
	Access to professional training and higher education
	Property ownership
	Household work and decision-making
Schuler et al. (1997)	Ability to interact effectively in the public sphere
	Participation in non-family groups
CIDA(1996)	Legal empowerment
Political empowerment	
Economicempowerment	
Social empowerment	
Hashemi et al. (1996)	Economic security
Jejeebhoy (1995)	Knowledge autonomy
	Decision-making autonomy
	Physical autonomy
	Emotional autonomy
	Economic and social autonomy and self-reliance
Stromquist (1996)	Cognitive
	Psychology
	Economic
	Political

2.2. Review related to concept of empowerment

World Bank (2011) described as “Empowerment is a process of change by which individuals or groups gain the power and ability to take control of their lives”

Malhotra *et al.* (2002) defined the empowerment as “Empowerment’ is therefore a multi-dimensional concept that encompasses economic, socio-cultural, familial/interpersonal, legal, political and psychological aspects”.

Matthew (2014) described as Economic empowerment requires access to, and control over, productive resources and some degree of financial autonomy. Social empowerment is defined by the individual’s importance in family and society, andshould enable him/her to make use of available resources. The political element includes the capability to analyze, organize and mobilize the environment for social transformation.

Bradley *et.al* (1999) defined empowerment is a collective undertaking, involving both individual and collective action.

Kulandavel (2005) stated as Empowerment is a way of defining, challenging and overcoming barriers of one’s life through which people increase their ability to shape their own lives and environment. Empowerment is a multidimensional process which enables individual or a group of individuals to realize their full identity and powers in all spheres of life. Empowerment consists of greater access to knowledge and resources, greater autonomy in decision making to enable them to have greater ability to plan their lives and free from shocks imposed on them by custom, belief and practices.

Mathew (2005) described as Empowerment can be conceived as a process that people undergo, which eventually leads to change. Empowerment as a process to change the distribution of power both in interpersonal relations and in

institutions throughout society or a process of acquiring providing, bestowing the resources and the means enabling the accesses to control over such means and resources.

Bennett (2002) defined as “Empowerment is the enhancement of assets and capabilities of diverse individual and group to engage, influence and hold accountable the institutions which after them”.

Annonuevo (1997) stated that Empowerment is the process- and the result of process- whereby the powerless or less powerful numbers of the society gain access and control over material and knowledge resources, challenge the ideologies of discrimination and subordination and transform the institutions and structures through which unequal access and control over resources is situated and perpetuated.

Stromquist (1996) stated that Empowerment is the process to change distribution of power, both in interpersonal relationships and institutions throughout society.

Karl (1995) defined as “Empowerment is a process of awareness and capacity building, leading to greater decision-making power and control and to transformative action”.

Batliwala (1994) expressed as Empowerment is the process of challenging existing power relations and of gaining greater control over the sources of power.

Moin (2008) described that Empowerment refers to increasing the spiritual, political, social or economic strength of individuals and communities. It often involves the empowered developing confidence in their own capacities.

Thus, Empowerment refers to enhance the economic, political, social or psychological development of an individual or communities in relation to improving the living status.

2.3. Review related to concept of e-Agriculture

This section describes the context of e-agriculture in Bangladesh and specifically in subcontinent. To understand what e-agriculture is, knowledge of information communication technology is important. Hence the presentation reviews of ICT, e-Services & e-Agriculture.

2.3.1. e-Agriculture

The term e-Agriculture is widely used by many individuals,academic institutions, professional bodies, and fundingorganizations. E-agriculture offers the rich potential ofsupplementing traditional delivery of services and channelsof communication in ways that extend the agricultureorganization's ability to meet the needs of its farmers.

According to Meera&Jhamtani (2004), e-Agriculture describes an emerging field focused on the enhancement of agricultural and rural development through improved information and communication processes. More specifically,e-Agriculture involves the conceptualization, design, development, evaluation and application of innovative ways to use information and communication technologies (ICTs) in the rural domain, with a primary focus on agriculture. It is a recent term that was coined by United Nations to embrace all Information communication technologies that supports agriculture.

In fact, Food and Agriculture Organization (FAO, 2006) of the United Nations conducted a survey in 2006 on the usage of the term e-Agriculture. The study found that half of those who replied identified “e-Agriculture” with information dissemination, access and exchange, communication and participation processes improvements around development. In contrast, less than a third highlighted the importance of technical hardware and technological tools.

Adhau (2010) explained that e-Agriculture is today affecting all the spheres of human life. It can exploit these advances to design a cost effective system to

provide expert advice to the farmers. Here, it explains some of the advances in e-Agriculture that can be used to build proposed system.

- During the last three decades database and data warehousing technology had been developed which can be used to store and retrieve large amounts of data efficiently at affordable cost. Mobile phones can be used by farmers to get access to this data on the prices of different products in different town and which varieties of crops to produce.

- Also, due to advances in networking technology we have Internet technology (or World Wide Web), which can be used to send information instantaneously to farming community in parallel.

- The data mining techniques can be used to extract the possible meaningful patterns for a large amount of data that could give potential useful advice depending on the situation. Also, modelling and simulation technology can be used to model an ideal crop situation and predict the crop growth through extrapolation and other techniques by considering a specific crop environment.

Inklaar*et al.* (2005) noted that with the advent of modern information technology revolution (mainly the database and web technology), it is possible to provide latest expert advice in a timely manner to the farmer and thereby reduce the effect of the factors that disturb the crop. By exploiting the advances in information technology especially e-Agriculture, we can enable the agriculture assistance to get the status of the crop in a cost effective manner. An architecture that depicts the use of e-Agriculture can be modeled based on the database available for different products and dissemination of this information to the farmer. Due to the low cost and availability of mobile phones, farmers will use this ICT tools to get the data required.

According to Brynjolfsson (2009), FAO hosted the first e-Agriculture workshop in June 2006, bringing together representatives of leading development organizations involved in agriculture. The meeting served to

initiate development of an effective process to engage as wide a range of stakeholders involved in e-Agriculture, and resulted in the formation of an e-Agriculture Community of Practice Founding Group. Members include: Consultative Group on International Agricultural Research (CGIAR); Technical Centre for Agriculture and Rural Development (CTA); UN Department of Economic and Social Affairs (DESA); FAO; Gesellschaft fur TechnischeZusammenarbeit (GTZ); Global Forum on Agricultural Research (GFAR); Inter-American Institute for Cooperation on Agriculture (IICA); International Association of Agricultural Information Specialists (IAALD); International Centre for Communication for Development (IICD); International Fund for Agricultural Development (IFAD); International Telecommunications Union (ITU) and World Bank Countries that have embraced e-Agriculture have had their economies improve and food security promoted.

A study conducted by Adhau (2010) found that India's agricultural sector economy grew by 3 percent after the government encouraged farmers to embrace e-agriculture. In Kenya, the government has no policy towards the implementation of e-agriculture even though the use of ICT tools especially mobile phones has continued to grow at an exponential rate.

CCK (2010) report noted that in 1999, just 3 percent of Kenyans owned a phone of any sort; today, the figure is 93 percent. The use of mobile phones is ubiquitous in urban areas and commonplace even in remote parts of the country, generating all the obvious benefits. It is the intention of this study to assess the awareness and adoption of e-agriculture in Trans Nzoia County with a view to advising various stakeholders and the government on how best they can utilize ICT tools in promoting food security in the country. The study also highlighted the major challenges faced by farmers in using e-Agriculture to promote agribusiness in TransNzoia County.

Peter Namisiko, P. and Aballo M. (2013) found out the following results of e-Agriculture:

- Majority of farmers within Trans Nzoia County were aware that mobile phones can be used to conduct businesses. The study found out that 80% of farmers have access to mobile phones which they can use to conduct business through Safaricom MPESA platform.
- Few farmers within TransNzoia County have conceptualized the use of e-Agriculture within Trans Nzoia County. The study asked respondents whether they have operationalized e-agriculture in conducting agricultural activities. This study found out that 32% of farmers within Trans Nzoia County have used mobile phones to conduct agricultural activities. The pie- chart below shows the results obtained from the survey.
- Majority of farmers within Trans Nzoia County have not operationalized e-Agriculture because of lack of awareness. The study asked why farmers in have not implemented e-Agriculture. The study found out that 63% of farmers have not implemented e-Agriculture because they were unaware.

2.3.2. e-Services

Lofstedt (2005) stated the e-service as "The concept of e-service (short for electronic service) represents one prominent application of utilizing the use of Information and Communication Technology (ICT) in different areas. However, providing an exact definition of eservice is hard to come by as researchers have been using different definitions to describe e-service. Despite these different definitions, it can be argued that they all agree about the role of technology in facilitating the delivery of services which make them more of electronic services".

According to Rowley (2006) e-services as: “deeds, efforts or performances whose delivery is mediated by information technology. Such e-service includes the service element of e-tailing, customer support, and service delivery”.

Jeong (2007) defined as “e-Service constitutes the online services available on the Internet, whereby a valid transaction of buying and selling (procurement) is possible, as opposed to the traditional websites, whereby only descriptive information are available, and no online transaction is made possible”

According to Goldkuhl, G &Persson, A. (2006), e-service means that an external user (a citizen) interacts through a user interface of a public IT system based on web technology.

2.3.3. Information Communication Technology

According to Pretty *et al.* (2002) information Communication Technology refers to a set of tools that can be used to collect, disseminate, store and disseminate information for decision making.

Pretty *et al.* (2002) defined the term ICT in terms of information collection, storage, dissemination and processing, it does not indicate the ICT tools.

A can be obtained from, Dewan& Kraemer (2000) defined more profound definition of ICT as a collection of hardware, software, telecommunication networks, people, data and procedures that can aid in data collection, processing, storage and dissemination of information.

Unwin (2009) argued that due to vast change in ICT technology, ICT based developments provide new opportunities to improve the utilization and performance of livelihood technologies such as agriculture, education, library, health and medical services, and artesian technologies. The research challenge here is to identify the areas where progress in ICT could be used to improve the performance of these services and technologies, and build cost effective ICT based systems that improve the living standards of rural people.

Fiedler *et al.* (2009) noted that India's food production has improved significantly during last three decades due to all-round efforts such as modernizing Indian agriculture, providing it with modern inputs like improved seeds, fertilizers and pesticides etc, application of modern tools and farm equipment etc.

2.4. An overview of earlier initiatives for providing e-Agriculture services in Bangladesh

Providing of information by using ICT equipment is no more confined in the town people rather it has been regarded as an important tool for developing the rural areas and brings the rural people with the mainstream of development. It is an initiative to reach the government services to the rural people instantly by using the ICT equipment.

2.4.1.The Dhaka Ahsania Mission (DAM)

In 1987, Dhaka Ahsania Mission (DAM), first started the community-learning centre most commonly known as Gonokendracenter which is similar to UISC. Some of the community learning centers were providing different types of ICT facilities by using computers throughout the country. (DAM,2015)

2.4.2. Development Research Network (D.Net)

It is a research organization which was established in 2001.It is seen that this organization established 4 (four) Pallitathaya Kendra which are similar to Union Information and Services Center(UISC) at the rural areas throughout the country in 2005 as a part of pilot project in Nilphamri, Netrokona, Noakhali and Bagerhat. (D.Net, 2015)

2.4.3.Katalyst (2015)

It is an initiative to provide the ICT facilities at the rural areas of Bangladesh. Katalyst started to work in partnership with two renowned private sectors namely Alokito Gram and GHAT in order to extend the ICT facilities through establishing the Rural ICT Center (RIC) at the community level of Bangladesh (http://www.katalystbd.com)

2.4.4. Community Development Library (CDL)

CPDL was founded to satisfy the necessity of information needs of development organizations and rural community people of Bangladesh .It is such an organization which was established to exchange the information, to process different types of development information. To mitigate the information thirst of rural community people, this library has established another 26, RIRC (Rural Information Resource Centers) throughout the country. These RIRCs serve as forums for women and youth, children's corner, awareness-building, knowledge and information sharing facilities (Islam & Islam, 2008).

2.4.5.Grameen phone community information center

Grameen Phone (GP) is one of the pioneer organizations for providing community information in Bangladesh. This organization took a pilot project in 2006 namely “Community Information Center” to provide Internet access and some other services among the rural people. CIC provides greater access to news and information about the daily lives and development of the citizens of Bangladesh on a range of topics relevant to their daily lives and developments. (GPCIC, 2015).

2.4.6. Community information services offered by govt. organizations

The three important ministries of Bangladesh namely Ministry of Information and Communication Technology, Ministry of Education and Ministry of Cultural Affairs provide various information among the people through ministry (Islam & Islam, 2008).

2.4.7. Practical Action Bangladesh

It was established in 1966 with a view to reducing poverty. Afterwards it founded two another Rural Technology Centers (RTC) in 2006.Moreover, a good number of steps have been taken to reach the ICT facilities at the door-steps of rural people by the following organizations namely Telecentre Network (BTN), Amader Gram Learning Center (AGLC),Youth Community Multimedia Center (YCMC), Rural Information Resource Center (RIRC), Bangladesh NGOs Network for Radio and Communication (BNNRC), BRAC Bdmail Network Ltd (brac Net), Digital Equality Network (DEN), Digital Knowledge Foundation (DKF) and so on. These organizations worked like the union information and services centers (Islam & Islam, 2008).

2.4.8. SRDI SOLARIS data interpreter

The Soil and Land Resource Information System (SOLARIS) is a data repository that was developed by CEGIS and later modified by SRDI. This 2GB database stores soil data using primary information from UpazilaNirdeshika from 460 districts. A customized GIS software SOLARIS-GIS maps soil data based on classification(Soil Texture, Landtype, Landform, Drainage, Slope, Surface Water Recession) and condition (Crop Suitability, Land Zoning, Nutrient Status and Fertilizer Recommendation). This GIS system can analyze data at the Upazilla level, District level and finally at the national level. (SRDI,2015)

2.4.9. DAM website

The DAM website provides commodity price information with the aim to involve all agriculture stakeholders, especially farmers in the decision making process. Currently in its pilot phase, the database provides wholesale and retail prices of around 200 commodities from 30 of the 64 districts. The price information is collected daily and sent to the DAM headquarter in Dhaka through e-mail. The headquarter the populates the database with the received price information and prepares a report .The daily price reports are also posted on the website and are accessible in three different formats including an .xls

file, which allows data to be downloaded and manipulated by user. Periodic reports are also available from the website but cannot be modified by user. Although this website is not currently being used for the original purpose intended, it is being used mostly for researching and studying price trends. A more farmer-Friendly format is needed. (DAM, 2015)

2.4.10. BRRI knowledge bank

Bangladesh Rice Knowledge Bank (BRKB) is a treasure of rice knowledge. This is a dynamic source of knowledge that is updated regularly to keep consistency with the latest innovations and users' feedback. The BRKB contains rice knowledge to address the regional as well as national issues associated with rice production and training. It started with rice but extends promise to be expanded to non-rice technologies in future. The extension service providers are the immediate beneficiaries of the BRKB. However, ultimately farmers will be benefited from it. (BRRI, 2015)

2.4.11. DAE website

In order to develop and strengthen the ICT department of DAE, GOB had initiated a project called “The ICT Development of DAE”. The DAE website (www.dae.gov.bd) is one of the key components of the project. This website stores and disseminates field level information from and through extension workers. (DAE, 2015)

2.4.12. Bangladesh Country Almanac (BCA)

This project, jointly implemented by BARC, SRDI, BRRI and CIMMYT with financial support from USAID was commenced in July 2002. The main objective of this project is to disseminate the natural resources, climatic and socioeconomic information generated through earlier FAO/UNDP funded AEZ & GIS project at BARC and also the information from other organizations. In the BCA-CD, both spatial and non-spatial type of data are stored that also includes a GIS tools called Where ACT for use in agriculture and natural

resource management activities for characterizing and analyzing geographic variation in relation to agricultural and environmental concerns. (BCA, 2014)

2.4.13.Telecenters

Telecenters provide e-services to grassroots communities and in the longer term become knowledge hubs for communities they belong to. Through these, people can access computers, the Internet, and other digital technologies that enable people to gather information, create, learn, and communicate with others while they develop essential 21st-century digital skills. While each telecenter is different, their common focus is on the use of digital technologies to support community, economic, educational, and social development—reducing isolation, bridging the digital divide and creating economic opportunities. As of December 2007, there are-

- 100Gonokendra: Centre for Community Development (Dhaka Ahsania Mission);
- 05Amader Gram Learning Centre (AGLC);
- 27Internet Learning Centre: School based Telecentre(Relief International);
- 03Youth Community Multimedia Centre (YPSA);
- Rural Technology Centres(Practical Action);
- 02Ghat: Rural ICT Centres(DEN);
- 452Community Information Centre (CIC) (Grameen Phone);
- 27Pallitathyakendra(D.Net)

Table 2.1. Divisional distribution of telecentres

Sl. No.	Name of the District	Telecenter No.
1.	Barisal	56
2.	Chittagong	304
3.	Dhaka	324
4.	Khulna	160
5.	Rajshahi	202
6.	Sylhet	63
Total		1109

(e.Krishi Vision 2025, 2008)

It was observed that ICT Adoption for Agriculture should be considered as an issue of public concern beyond farmer's interests. (Jamwal&Padha, 2009)

2.4.14. Agriculture Information Service (AIS)

Agriculture Information Service under the ministry of Agriculture are providing e-Agriculture through Touch Screen Kiosk, ICT lab, Community Radio, AICC (Agriculture Information and Communication Center), Krishi Call Centre (AIS,2015)

2.4.15An overview of earlier initiatives for providing e-Agriculture services inIndia

With the constraints that responsible for the declining position of agriculture in the total Indian economy call for the planning and execution of technology in the field of agriculture. As a result, over a period of decade state government NGOs and some pioneering companies have taken up an initiative to launch some pilot projects through various agriculture programmes. Mentioned below are some remarkable ones-

1. PRIDE is Progressive Rural Integrated Digital Enterprise powered by TCS Mkrishi platform, is a patented Mobile Based Personalized Services Delivery Platform that enables two-way data and information exchange the end users such as farmers and field agents and repositories of vital knowledge banks, agriculture experts and procurement officers. Mkrishi is an award winning, rural services delivery platform developed by TCS innovation labs –Mumbai. It is comprised of multiple applications to strengthen the rural agro based enterprise.

2. TCS Mkrishi Project of Kanchipuram successfully demonstrated Chennai horticulture produce producer companyLtd.-CHPCL is especially for the innovations to be successfully accepted by the target market group, i.e. the rural farmers.CHPCL has incorporated both the innovations into creating a unique solution that can potentially make a significant impact on the industry and hence the large population. (Srini P,2013)

3. e-Choupal is the another noteworthy example of the private initiative by Indian tobacco corporation(ITC) Ltd, to link directly with farmers for procurement of agricultural / aquaculture produce. It was basically designed to tackle the challenges posed by the unique feature of Indian agriculture, characterized by the fragmented farms, weak infrastructure, and involvement of numerous intermediaries among others (http://www.youth4kiawaaj.com). It was launched in June 2000, has reached out to more than 40 lakhs farmers of 40,000 villages across 8 states, named, AP., Karnataka, Maharashtra, Madhya Pradesh, Rajasthan, Tamil Nadu and Uttarakhand. ITC limited plans to cover 100,000/- villages in 15 states reaching to 15 million farmers. The farmer customer of e-choupal benefited in rise in income levels, which is the outcome of rise in yields with low cost investments with quality out puts.

4. Through e-Kutir system in Orissa, farmer can access various resources and knowledge. He can gain maximum yield from his land through efficient resource management. Mostly used in decision making to reduce risk.

5. Annapoorna: Securing Farmers Future.

6. mKrishi is a mobile-based service delivery platform for the farmers. This platform is capable of providing personalized advice specific to the subscribers' needs. Right information at right time during farming plays a crucial role for a farmer as it will result in better agricultural production. Farmers need answers for their daily queries on various crop diseases, appropriate quantity of fertilizers/pesticides, best practices for irrigation, etc.

7. United Nations Environment Programme (UNEP)'s “Billion Tree Campaign” which intends to plant one billion trees around Research Projects, Village Adoption Scheme of the Central Agricultural University, Rural Horticultural Work Experience Programme (RHWE).

8. Computer Education and e-Literacy: Regular computer education and e-literacy programmes were conducted for the benefit of tribal children and youth and other villagers in the ten e-Village centers.

9. Rural Horticultural Work Experience Programme-Team created for e-farming awareness, plantation campaign, mushroom cultivation,vermin-compost,Soil sampling & testing, horticulture product processing, landscaping & flower arrangement training at e-village training centre, Environmental Awareness Programmes. C-DAC, Hyderabad and the Central Agricultural University(CAU), College of Horticulture and Forestry, Pasighat, Arunachal Pradesh, jointly implemented a research project called “Creating Model e-Villages in North East India” e-governance initiative for the agricultural and rural development, since 2008.

10. GRAMSEVA: KISAN is a mobile based application that informs the farmers and wholesalers of the current price of commodities.It replaced the conventional web, radio & TV. Models. (Pande, and Deshmukh, 2015)

Raj, S.*et. al.* (2008) expressed that the experiences of e-Arik project shows encouraging results for the sustainability and scaling-up of the project in North-East India.

Major Activities of the e-Arik Project (Phase I: From May, 2007 to April, 2008), did the following activities for providing e-services to the farmers as-

1. Farmers' Information Needs Assessment
2. Survey on ICT Indicators
3. Field Visits and Diagnosis
4. Digital Documentation
5. Farm Advisory Services
6. On-farm Demonstrations
7. Market and Weather Information
8. Awareness Meetings & Group Discussions
9. Organizing Multimedia Shows
10. Identifying & Developing Village Knowledge Managers/ Intermediaries
11. Farm Inputs Familiarization
12. Establishing Village Library
13. Creating Digital Resource
14. Information on Health, Education & Governance
15. Computer Literacy to the Villagers

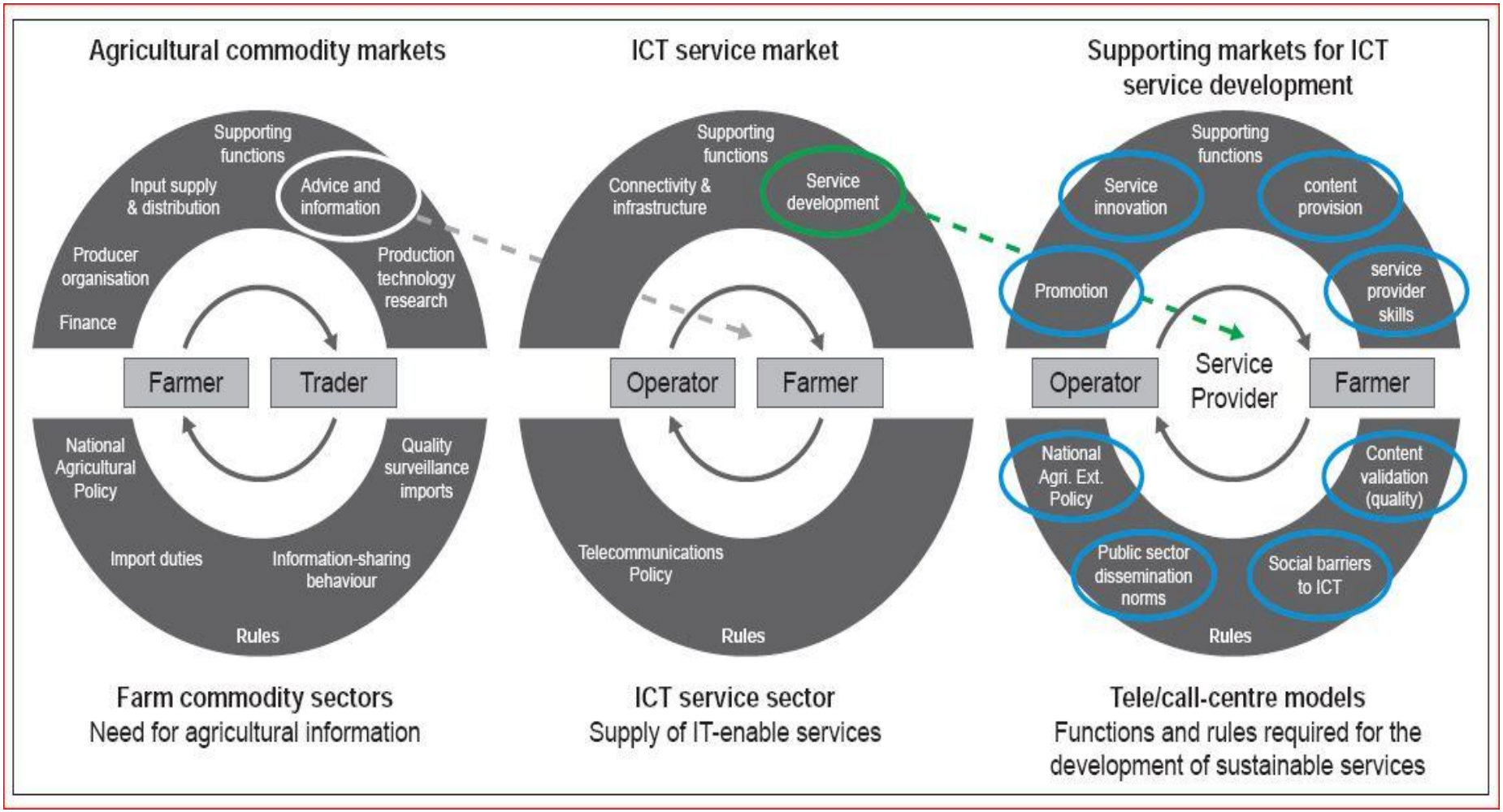

Figure 2.1. Depictingcatalysts analytical processes: from agricultural commodity markets to ICT service development conditions

2.5. e-Agriculture & its effects on rural livelihood

Mahiuddin and Hoque (2013) stated that supportive services will cover human resources development, community, voluntary organization, media engagement a

nd research organization. The A2I program supported by UNDP is extending more about the ICT facilities for the better and quick e-service delivery of the rural people as well as the farmers.

There is another study on "*Information support services of the rural development libraries in Bangladesh"* (Islam & Uddin, 2005) where authors have shown theinformation and services system of rural development libraries of Dhaka, Comilla andBogra districts in Bangladesh. In this study authors have pointed out the situation ofrural development libraries due to revolution and advancement of informationcommunication technology. The study identifies the tools and techniques which areused in different functional units of these libraries to fulfill the demand of growinginformation needs of the rural people of Bangladesh.

There is conducted another study on *Community Information: What Libraries can Do: A Consultation Document* where it is said that the "the services which helpsindividuals and groups about the daily problem-solving and with participation in thedemocratic process. The community information services centers concentrate on theneeds of those who are not ready access to other sources of assistance and on the mostimportant problems that people have to face, problems to do with their homes, jobs andthe rights"(The Library Association,1980)

There is an another study in India on *"Community Information Center Project in North East India: connecting the far flung"*(Battcharjee, 2002).This project was initiated to interface between citizen and government, providing internet access, web browsing and email facilitation of people, usage of computers

make available among children and women to provide the IT services for local community people.

There is another related study namely, "*Telecenters for Sustainable Rural Development: Review and case study of a South African Rural Telecenters*"(Breitenbach, 2013). This paper has shown how the telecenterss of Africa played animportant role in the field of Communication Technology for the economicdevelopment .This Paper has also showed how the telecenters improved the lives of thepeople of the rural community at Thabina in Africa.

There is another study entitled *Multipurpose community Telecenter's for rural development in Pakistan* (Mahmood, 2005). Here the author has shown about thechallenges and opportunities of establishing Multipurpose Community Telecenters(MCTs) in rural areas of Pakistan. In his study he has also shown about the proposeof establishing of MCTs in Pakistan in terms of policy formulation, planning,management, funding, building, equipment, technology, services, target groups, marketing and sustainability.

2.6. Conceptual framework of the study

It is evident from the past studies that every occurrence or phenomenon is the outcome of a number of variables, which may or may not be interdependent or interrelated with each other. Variables together are the cause effect and thus, there is cause-effect relationship everywhere in the universe.

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, empowerment of farmers 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, usages of e-Agriculture, attitude towards e-Agriculture, organizational participation cosmopolitenessand availability of e-Agricultureareindependent variables.

In order to have a clear understanding of the nature of empowerment, the dependent variables were considered from the view of dissemination of empowerment. These were economic empowerment, family and social empowerment, political empowerment, knowledge empowerment and psychological empowerment.

In view about discussion and prime findings of review of literature, the researcher constructed a conceptual framework of the study which is self-explanatory and is presented in figure 2.2.

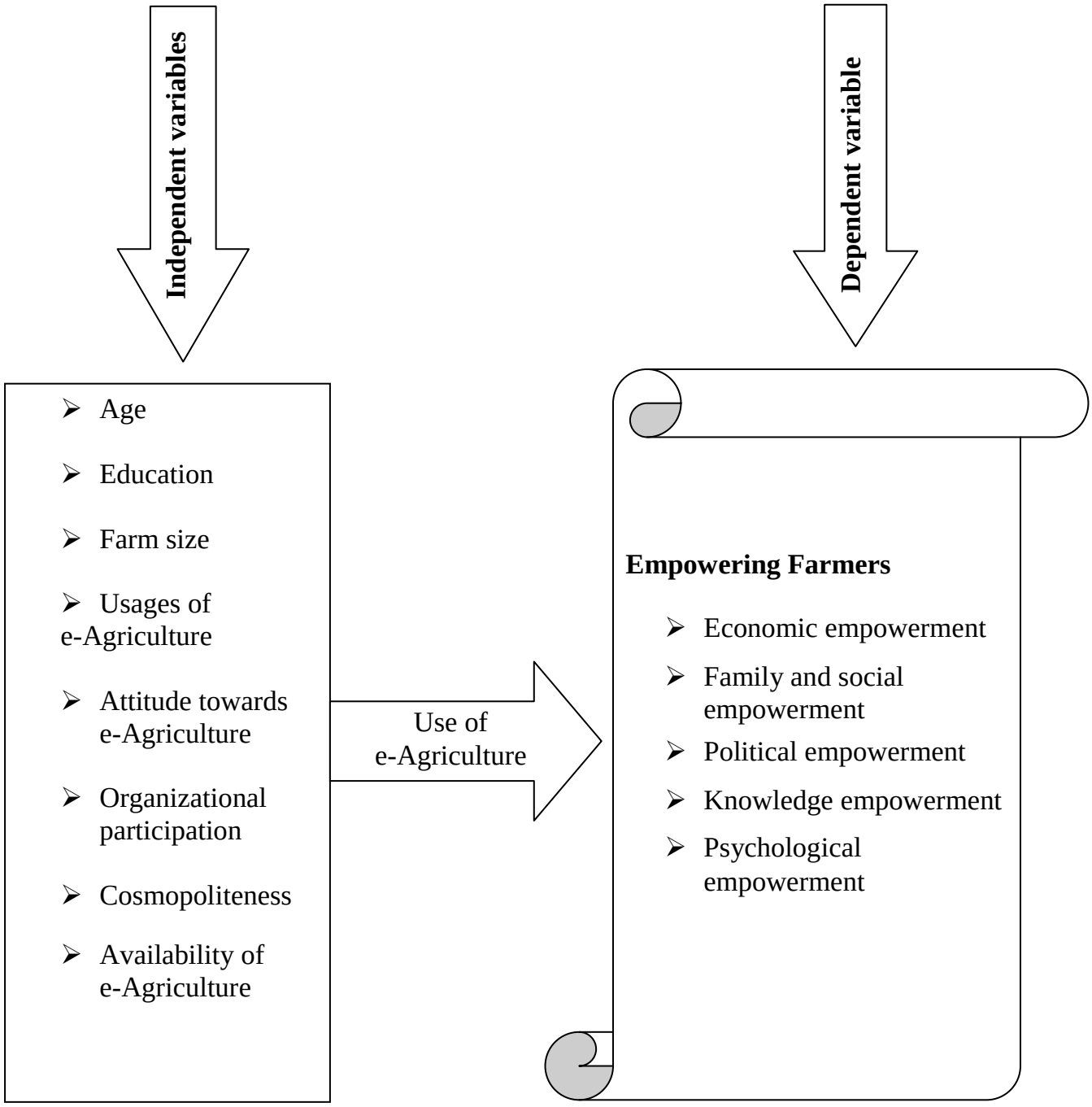

Figure 2.2. The conceptual framework of the study

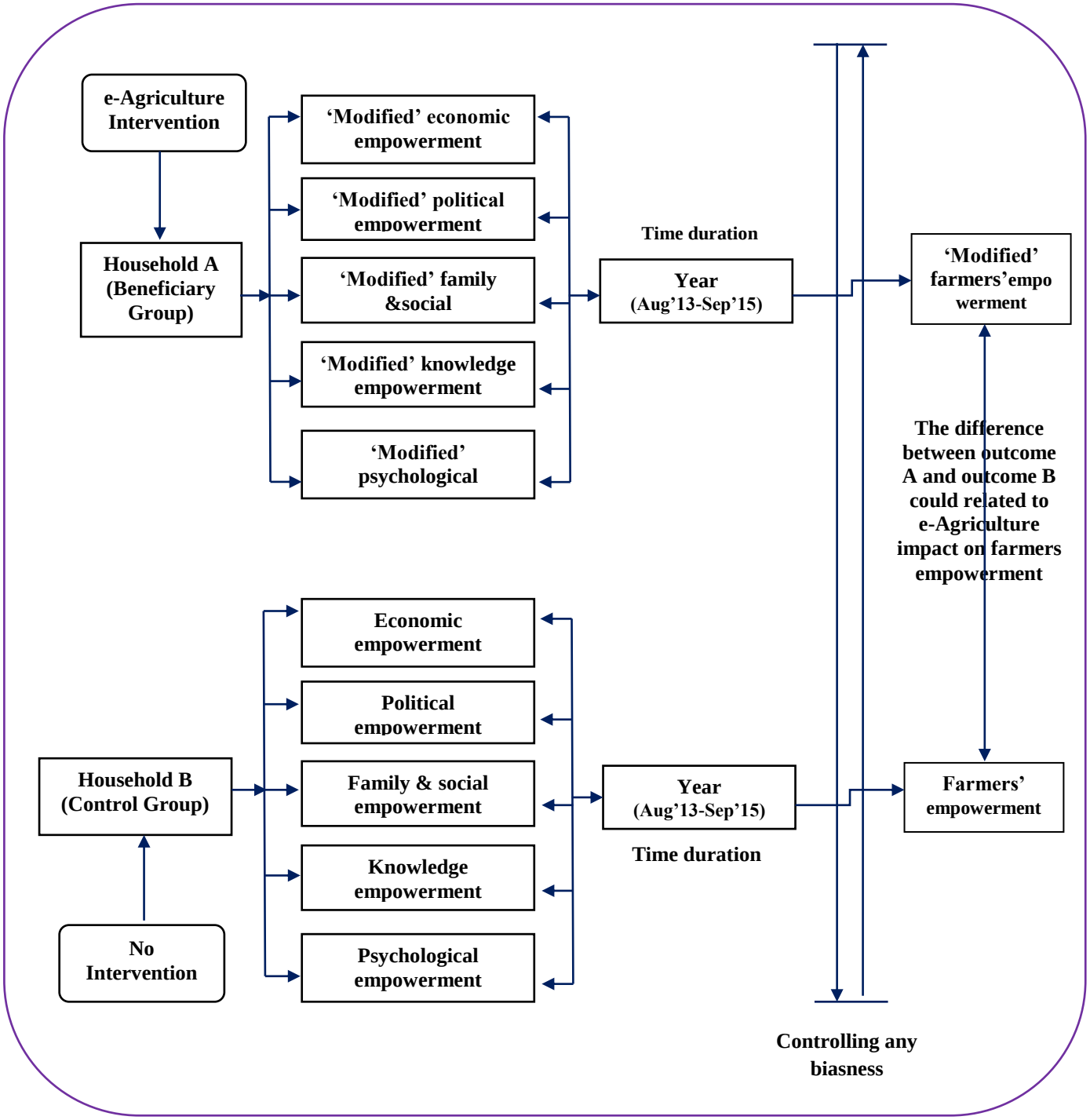

Figure 2.3. What is the impact of e-Agriculture on farmers' empowerment?

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. Research Design

A research design is detailed plan of investigation. It is the blueprint of the detailed procedure of testing the hypothesis and analysis of the obtained data. The research design followed in this study was *ex-post facto,* because of uncontrollable and non-manipulating variables. This is absolute descriptive and diagnostic research design. A descriptive research design is used for fact findings with adequate interpretation. Diagnostic research design, on the other hand, is concerned with testing the hypothesis for specifying and interpreting the relationship of variables.

3.2. Locale of the study

Manikganj district consists of nine upazilas. The study was taken at ManikganjSadarUpazila (Manikganj District) where the government of Bangladesh has been implementing a numbers of e-Agriculture related development projects with the help of foreign aids through Department of Agricultural Extension (DAE) for the improvement as well as the empowerment of the farmers. According to DAE,the dighi union is segmented of three blocks namely Dautia, Muljan and Bhatbour(MoA, 2015). The present study was conducted at Bhatbour Block of DighiUnion based on the population size in the selected area. The Blocks' population had almost eagerness to the e-Agriculture. The areas of the selected block is 4.8 square kilometer. There are nine villages of the study area which has covered cultivable land 480 hectors, located in between 23°50' and 23°54' north latitudes and in between 89°50' and 89°75' east longitudes. It is bounded by the Garpara Union on the north, GhiorUpazila on the south, Jaigir and ManikganjPourosovaon the east,GhiorUpazila on the west. The total population of the study area is 6165 where male and female consists 3190 and 2975 respectively. The farm families are 1148.

The map of the Manikganj district has been presented in Figure 3.1.and the specific study locations of DighiUnion under ManikganjSadarUpazila of Manikganj District have also been shown in Figure 3.2.

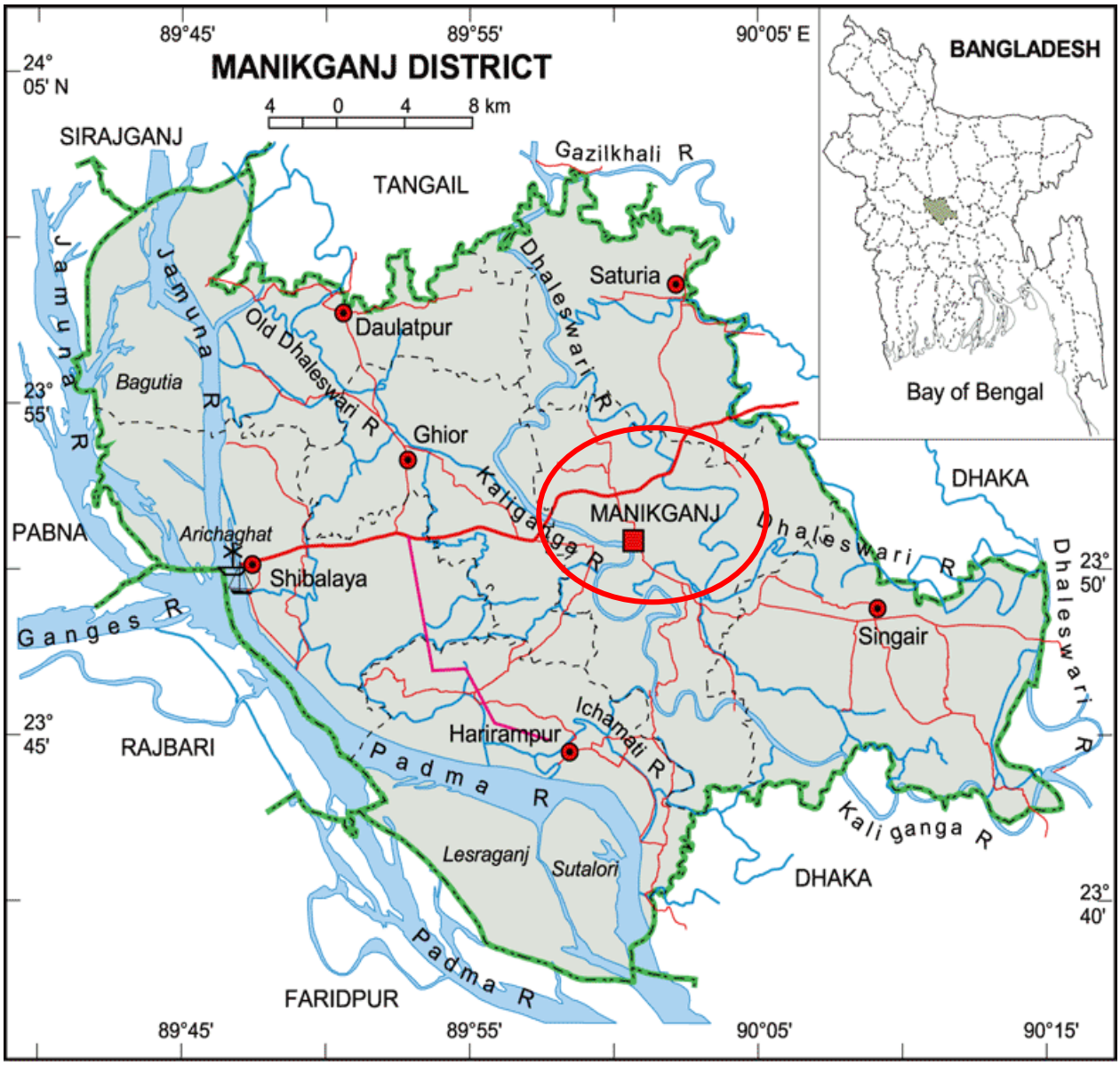

Figure 3.1. Map of Manikganj District showing the study area- Manikganj SadarUpazila

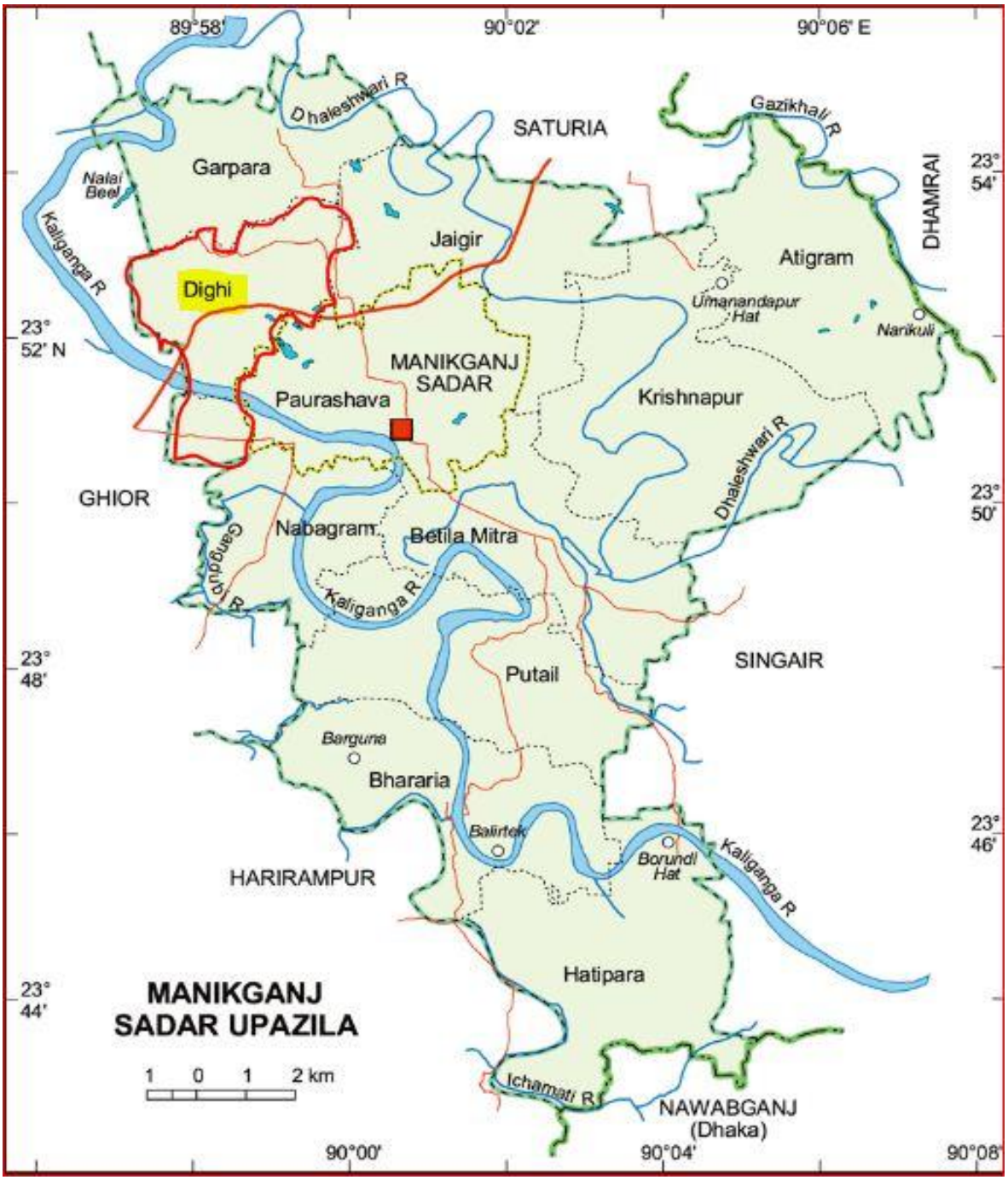

Figure 3.2. Map of ManikganjSadarUpazila showing the study area

3.3. Unit of analysis

The unit of analysis of the study was the people who empowered through e-Agriculture use in rural area as a study group and who empoweredwithout e-Agriculture use as a control group.

3.4. Population and Sampling

People who permanently reside in the selected villages constituted the active population of this study. As all population of the study area could not possible to measure, head of the farm families of Bhatbour block of Dhighi Union (segmented by the Department of Agricultural Extension under the Ministry of Agriculture) of ManikganjSadarUpazila under Manikganj district were the population of the study. However, representative sample from the population were taken for collection of data following purposive sampling technique. One farmer (who mainly operated the farming activities of the family) from each of the farm families was considered as the respondent. Updated lists of all farm families who used e-Agriculture of the selected block were prepared with the help of SAAO and local leader (Matobbor). Farm families who usede-Agriculture of the villages of Bhatbour block were considered as the study group and the farm families who did not use e-Agriculture of the ninevillages of Bhatbour block as treated control group. A purposive sampling procedure was followed to select one district from the whole of Bangladesh, and a random sampling method was used to select the Upazila. Random sampling was also used to select the Bhatbour block of Dhighi Union as the study group. The total number of individuals under study was estimated 1148 in the study area which is showing in the following table 3.1.

Table 3.1. Population of the study area

Name of the selected Upazila	Name of the selected block (union)	Name of the villages	Number of the respondents
Manikganj SadarUpazila	Bhatbour (Dighi)	Bhatbour	175
		ChutiBhatbour	215
		NatunBosti	90
		Dighi	208
		Kaliani	40
		Shalpohatkora	109
		Chandora	185
		Kakzi Nagar	85
		Chan Nagar	41
	Total		1148

(**Source:** Field survey, 2015)

3.4.1. Study Group (SG) Sampling

There are several methods for determining the sample size.Here, researcher used Yamane's (1967) formula for study group:

$$n = \frac{z^2 P(1-P)N}{z^2 P(1-P) + N\ (e)^2}$$

Where,

n = Sample size;

N, Population size = 1148;

e, The level of precision = 8% ;

z = the value of the standard normal variable given the chosen confidence level(e.g., z = 1.96 with a confidence level of 95 %) and

P, The proportion or degree of variability = 50%;

So, the sample size (n) is = 133.

3.4.2. Control Group (CG) Selection

The respondents' size of the control group was45 farmers which calculated asone-third of the sampling population number. Sampling selected as 133 respondents who used e-Agriculture from the study area and 45 respondents as controls who did not use e-Agriculture. To ensure similar socio-economic conditions for both the control and test groups, a two-way stratified random sampling technique was used (Mazumder and Wencong, 2015), in which education and farm size were considered as two individual strata. Education was categorized into three groups: group 1 (denoted E_1), respondents are illiterate or can sign only; group 2 (denoted E_2), respondents have primary education, and group 3 (denoted E_3), respondents have secondary or higher education. Farm size was also categorized into three groups: group 1(denoted F_1), small farm group (farm size up to 0.5 hectors); group 2 (denoted F_2), medium-farm group (farm size 0.51 to 1.0 hector), and group 3 (denoted F_3), large farm group (farm size above 1.0 hector). The two-way stratified random table is given as Table 3.2.

Table 3.2. Two-way stratified random sampling of respondents based on their level of education and farm size

Category	% of respondents	No of respondents from the study group	No of respondents from control group (one-third of the study group)
$E_1 \times F_1$	10.53	14	5
$E_1 \times F_2$	5.26	7	3
$E_1 \times F_3$	4.51	6	2
$E_2 \times F_1$	21.05	28	9
$E_2 \times F_2$	9.02	12	4
$E_2 \times F_3$	12.03	16	5
$E_3 \times F_1$	22.56	30	10
$E_3 \times F_2$	9.02	12	4
$E_3 \times F_3$	8.27	11	3
Total	100	133	45

With the help of the two-way stratified random sampling procedure, homogeneous/ similar categories of control and testing group respondents were selected, and then the proportionate random sampling technique was used to select either study or control group respondents from each village/group. A reserve list was maintained to fill in the gaps if any respondent in the original list was found missing as the same respondent in the interview. To ensure the same respondents for the interviews, 5% extra respondents were interviewed to fill in the gaps in case of any interviewed respondent unavailable.

3.5. Sample Size

The total numbers of sample size under the study area were estimated 178where the Study Group (SG) and Control Group (CG) covered 133 and 45 respectively. The sample size is showing in the following table 3.3.

Table 3.3. Sample Size of Study Group (SG) and Control Group (CG)

Name of Villages	Population	Study Group(SG)	Control Group (CG)
Bhatbour	175	14	5
ChutiBhatbour	215	7	3
NatunBosti	90	6	2
Dighi	208	28	9
Kaliani	40	12	4
Shalpohatkora	109	16	5
Chandora	185	30	10
Kakzi Nagar	85	12	4
Chan Nagar	41	11	3
Total	1148	133	45

3.6. Variables and their measurement techniques

In a descriptive social research, selection and measurement of the variable is an important task. A variable is any characteristics which can assume varying or different values are successive individuals' cases (Ezekiel and Fox, 1959). An organized research usually contains at least two identical elements i.e. independent and dependent variable. An independent variable is a factor which is manipulated by the researcher in his attempt to ascertain its relationship to an observed phenomenon. A dependent variable is a factor, which appears, disappears or varies as the experimenter introduces, removes or varies the independent variables (Townsend, 1953). According to the relevance of the research area, the researcher selected 08 characteristics of the respondents as the independent variables (e.g. age, education, farm size, usages of e-Agriculture, attitude towards e-Agriculture, organizational participation, cosmopoliteness, and availability of e-Agriculture). On the other hand,empowerment of farmers through e-Agriculture was dependent variableregarding in sub-parameter such as economic empowerment, family and social empowerment, political empowerment, knowledge empowerment and psychological empowerment. The following sections contain procedures of measurement of dependent and independent variables of the study.

3.6.1. Measurement of independent variables

The independent variables of the study were age, education, and farm size, usages of e-Agriculture, attitude towards e-Agriculture, organizational participation, cosmopoliteness, and availability of e-Agriculture. The procedure followed in measuring the independent variables have been discussed in the subsequent sections.

3.6.1.1. Age

Age of the respondent was measured in terms of actual years from their birth to the time of the interview, which was found on the basis of the verbal response of the rural people (Azad, 2003). A score of one (1) was assigned for each year

of one's age. This variable appears in item number one (1) in the interview schedule as presented in Appendix-A. Based on the available information cited by the respondents, they were classified into three categories.

Category	Year
Young age	≤ 35
Middle age	36 to 50
Old age	>50

3.6.1.2. Education

Education was measured by assigning score against successful years of schooling by a respondent. One score was given for passing each level in an educational institution (Amin, 2004).

For example if a respondent passed the final examination of class five or equivalent examination, his/her education score has given five (5). Each respondent of can't read & writehas given a score of zero (0). A person not knowing reading or writing but being able to sign only has given a score of 0.5. If a farmer did not go to school but took non-formal education, his educational status was determined as the equivalent to a formal school student.This variable appears in item number two (2) in the interview schedule as presented in Appendix-A. Based on the available information cited by the respondents, they were classified into five categories.

Category	Education (Year of schooling)
Can't read & write	0
Can sign only	0.5
Primary education	1 to 5
Secondary education	6 to 10
Above secondary	> 10

3.6.1.3. Farm size

Farm size of a respondent referred to the total area of land on which his family carried out the farming operation, the area being in terms of full benefit to the family. The term refers to the cultivated area either owned by the respondent or cultivated on sharecropping, lease or taking from other including homestead area.It was measured in hectares for each respondent using the following formula (Khan, 2004):

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

Where, FS = Farm size,

A = Homestead area including garden and pond,

B = Own land under own cultivation,

C = Land taken from others as borga,

D = Land given to other as borga and

E = Land taken from others on lease.

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

Category	**Area (hectare)**
Landless	≤ 0.020
Marginal farmer	0.021 to 0.20
Small farmer	0.21 to 1.00
Medium farmer	1.01 to 3
Large farmer	>3

3.6.1.4. Usages of e-Agriculture

Usages of e-Agriculture referred to the total usages for getting benefits from e-Agriculture services. It was expressed in the score. In measuring this variable, a score of one was given for rare use of e-Agriculture. This variable appears in item number four (4) in the interview schedule as presented in Appendix-A.

The usages of e-Agriculturescoring of the farmers were done in the following manner-

Category	Score
Frequently	3
Occasionally	2
Rarely	1
Not at all	0

3.6.1.5. Attitude towards e-Agriculture

Attitude towards e-Agriculture of a respondent implies to his/her beliefs, outlook, perception and action tendencies. To determine this criterion, a number of 10 statements (5 positive and 5 negative) were randomly presented before the interviewees. A five-point scale was used to measure the attitude of the beneficiaries. This scoring was done in the following manner-

Extent of agreement	Score for positive Statement	Score for negative Statement
Strongly agree	5	0
Medium agree	4	1
Low agree	3	2
Undecided	2	3
Disagree	1	4
Strongly disagree	0	5

All the scores for positive and negative statements were summed up and the final score was determined. For example, if a respondent had a total score of 18 for the positive statements and a total score of 6 for the negative statement, that respondent would have a final score of 12. This variable appears in item number five (5) in the interview schedule as presented in Appendix-A.

3.6.1.6. Organizational Participation

Organizational participation of a respondent was computed on the basis of his/her participation in different organizations. This variable appears in item number six (6) in the interview schedule as presented in Appendix-A.

Scoring of the organizational participation was done using the following formula and in the following way-

OP = $P_{om} + P_{em} + P_{eo}$

Where, **OP =** Organizational participation score,

P_{om}= Participation as ordinary committee member,

P_{em} = Participation as executive committee member and

P_{eo} **=** Participation as executive committee officer (president/secretary).

Nature of participation	Score assigned
No participation	0
Participation as ordinary member	1
Participation as executive member	2
Participation as secretary/ president	3

For example, if a respondent participated as an executive committee member of school committee, an ordinary member at NGO organized society and no participation in other organizations, that respondent would have a total score 3.

3.6.1.7.Cosmopoliteness

Cosmopoliteness of a respondent referred to frequency of visit to different places outside of his own village. The following scale was used:

Place of visiting	Scoring system
1.Visit to other villages	0=not even in a year **(**Never), 1= 1-5 times in a year (Rarely), 2= 6-9 times in a year (Occasionally) and 3= 10 or more times in a year (Regularly).
2. Visit to own upazilla town	0= not even in a year (Never), 1= 1-3 times in a year (Rarely), 2= 4-7 times in a year (Occasionally) and 3= 8 or more times in a year (Regularly).
3. Visit to own district town	0= not even in a year (Never), 1= 1-2 times in a year (Rarely), 2= 3-5 times in a year (Occasionally) and 3= 6 or more times in a year (Regularly).
4. Visit to another district town	0= not even in a year (Never), 1= 1-2 times in a year (Rarely), 2= 3-4 times in a year (Occasionally) and 3= 5 or more times in a year (Regularly).
5. Visit to capital city	0= not even in a year (Never), 1= Once in a year (Rarely), 2= 2-3 times in a year (Occasionally) and 3= 4 or more times in a year (Regularly).

Score obtained for a visit to each of the above five category of places were added together to get the cosmopoliteness score of a respond. The range of cosmopoliteness score could be from "0" to "15", where "0" indicated "no cosmopoliteness" and "15" indicated "very high cosmopoliteness". This variable appears in item number seven (7) in the interview schedule as presented in Appendix-A.

3.6.1.8. Availability of e-Agriculture

The term availability of e-Agriculture refers to the degree to which an individual is relatively easily and frequently get the e-Agriculture. It was measured on the basis of e-Agriculture service availability. It was expressed in the score. In measuring this variable, a score of one was given for rarely available of e-Agriculture. This variable appears in item number eight (8) in the interview schedule as presented in Appendix-A.Theavailability of e-Agriculture scoring of the farmers were done in the following manner-

Availability of e-Agriculture	Score assigned
Regularly	3
Frequently	2
Occasionally	1
Not at all	0

3.6.2. Measurement of dependent variable

Farmers' empowerment is the dependent variable. To reveal this empowerment, the researcher considered five (05) sub-parameters:economic empowerment, family and social empowerment, political empowerment, knowledge empowerment and psychological empowerment. All the sub-parameters were measured with the help of identified subcomponents. Each sub-parameter was measured against the identified items, collected through the process of review of relevant literature, focused discussion with the officials, experts, experienced farmers.

Empowerment of Farmers (EoF) was calculated by using the formula:

$$EoF = E_{eco} + E_{fs} + E_{pol} + E_{kno} + E_{psy}$$

Where, EoF= Empowerment of farmers,

E_{eco}= Economic empowerment,

E_{fs}= Family and social empowerment,

E_{pol}= Political empowerment,

E_{kno}= Knowledge empowerment and

E_{psy}= Psychological empowerment.

3.6.2.1. Empowerment of farmers

To see how the e-Agriculture empowered the farmers, the researcher had collected responses from the respondents for the two occasions such as before e-Agriculture use and after e-Agriculture use by using structured interviewed schedule.

3.6.2.2. Economic empowerment

Increasing the income due to yield obtaining, saving money, investments, availing agriculture loans, purchase of inputs of farming were considered as the sub items for scoring of economic empowerment of the farmers and obtained score was calculated by deducting the present situation and previous situation. A score of one (1) was given for very low situation. Data obtained in response to item number 9.1 of the interview schedule for the study group (Appendix-A)and item number4.1 of the interview schedule for the control group (Appendix-B) were used to determine the economic empowerment of a respondent. Scoring was done as –

Level of change	**Assigned score**
Very Well	5
Well	4
Moderate	3
Low	2
Very Low	1
Not at all	0
Obtained score	Score of after e-Agriculture use - Score of before e-Agriculture use

For example, if a respondent got a score of 15 after e-Agriculture use and score of 10 before e-Agriculture use then the respondent obtained a score of economic empowerment that would have a score of five (5).

3.6.2.3. Family and social empowerment

Increasing in the area of developing institutional contact, linkage with development departments,team spirit, leadership quality, group consensus to solve problem were considered as the sub items for scoring of family and social empowerment of the farmers and the obtained score was calculated by deducting the present situation and previous situation. A score of one (1) was given for very low situation. Data obtained in response to item number9.2 of the interview schedule for the study group (Appendix-A)and item number4.2 of the interview schedule for the control group (Appendix-B) were used to determine the family and social empowerment of a respondent. Scoring was done as-

Level of change	Assigned score
Very Well	5
Well	4
Moderate	3
Low	2
Very Low	1
Not at all	0
Obtained score	Score of after e-Agriculture use - Score of before e-Agriculture use

For example, if a respondent got a score of 19after e-Agriculture use and score of 12 before e-Agriculture usethen the respondent obtained a score of family and social empowerment that would have a score of seven (7).

3.6.2.4. Political empowerment

Increasingthe participation in social well-being activities, membership in the social organization, freedom of expression, conflict management were considered as the sub items for scoring of political empowerment of the farmers and the obtained score was calculated by deducting the present situation and previous situation. A score of one (1) was given for very low situation. Data obtained in response to item number9.3 of the interview

schedule for the study group (Appendix-A)and item number4.3 of the interview schedule for the control group (Appendix-B) were used to determine political empowerment of a respondent. Scoring was done as follows-

Level of change	Assigned score
Very Well	5
Well	4
Moderate	3
Low	2
Very Low	1
Not at all	0
Obtained score	Score of after e-Agriculture use- Score of before e-Agriculture use

For example, if a respondent got a score 17 after e-Agriculture use and score of 14 before e-Agriculture use then the respondent obtained a political empowerment score that would have a score of three (3).

3.6.2.5. Knowledge empowerment

Increasingthe use of machineries &equipments, knowledge on value addition, adoption of IPM practices, adoption of INM practices, and adoption of IWM practices were considered as the sub items for scoring of knowledge empowerment of the farmers and the obtained score was calculated by deducting the present situation and previous situation. A score of one (1) was given for very low condition. Data obtained in response to item number9.4 of the interview schedule for the study group (Appendix-A)and item number4.4 of the interview schedule for the control group (Appendix-B) were used to determine knowledge empowerment of a respondent. Scoring was done as follows-

Level of change	Assigned score
Very Well	5
Well	4
Moderate	3
Low	2
Very Low	1
Not at all	0
Obtained score	Score of after e-Agriculture use - Score of before e-Agriculture use

For example, if a respondent got a score 18 after e-Agriculture use and score of 12 before e-Agriculture use then the respondent obtained a knowledge empowerment score that would have a score of six (6).

3.6.2.6. Psychological empowerment

Increasing the motivation in farming, self-esteem, risk taking ability, confidence, and decision making ability were considered as the sub items for scoring of psychological empowerment of the farmers and the obtained score was calculated by deducting the present situation and previous situation. A score of one (1) was given for very low condition. Data obtained in response to item no. 9.5 of the interview schedule for the study group (Appendix-A)and item no. 4.5 of the interview schedule for the control group (Appendix-B) were used to determine the increasing net income of a respondent. Scoring was done as follows-

Level of change	Assigned score
Very Well	5
Well	4
Moderate	3
Low	2
Very Low	1
Not at all	0
Obtained score	Score of after e-Agriculture use - Score of before e-Agriculture use

For example, if a respondent got a score 16 after e-Agriculture use and score of 12 before e-Agriculture use then the respondent obtained a psychological empowerment score that would have a score of four (4).

3.7. Hypothesis of the study

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

3.7.1. Research hypothesis

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

"Each of the 08 selected characteristics (age, education, and farm size, usages ofe-Agriculture, attitude towards e-Agriculture, organizational participation, cosmopoliteness, and availability of e-Agriculture)of the farmers has significant contributiontothe empowermentoffarmers through e-Agriculture"

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

3.7.2. Null hypothesis

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

"There is no contribution of the selected characteristics (age, education, farm size, usages of e-Agriculture, attitude towards e-Agriculture, organizational participation, cosmopoliteness, availability of e-Agriculture) of farmers in empoweringthem through e-Agriculture."

3.8. Instrument for collection of data

In order to collect reliable and valid information from the respondents, an interview schedule was prepared for collection of data from respondents keeping the objectives of the study in mind. The schedule was prepared in Bangla for a clear understanding to the respondents. The Bengali version of interview schedule was used to collect data. The question and statements contained in the schedule were simple, direct and easily understandable by the farmers. Simple and direct question, different scales, closed and open form statements and questions were included in the interview schedule to obtain necessary information. The draft interview schedule was prepared in accordance with the objective of the study. The interview schedule was pre-tested with 15 respondents of the farmers in the study area during 05 to 09 September 2015 andtwo years back (August, 2013) data were considered through respondents' memory recall. Appropriate scales were also developed to operation the reasons to questions.

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

3.9. Data collection

Data were collected personally by the researcher himself through personal interview schedule from the sampled farm families of the selected villages. Before starting the collection of data; the researcher met the respective Upazila Agriculture Officer (UAO), Agriculture Extension Officer (AEO), Upazila

Food Program Officer (UFPO), Assistant Health Inspector (AHI) and the concerned SAAOs. The researcher also discussed the objectives of the present study with the respondents and above mentioned officers and requested them to provide actual information. A rapport was established with the rural people so that they feel easy to answer the questions. The researcher took all possible care to establish rapport with the respondents so that they would not feel any indecision while starting the interview. Very good cooperation was obtained from the field extension workers and the local leaders. No serious difficulty was faced by the researcher during the collection of data. The interviews were made individually in the houses of respondents. Questions were asked in different ways so that the respondents could easily understand the questions. Whenever a respondent faced difficulty in understanding any questions, care was taken to explain the same clearly with a view to enabling him to answer it properly.

Before going to the respondents' home for interviewing they were informed verbally to ensure their availability at home as per schedule date and time. In the case of failure to collect information from the respondents due to their other business, a revisit was made with prior to appointments. If any respondent failed to understand any question, the researcher took great care to explain the issue. If the respondents could not clear about what was wanted to know then supplementary questions were asked for further clarification. The researcher received full cooperation from the respondents during the time of interview. Data were collected during 10 September, 2015 to 25 October, 2015. Two years back (August, 2013) data were considered through respondents' memory recall.

3.10. Compilation of data

After completion of field survey, data recorded in the interview schedules were coded, compiled, tabulated and analyzed in accordance with the objectives of the study. In this process, all the responses in the interview schedule were

given numerically coded values. Local units were converted into standard units and qualitative data were converted into quantitative ones by means of suitable scoring whenever necessary. All the collected data were checked and cross-checked before transplanting to the master sheets. To facilitate tabulation, the collected data were properly coded and transferred from interview schedule to a master sheet. Tabulation and cross tabulation was done on the basis of categorization developed by the researcher.

3.11. Statistical analysis

Data collected from the respondents were analyzed and interpreted in accordance with the objectives of the study. The analysis of data was performed using statistical treatment with SPSS (Statistical Package for Social Sciences) computer program, version 20. Statistical measures as a number, range, mean, standard deviation were used in describing the variables whenever applicable. In order to estimate the contributionofthe selected characteristics of farmers inempowering them through e-Agriculture, Multiple regression analysis (B) analysis was used. Throughout the study, five percent (0.05) level of significance was used as the basis for rejecting any null hypothesis. If the computed value of (B) was equal to or greater than the designated level of significance (*p*), the null hypothesis was rejected and it was concluded that there was a significant contributionbetween the concerned variable. Whenever the computed value of (B) was found to be smaller at the designated level of significance (*p*), the null hypothesis could not be rejected. Hence, it was concluded that there was no contribution of the concerned variables.

Changes in economic empowerment, changes in family and social empowerment, changes in political empowerment, changes in knowledge empowerment and changes in psychological empowerment were considered as the sub-parameters of dependent variable against respondents' empowerment condition. The model used for this analysis can be explained as follows:

$Y_i = a + b_1x_1 + b_1x_2 + b_1x_3 + b_1x_4 + b_1x_5 + b_1x_6 + b_1x_7 + b_1x_8 + e$; (i=1, 2, 3, 4, 5)

Where, $Y_{i=1}$ is the changed economic empowerment,

$Y_{i=2}$ is the changed family and social empowerment,

$Y_{i=3}$ is the changed political empowerment,

$Y_{i=4}$ is the changed knowledge empowerment and

$Y_{i=5}$ is the changed psychological empowerment.

Of the independent variables, x_1 is the respondent's age, x_2 is education, x_3 is farm size, x_4 is usages of e-Agriculture, x_5 is the attitude towardse-Agriculture, x_6 is organizational participation, x_7 is cosmopoliteness, x_8 is the availability of e-Agriculture. b_1, b_2, b_3, b_4, b_5, b_6, b_7 and b_8 are regression coefficients of the corresponding independent variables, and e is random error, which is normally and independently distributed with zero mean and constant variance.

3.12. Empowerment Condition Index

It is also agreed that certain key measures of empowerment such as decision-making, self-confidence and self-esteem are very difficult to measure (Cheston and Kuhn, 2002). Knowledge empowerment,psychological empowermentwere measured that also measured by Sendilkumar,2012. The empowerment was measured by determining the empowerment conditions, presented as the Empowerment Condition Index (ECI), with the variables being (a) changes in economic empowerment, consisting of income due to yield obtaining, saving money, investments, availing agriculture loans and purchase of inputs of farming, (b) changes in family and social empowerment, considered by measuring changes in a respondent's developing institutional contact, linkage with development departments, team spirit, leadership quality, group consensus to solve problem, (c) changes in political empowerment, where political empowerment was considered through changes in level of social well-being activities, membership in the social organization, freedom of expression and conflict management. (d) changes in knowledge empowerment, considered by

measuring changes in a respondent's use of machineries & equipment, knowledge on value addition, adoption of IPM, INM, IWM practices and (e) changes in psychological empowerment, considered by measuring changes in a respondent's motivation in farming, self-esteem, risk taking ability, confidence and decision making ability.

The respondents' responses variable were counted by providing a score based on a response scale. Each respondent's total change (unit free score) was considered as the 'condition index'.

Chapter-4

RESULTS AND DISCUSSION

The findings of the study and their interpretation have been presented in this chapter. These are presented in four sections according to the objective of the study. The first section deals with the selected characteristics of the respondents, while the second section deals with the empowerment of farmers through e-Agriculture. The third section deals with relationship between the selected characteristics of the respondent and empowerment of farmers through e-Agriculture.

4.1. Socio-demographic profile of the respondents

Behavior of an individual is determined to a large extent by his personal characteristics. There were various characteristics of the rural people that might have consequence to use e-Agriculture. But in this study, eight characteristics of them were selected as independent variables, which included their age, education, farm size, usages of e-Agriculture, attitude towards e-Agriculture, organizational participation, cosmopolitenss and availability of e-Agriculture. The purpose of this section is to gain understanding on eight characteristics of the respondents. The salient features of the different characteristics of the respondents have been presented in table 4.1. These characteristics were discussed under the following sub-headings.

Table 4.1. Salient features of the selected characteristics of farmers'

Independent variables (measuring unit)	Possible score	Obser-ved score	Respondents (N=133)			Mean	Std. Dev.
			Category	No.	%		
Age (year)	Unknown	27-65	Young age (≤35)	19	14.3	46.32	10.061
			Middleage (36-50)	64	48.1		
			Old age (>50)	50	37.6		
Education (year of schooling)	Unknown	0-14	Can't read & write (0)	9	6.8	4.99	3.598
			Can sign only (0.5)	18	13.6		
			Primary education (1-5)	55	39.5		
			Secondary education (6-10)	47	34.7		
			Above secondary (>10)	7	5.4		
Farm size (ha)	Unknown	.008-2.05	Landless (≤0.02 ha)	8	6.0	0.659	.571
			Marginal (0.021-0.20 ha)	27	20.3		
			Small (0.21-1.00 ha)	68	51.1		
			Medium (1.01-3 ha)	30	22.6		
			Large (>3 ha)	0	0		
Usages of e-Agriculture (Score)	0-12	1-8	Low (≤3)	81	60.9	3.56	1.835
			Medium (4-6)	40	30.1		
			High (>6)	12	9.0		
Attitude towards e-Agriculture (Score)	0-25	4-22	Poor (≤7)	8	6.0	12.67	3.619
			Medium (8-15)	98	73.7		
			Strong (>15)	27	20.3		
Organizational Participation (Score)	0-15	0-8	No participation (0)	18	13.5	2.35	1.908
			Low (1-5)	104	78.2		
			Medium (6-10)	11	8.3		
			High (>10)	0	0		
Cosmopoliteness (Score)	0-15	5-12	Low Cosmopoliteness(≤3)	54	40.6	7.24	1.911
			MediumCosmopoliteness (4-6)	67	50.4		
			High Cosmopoliteness (>6)	12	9.0		
Availability of e-Agriculture (Score)	0-3	1-3	Low (1)	32	24.1	1.86	0.566
			Medium (2)	88	66.2		
			High (3)	13	9.8		

(**Source:** Field survey, 2015)

4.1.1. Age

Age of the farmers ranged from 27 to 65 years with a mean of 46.32 years and standard deviation of 10.061. However, based on their age the farmers were classified into three categories as young age, middle age and old age.

It was also found that 14.3 percent of the respondents were young, 48.1percent were middle-aged and the rest 37.6percent were old (Table-4.1). During the study, the researcher came to know that medium age farmers were more likely to use e-Agriculture especially.

4.1.2. Education

The level of education of the respondents ranged from 0 to 12, the average being 4.99 with a standard deviation of 3.598. According to the national standard of classification, among the respondent of farmers, 6.8 percent can't read & write, 13.6 percent could sign only, 39.5 percent had education at primary level, 34.7 percent had education at secondary level and 5.4 percent had education at above secondary level (Table-4.1).

The researcher found that more education were more willing to use e-Agriculture and used it more properly. The researcher also found that 74.1 percent of the beneficiaries had a primary and secondary level of education.

4.1.3. Farm Size

Farm size of the respondents ranged from 0.0080 to 2.05 ha having an average of 0.659 and standard deviation 0.571. On the basis of the farm size of the farmers, they were classified into five categories.

Data presented in table 4.1 indicate that 20.3percent of the farmers had marginal farm size, while 6.0 percent of the farmers were landless and 51.1percent had small farm size. Data also revealed that 22.6 percent of the farmers' beneficiaries had medium farm size. The researchers did not find any larger farmer of the study area. Farm size is an important factor for using e-Agriculture.

4.1.4. Usages of e-Agriculture

Usages of the e-Agriculture score of the farmers ranged from 1 to 8. The average and standard deviation were 3.56 and 1.835 respectively.

Bases on usages of e-Agriculture, the respondents were categorized into three classes' namely low usages, medium usage and high usage. The observed data showed that the most of the farmers (60.9 percent) had low usage while 30.1 and 9.0 percent of them had medium, high usage respectively (Table-4.1).

4.1.5. Attitude towards e-Agriculture

Attitude towards e-Agriculture of the farmers ranged from 4 to 22. The average and standard deviation were 12.67 and 3.619 respectively shown in table 4.1.

On the basis of attitude towards e-Agriculture, the respondents were categorized into threeclasses' namely poorly favorable attitude, moderately favorable attitude and highly favorable attitude. The observed data showed that the most of the rural farmers (73.7 percent) had a medium attitude towards e-Agriculture while 20.3 and 6.0 percent of them had strong and poor attitude respectively. The attitudeof the respondents expressed their perception about e-Agriculture. It helped the researcher to judge or measure the acceptance or rejection of e-Agriculture in the rural area.

4.1.6. Organizational Participation

The observed range of organizational participation of the farmers varied from 0 to 8 score with a mean of 2.35 and standard deviation of 1.908. On the basis of organizational participation, the respondents were categorized into four classes namely no participation, low, medium and high participation shown in table 4.1.

The highest proportion of the respondents (78.2 percent) showed low participation while 13.5 and 8.3 percent of them showed no participation and high participation respectively. The researcher did not find any beneficiaries to fall under high participation category.

4.1.7.Cosmopoliteness

The observed range of cosmopoliteness of the farmers varied from 5 to 12 score with a mean of 7.24 and standard deviation of 1.911. On the basis of cosmopoliteness the respondents were categorized into three classes' namely low, medium and high cosmopoliteness shown in table 4.1.

The highest proportion of the respondents (50.4 percent) showed medium participation while 40.6 and 9.0 percent of them showed low and high cosmopoliteness respectively.

4.1.8. Availability of e-Agriculture

The observed range of availability of e-Agriculture varied from 1 to 3 score with a mean of 1.86 and standard deviation of 0.566. On the basis of availability of e-Agriculture, it was categorized into three classes' namely low, medium and high available of e-Agriculture shown in table 4.1.

The observed data showed that the most of the farmers (66.2 percent) had gotten the medium availability of e-Agriculture service while 24.1 and 9.8 percent of them had low and high availability of e-Agriculture respectively.

4.2. Empowerment Condition Index

In the ECI, the UNDP-designed technique takes three indicators into consideration and combines them into a single, measureable index: economic, family and social, and political empowerment. This method of indexing allows us to establish the degree to which e-Agriculture impacts on respondents' empowerment and the performance of each organization. Additional knowledge and psychological empowerment parameter was selected in this study according to the time demand. In this way, all the related variables

impact/changes are counted using a numeric value and given an appropriate score of equal valence, also taking into consideration the number of members in study group and control group. All empowerment conditions were taken into account in this study.

4.2.1. Economic empowerment

The economic empowerment of the farmer members was studied based on the selected parameters like income, savings habit, investments, financial management skill, extent of dependency on money lenders, purchasing of input of farming etc. and given in Table 4.2.

Table 4.2. Economic empowerment of farmers through e-Agriculture

Sl. No	Economic empowerment components	Mean Score		t-test value
		Before e-Agriculture use	After e-Agriculture use	
1.	Increased income due to yield obtaining	2.47	3.43	15.949**
2.	Saving money	2.14	3.41	7.030**
3.	Investments	1.89	3.16	4.460**
4.	Availing agriculture loans	1.95	3.41	3.333**
5.	Purchase of inputs of farming	1.35	2.60	0.864
Total Mean Score		9.80	16.01	
Overall mean score		1.96	3.202	

t value (1% significance) = 2.576

(**Source:** Field survey, 2015)

It wasobserved that income of the respondents had been increased, which might be due to the increase in the yield obtained. The purchase of inputs for farming, respondents have gained increased mean score (2.60) especially after joining to the group, because of the reason that the required farm inputs information were provided by e-Agriculture at a subsidized cost. With respect to availing of agricultural loans, farmers had been empowered considerably (mean score 1.95 to 3.41), due to reason that, e-Agriculture was providing the information low or

interest free loans to the farmers. The savings of the members had also increased (2.14) in spite of poor return from farming. The t-test computed also support the mean score obtained and shown significant difference.

4.2.2.Family and social empowerment

The family and social empowerment was studied in terms of freeness to work with group members, involvement in the decision making process, team spirit, leadership quality and group consensus to solve problem. The result depicted in Table 4.3.

Table 4.3. Family and social empowerment of farmers through e-Agriculture

Sl. No	Family and social empowerment components	Mean Score		t-test value
		Before e-Agriculture use	After e-Agriculture use	
1.	Developing institutional contact	2.18	3.15	13.005**
2.	Linkage with developing departments	2.51	3.39	13.658**
3.	Team spirit	1.88	2.99	6.398**
4.	Leadership quality	1.96	3.18	6.291**
5.	Group consensus to solve problem	1.59	2.90	2.150
Total Mean Score		10.12	15.61	
Overall Mean Score		2.024	3.122	

t value (1% significance) = 2.576

(**Source:** Field survey, 2015)

From the Table4.3, it was evident that the contact with institutions and linkage with development departments by the respondents had shown remarkable improvement. After usages of e-Agriculture, the mean scores for the above said subcomponents were increased from 2.18 to 3.15 and 2.51 to 3.39 respectively. Regarding group consensus to solve problem, there was an increase in mean score (1.59 to 2.90) noticed. It can be seen that team spirit and leadership quality of the respondents were improved. The t-test computed also support the mean score obtained and shown significant difference.

4.2.3. Political empowerment

The political empowerment studied with variables like participation in social well-being activities, membership in social organization and conflict management and shown in Table 4.4.

Table 4.4. Political empowerment of farmers through e-Agriculture

Sl. No.	Political empowerment components	Mean Score		t-test value
		Before e-Agriculture use	Before e-Agriculture use	
1.	Participation in social well-being activities	2.15	3.10	14.661**
2.	Membership in the social organization	2.24	3.24	5.813**
3.	Freedom of expression	1.80	2.99	5.415**
4.	Conflict management	1.90	3.93	6.574**
Total Mean Score		9.96	16.25	
Overall Mean Score		1.99	3.25	

t value (1% significance) = 2.576

(**Source:** Field survey, 2015)

Table 4.4 revealed that the mean scores obtained by the respondents in political empowerment components, before and after the usages of e-Agriculture had also improved. With respect to conflict management, the average score obtained by the respondents was increased the highest by 1.22. Rest of other variables, such participation in social well-being activities, membership in social organization, an improvement had been recorded. The t-test computed also support the mean score obtained and shown significant difference.

4.2.4. Knowledge empowerment

The knowledge empowerment was analyzed in terms of awareness of information, knowledge and skills possessed by the respondents before and after usages of e-Agriculture presented in Table 4.5.

Table 4.5. Knowledge empowerment of farmers through e-Agriculture

Sl. No.	Knowledge empowerment components	Mean Score		t-test value
		Before e-Agriculture use	After e-Agriculture use	
1.	Use of machineries & equipments	2.32	3.26	12.109**
2.	Knowledge on value addition	1.47	2.67	2.813**
3.	Adoption of IPM practices	1.99	3.29	5.614**
4.	Adoption of INM practices	1.01	2.20	1.620
5.	Adoption of IWM practices	1.12	2.35	0.896
Total Mean Score		7.91	13.77	
Overall Mean Score		1.582	2.754	

t value (1% significance) = 2.576

(**Source:** Field survey, 2015)

It was noticed (Table 4.5.) that adoption of integrated farm management practices (IPM, INM and IWM) by the respondents had been increased from 1.99, 1.01, and 1.12 to 3.29, 2.20, and 2.35 respectively after usages of e-Agriculture. All the respondents (100 percent) had responded positively when asked questions regarding knowledge on the use of machinery and equipment after usages of e-Agriculture. Adoption of IPM practices (CMD,1.31) has been contributed heavily to the knowledge empowerment dimension. It was evident that mean scores of all the dimensions of empowerment were increased greatly after usages of e-Agriculture. The major reason for knowledge empowerment was mainly due to theirparticipation in the digital video programs conducted by various specialists to the respected field.The t-test computed also support the mean score obtained and shown significant difference.

4.2.5. Psychological empowerment

The psychological empowerment of the farmers was assessed in terms of change in motivation in farming, decision making quality, risk taking ability etc. and furnished in Table 4.6.

Table 4.6. Psychological empowerment of farmers through e-Agriculture

Sl. No	Psychological empowerment components	Mean Scores		t-test value
		Before e-Agri. use	After e-Agri. use	
1.	Motivation in farming	2.15	3.10	12.894**
2.	Self esteem	2.24	3.24	10.864**
3.	Risk taking ability	1.80	2.99	5.575**
4.	Confidence	1.90	3.93	6.574**
5.	Decision making ability	1.87	2.99	5.816**
Total Mean Score		9.96	16.25	
Overall Mean Score		1.99	3.25	

t value (1% significance) = 2.576

(**Source:** Field survey, 2015)

Table 4.6 revealed that there had been considerable improvement in the psychological attributes of the respondents. Remarkable improvement in confidence was noticed (mean score from 1.9 to 3.93). The risk taking ability of the members had also been increased. With regard to feeling of positive attitude and self-esteemand decision making ability, there had been an outstanding improvement, were noticed. Self-esteem had been increased from the mean score of 2.24 to 3.24 respectively. The t-test computed also support the mean score obtained and shown significant difference.

4.3. A comparison empowerment condition index forStudy Group (SG) and Control Group (CG)

A comparison between Study Group (SG) and Control Group (CG) was done to find out the e-Agriculture impact on farmers. e-Agriculture users had mentionable improvement in empowerment. Study group mean score of empowerment was 26.569 while the control group gained only 19.411. The distributions of changed empowerment and with respect to study group and control group respondents' are shown in table 4.7 along with t-test value.

Table 4.7. Distribution of study group and control group respondents' level of empowerment based on their changed value

Sub-parameter of empowerment (scoring method)	Empowerment indicator	Study Group (changed mean value differences)	Control Group (changed mean value differences)	t-test value
Economic empowerment	Increased income due to yield obtaining	0.955	0.674	3.728**
	Saving money	1.271	0.891	6.080**
	Investments	1.271	0.717	5.295**
	Availing agriculture loans	1.459	0.891	4.347**
	Purchase of farming inputs	1.248	1.217	3.162**
Sub total		6.203	4.391	
Family and social empowerment	Developing institutional contact	0.977	0.717	2.789**
	Linkage with developing departments	0.895	0.652	1.848
	Team spirit	1.105	0.761	6.514**
	Leadership quality	1.218	0.869	3.919**
	Group consensus to solve problem	1.293	0.783	5.449**
Sub total		5.488	3.781	
Political empowerment	Participation in social well-being activities	0.744	0.608	2.874**
	Membership in the social organization	0.406	0.456	0.724
	Freedom of expression	1.188	0.761	4.023**
	Conflict management	1.218	0.826	2.874**
Sub total		3.556	2.652	
Knowledgeempowerment	Use of machineries &equipments	0.939	0.522	4.933**
	Knowledge on value addition	1.195	0.783	4.739**
	Adoption of IPM practices	1.316	0.848	4.392**
	Adoption of INM practices	1.188	1.217	2.031
	Adoption of IWM practices	1.226	0.957	3.511**
Sub total		5.864	4.326	
Psychological empowerment	Motivation in farming	0.939	0.587	3.697**
	Self esteem	1.015	0.739	4.057**
	Risk taking ability	1.181	0.935	3.500**
	Confidence	1.218	0.869	3.748**
	Decision making ability	1.105	1.131	0.553
Sub total		5.458	4.261	
Total		26.569	19.411	

t value (1% significance) = 2.687

Empowerment impact= Mean score of study group empowerment -
Mean score of study group empowerment
= 26.569-19.411
= 7.158

The score of empowerment impact found 7.158.

Finally, there was a significant difference between study group and control group respondents' level of empowerment based on t-test statistics value.So, there was a positive impact of e-Agriculture.

4.4. Empowerment of farmers through e-Agriculture

Empowerment of farmers through e-Agriculture ranged from 9 to 48. The average and standard deviation were 26.55 and 5.89 respectively. On the basis of empowerment of farmers through e-Agriculture, the respondents were categorized into three categories namely low, moderate and high empowerment (positive) as shown in table 4.8.

Table 4.8. Distribution of the respondents according to their empowerment

Category (score)	No. of respondents	Percent	Mean	Standard Deviation
Low(≤25)	71	53.4		
Moderate (26-50)	62	46.6	26.55	5.89
High (>50)	0	0		
Total	133	100		

(**Source:** Field survey, 2015)

The observed data showed that the most of the farmers (53.4 percent) had low empowerment through e-Agriculture, while 46.6percent of them had the medium empowerment.None of the farmers were highly empowered.

4.5.Variables related in empowering of farmers

In order to estimate the empowerment from the independent variables, multiple regression analysis was used which is shown in the table 4.9.

Table 4.9. Multipleregressioncoefficients ofcontributingvariablesrelated in empowering of farmers through e-Agriculture

Dependent variable	Independent variables	B	*p*	R^2	Adj. R^2	F	*p*
Empowering of farmers	Age	-0.011	0.676	0.892	0.884	201.782	0.000***
	Education	0.002	0.986				
	Farm size	0.686	0.032**				
	Usages of e-Agriculture services	1.271	0.000***				
	Attitude towards e-Agriculture	0.369	0.000***				
	Organizational Participation	0.423	0.005***				
	Cosmopoliteness	0.536	0.014**				
	Availability of e-Agriculture	0.902	0.068*				

*** Significant at p<0.01.

** Significant at p<0.05.

* Significant at p<0.1.

The data in Table 4.9 test thefinal null hypothesis: There is no contribution of the selected characteristics (age, education, farm size, usages of e-Agriculture, attitude towards e-Agriculture, organizational participation, cosmopoliteness, availability of e-Agriculture) of farmers in empoweringthem through e-Agriculture.

In order to assess which factors contribute to empowerment, multiple regression analysis was used. Table 4.9 shows that there is a significant contribution of respondents' farm size, usages of e-Agriculture, attitude towards e-Agriculture, organizational participation, cosmopoliteness and

availability of e-Agriculture to change their empowerment regarding the sub parameter such as economic, family and social, political, knowledge and psychological empowerment through e-Agriculture. Of these, usages of e-Agriculture, attitude towards e-Agriculture, organizational participation were the most important contributing factors(significant at the 1% level of significance). Farm size and cosmopoliteness were also the important contributing factors (significant at the 5% level of significance) while coefficients of availability of e-Agriculture are also significant at the 10% level of significance.

89.2% (R^2= 0.892) of the variation in the respondents' changed empowerment can be attributed to their farm size, usages of e-Agriculture, attitude towards e-Agriculture, organizational participation, cosmopoliteness and availability of e-Agriculture, making this an excellent model (see 4.9). The F value indicates that the model is significant ($p<0.000$).

However, each predictor may explain some of the variance in respondents' empowerment conditions simply by chance. The adjustedR-square value penalizes the addition of extraneous predictors in the model, but values of 0.884still show that the variance in respondents' empowerment can be attributed to the predictor variables rather than by chance, and that both are suitable models (Table 4.9.). In summary, the models suggest that the respective authority should consider the respondents' farm size, usages of e-Agriculture, attitude towards e-Agriculture, organizational participation, cosmopoliteness and availability of e-Agriculture.

Chapter 5

SUMMARY, CONCLUSION AND RECOMMENDATIONS

5.1. Summary of findings

5.1.1. Empowerment of farmers

The empowerment score of the farmers varied from 38 to 75 against the possible range 0-120. The average empowerment score was 20.25. Based on their overall empowerment score, the farmers were classified into three categories highly empowered (>50), moderately empowered (26-50) and little empowered (<25). Empowerment of farmers through e-Agriculture ranged from 9 to 48. The average and standard deviation were 26.55 and 5.89 respectively. On the basis of empowerment of farmers through e-Agriculture, the respondents were categorized into three categories namely poor, medium and high empowerment (positive). The most of the farmers (53.4 percent) had low empowerment through e-Agriculture while 46.6 percent of them had the medium empowerment which is the highest percentage. None of the farmers were highly empowered.

5.1.2. Characteristics of the farmers

- **Age**

Age of the farmers ranged from 27 to 65 years with a mean of 46.32 years and standard deviation of 10.061. The researcher found that 14.3 percent of the respondents were young, 48.1 percent were middle aged and the rest 37.6 percent were old.

- **Education**

The highest proportions (39.5 percent) of the farmers were found to be under primary education category and 6.8percent of the farmers can't read & write. On the other hand, only 34.7percent and 5.4percent of farmers had secondary and higher secondary level of education respectively. Only 13.6 percent farmers found who can sign only.

- **Farm size**

Farm size of the respondents ranged from 0.0080 to 2.05 ha having an average of 0.659 and standard deviation .571. The researcher found that 51.1percent of the farmers had small farm size while 22.6 percent of the farmers were the medium farm and 20.3percent had marginal farm size. There was found 6.0 percent respondents who are classified into the landless category.

- **Usages of e-Agriculture**

Usages of the e-Agriculture score of the farmers ranged from 1 to 8. The average and standard deviation were 3.56 and 1.835 respectively. On the basis of the usages of e-Agriculture, the respondents were categorized into three classes' namely low usages, medium usage and high usage. The observed data showed that the most of the farmers (60.9 percent) had low usage while 30.1 and 9.0 percent of them had medium, high usage respectively.

- **Attitude towards e-Agriculture**

Attitude towards e-Agriculture of the farmers ranged from 4 to 22. The average and standard deviation were 12.67 and 3.619 respectively. On the basis of attitude towards e-Agriculture, the most of the rural farmers (73.7 percent) had the medium attitude towards e-Agriculture, while 20.3 and 6.0 percent of them had strong and poor attitude respectively.

- **Organizational Participation**

The observed range of organizational participation of the farmers varied from 0 to 8 score with a mean of 2.35 and standard deviation of 1.908 (Table 4.7). The highest proportion of the respondents (78.2 percent) showed low participation while 13.5 and 8.3 percent of them were no participation and high participation respectively. The researcher did not find any beneficiaries to fall under high participation category.

- **Cosmopoliteness**

The observed range of cosmopoliteness of the farmers varied from 5 to 12 score with a mean of 7.24 and standard deviation of 1.911. On the basis of cosmopoliteness the respondents were categorized into three classes' namely low, medium and high cosmopoliteness.The highest proportion of the respondents (50.4 percent) were medium participation while 40.6 and 9.0 percent of them showed low and high cosmopoliteness respectively.

- **Availability of e-Agriculture**

The observed range of availability of e-Agriculture varied from 1 to 3 score with a mean of 1.86 and standard deviation of 0.566. On the basis of availability of e-Agriculture,it was categorized into three classes' namely low, medium and highly available of e-Agriculture.The most of the farmers (66.2 percent) were get the medium availability of e-Agriculture while 24.1 and 66.2 percent of them had low and highly availability of e-Agriculture respectively.

5.1.3.Variables related in empoweringfarmers

Out of the eight independent variables, sixvariables namely farm size, usages of e-Agriculture, attitude towards e-Agriculture, organizational participation, cosmopolitenessand availability of e-Agriculture had significant contributiontowards farmers empowerment found throughthe multiple regression analysis. These sixvariablescontributed 88.4 percent in farmers' empowerment.

5.2. Conclusion

- Farm size of the farmers hada significant contribution.It can be concluded that the farmers having more lands had the tendency to receive e-Agriculture more.

- Usages of e-Agriculture were a major factor for improving the socio-economic condition and empowering farmers. Empowerment of farmers prevailed more on those farmers who got the facilities to use e-Agriculture.

- Attitude towards e-Agriculture is an important aspect of making improvement in farming activities. If people have the more positive attitude towards e-Agriculture, s/he would be gone one step ahead to empower.

- Organizational participation was a significant indicator for empowering the farmers. In an organization, the respondents got the inspiration to use and apply ICT in farming activities. So, it should give the emphasis for participating the organization to get more reluctant as well as development their lives.

- Cosmopoliteness brought the improved outlook to the farmers. It contributed a significant role to empower them.

- Availability of e-Agriculture provided the farmers more relax to get the information at the time of requirement. The farmers who got the e-Agriculture services frequently to regularly had kept the significance improvement in their activities. So, it would be given preference to avail the e-Agriculture for empowering the farmers.

From the study, it may, however, be concluded that, attitude, availability and usages of e-Agriculture has a great influence in changing farmers socio-economic condition and empowering them. The e-Agriculture would be very

effective if it has been given the preference to train the farmers and provide the e-services in an easy way.

5.3. Recommendations

5.3.1. Recommendations for policy implication

- Motivation program should be undertaken to increase the consciousness about more usages of e-Agriculture so that the farmers would get the more opportunity to empower themselves.

- The user-friendly different applications should be promoted for the farmers to increase the positive level of .attitude towards e-Agriculture.

- More training should be provided to the farmers for using e-Agriculture appropriately at the organizational level for increasing the active organizational participation and also should increase the facilities of the farmers' organization.

- For empowering farmers in rural areas, e-Agriculture facilities in different dimensions should be introduced at different areas by which the cosmopolite behavior of the farmers would increase.

- Devices for using e-Agriculture facility should be distributed to the farmers at a cheap rate which would help them to enhance the cultivable farm land.

- e-Agriculture facilities should be provided at the door steps of farmers so that the farmers can get the available e-Agriculture easily.

5.3.2. Recommendations for further study

- Empowering of farmers through e-Agriculture was conducted in one selected block of Manikganj district. Findings of the study may be verified by similar research in other areas of Bangladesh.

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

- This study was conducted at 8% level of precision of the population. It would be conducted at below 5% level of precision of the population for the better output.

- The present study was included five dimensions of empowerment. There is also various another dimension by which empowerment can measure. Further research may be conducted by considering another dimension of empowerment.

- This study determined only e-Agriculture contribution for empowerment the farmers. Therefore, other studies may be conducted to determine the other factors which contribute for the empowerment of the farmers.

- The impact of e-Agriculture in respect of improving socio-economic condition and empowerment of farmers can be determined by using other ways and methods which may be used in conducting further research.

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APPENDIX-A

English Version of the Interview Schedule (STUDY GROUP)
Department of Agricultural Extension and Information System
Sher-e-Bangla Agricultural University, Dhaka-1207.

Interview schedule for data collection for the research on

"EMPOWERING FARMERS THROUGH e-AGRICULTURE"

(The interview schedule is entitled for a research study)

Serial No. :

Name of the respondent :

Village : Upazilla : Manikganj

District : Manikganj Occupation: Farmer

Distance: Timing: Medium of communication:

(Please answer the following questions. Secrecy will be strictly maintained.)

1. Age

How old are you? Age…….years

2. Education

Please mention your educational status-

(a) Can't read and write…….
(b) Can sign only……..…..
(c) Read up to class ……...
(d) Others (specify) …….…

3. Farm size

Please mention your land area-

Sl.No	Types of land	Area(Local)	Area(hector)
1.	Own homestead		
2.	Own land under own cultivation		
3.	Own pond and garden		
4.	Own land given on borga to others		
5.	Land taken on borga from others		
6.	Land taken on lease from others		
7.	Land given on lease to others		
8.	Others		
Total area =			

4. Usage of e-Agriculture

Please indicate how often you use these e-Agriculture media:

Type of Media	Name of e-Agriculture weapon	Extent of Uses			
		Frequently (3)	**Occasion-ally (2)**	**Rarely (1)**	**Not at all (0)**
e-Agriculture	Radio broadcast through Medium weave, Short wave, FM band and Community Radio				
	Mobile Phone- Call/SMS/MMS/ AM/ BM/IVR/WAPS systems/ Tele-centre/ Call center				
	Teleconference/Video conference/ Phone in Program/Video chatting / Website or portal in Bangla and English				
	Video documentary, audio documentary, agricultural content digitization through online & offline…/ Website or portal in Bangla and English				

5. Attitude towards e-Agriculture

Please express your opinion regarding the following statements:

Sl. No.	Statements	Extent of Opinion					
		Strongly agree (5)	Medium Agree (4)	Low agree(3)	Undecid -ed(2)	Disag. (1)	Strongly Disagree (0)
1 (+)	e-Agriculture system is a great step to improve socio-economic condition of farmers						
2. (-)	e-Agriculture system doesn't play important role to increase income of farmer						
3. (+)	e-Agriculture system farmers to enjoy quality life						
4. (+)	e-Agriculture system creates an opportunity of self-employment						
5. (+)	It is better to receive information from e-Agriculture system						
6. (-)	Insufficient information in terms of necessity of farmers						
7. (-)	Some beneficiaries leave this system due inefficient management of e-Agriculture center						
8. (+)	Information from e-Agriculture system could be received without hazard						
9. (-)	Cost of e-Agriculture system is higher than others						
10. (-)	e-Agriculture system is not fruitful in terms of information access than others						
	Total:						

6. Organizational Participation

Please express your state regarding the following statements

Sl. No.	Name of the organization	Nature of participation (years)			
		No participation(0)	Ordinary member(1)	Executive member(2)	President/ Secretary (3)
1.	Farmers' association				
2.	School Committee				
3.	Bazar Committee				
4.	Co-operative society				
5.	NGO organized society				

7. Cosmopoliteness

Please mention your frequency of visits to the following places:

SI. No.	Place of Visiting	Frequency of visit (yearly)			
		Regularly (3)	Occasionally (2)	Rarely (1)	Never (0)
1	Visit to other villages				
2.	Visit to own Thana				
3.	Visit to own district				
4.	Visit to other thana/district				
5.	Visit to capital city				
Total					

8. Availability of e-Agriculture

Please express your opinion regarding the following statement:

SI. No.	Question	Score			
		Regularly (3)	Frequently (2)	Occasionally (1)	Not at all (0)
1.	Do you get the available e-Agriculture service?				

9. Empowerment of farmers

9. 1. Economic empowerment

Sl. No.	Economic empowerment components	Score											
		Before e-Agriculture use (August, 2013)						After e-Agriculture use (September, 2015)					
		Very Well (5)	Well (4)	Moderate (3)	Low (2)	Very low (1)	Not at all (0)	Very Well (5)	Well (4)	Moderate (3)	Low (2)	Very low (1)	Not at all (0)
1.	Increased Income due to yield obtaining												
2.	Saving Money												
3.	Investments												
4.	Availing agriculture loans												
5.	Purchase of inputs of farming												
Total													
Total Score = Score of after e-Agriculture use - Score of before e-Agriculture use =													

9.2. Family and social empowerment

Sl. No	Family and social empowerment components	Score											
		Before e-Agriculture use (August, 2013)						After e-Agriculture use (September, 2015)					
		Very Well (5)	Well (4)	Moderate (3)	Low (2)	Very low (1)	Not at all (0)	Very Well (5)	Well (4)	Moderate (3)	Low (2)	Very low (1)	Not at all (0)
1.	Developing institutional contact												
2.	Linkage with developing departments												
3.	Team spirit												
4.	Leadership quality												
5.	Group consensus to solve problem												
Total													
Total Score = Score of after e-Agriculture use - Score of before e-Agriculture use =													

9.3. Political empowerment

Sl. No	Politicalempowerment components	Score											
		Before e-Agriculture use (August, 2013)						After e-Agriculture use (September, 2015)					
		Very Well(5)	Well (4)	Moderate (3)	Low (2)	Very low (1)	Not at all (0)	Very Well (5)	Well (4)	Moderate (3)	Low (2)	Very low (1)	Not at all (0)
1.	Participation in social well-being activities												
2.	Membership in the social organization												
3.	Freedom of expression												
4.	Conflict management												
Total													
Total Score = Score of after e-Agriculture use - Score of before e-Agriculture use =													

9.4. Knowledge empowerment

Sl. No.	Knowledge empowerment components	Score											
		Before e-Agriculture use (August, 2013)						After e-Agriculture use (September, 2015)					
		Very Well (5)	Well (4)	Moderate (3)	Low (2)	Very low (1)	Not at all (0)	Very Well (5)	Well (4)	Moderate (3)	Low (2)	Very low (1)	Not at all (0)
1.	Use of machineries & equipments												
2.	Knowledge on value addition												
3.	Adoption of IPM practices												
4.	Adoption of INM practices												
5.	Adoption of IWM practices												
Total													
Total Score = Score of after e-Agriculture use - Score of before e-Agriculture use =													

9.5. Psychological empowerment

Sl. No.	Psychological empowerment components	Score											
		Before e-Agriculture use (August, 2013)						After e-Agriculture use (September, 2015)					
		Very Well (5)	Well (4)	Moderate (3)	Low (2)	Very low (1)	Not at all (0)	Very Well (5)	Well (4)	Moderate (3)	Low (2)	Very low (1)	Not at all (0)
1.	Motivation in farming												
2.	Self esteem												
3.	Risk taking ability												
4.	Confidence												
5.	Decision making ability												
Total													
Total Score = Score of after e-Agriculture use - Score of before e-Agriculture use =													

Thanks for your kind co-operation.

……..…….Date: Signature of the interviewer

APPENDIX-B

English Version of the Interview Schedule (CONTROL GROUP)
Department of Agricultural Extension and Information System
Sher-e-Bangla Agricultural University, Dhaka-1207.

Interview schedule for data collection for the research on

"EMPOWERING FARMERS THROUGH e-AGRICULTURE"

(The interview schedule is entitled for a research study)

Serial No. :

Name of the respondent :

Village : Upazilla : Manikganj

District : Manikganj Occupation: Farmer

Distance: Timing: Medium of communication:

(Please answer the following questions. Secrecy will be strictly maintained.)

1. Age

How old are you? Age…….years

2. Education

Please mention your educational status-

(a) Can't read and write…….
(b) Can sign only……..…..
(c) Read up to class ……...
(d) Others (specify) …….

3. Farm size

Please mention your land area-

Sl.No	Types of land	Area(local)	Area(hector)
1.	Own homestead		
2.	Own land under own cultivation		
3.	Own pond and garden		
4.	Own land given on borga to others		
5.	Land taken on borga from others		
6.	Land taken on lease from others		
7.	Land given on lease to others		
8.	Others		
Total area =			

4. Empowerment of farmers

4.1. Economic empowerment

Sl. No.	Economic empowerment components	Score											
		At the time of data collection (September, 2015)						Before 2 (two) years ago (August, 2013)					
		Very Well (5)	Well (4)	Moderate (3)	Low (2)	Very low (1)	Not at all (0)	Very Well (5)	Well (4)	Moderate (3)	Low (2)	Very low (1)	Not at all (0)
1.	Increased Income due to yield obtaining												
2.	Saving Money												
3.	Investments												
4.	Availing agriculture loans												
5.	Purchase of inputs of farming												
Total													
Total Score = Score of at the time of data collection - Score of before 2 (two) years ago =													

4.2. Family and social empowerment

Sl. No	Family and social empowerment components	Score											
		At the time of data collection (September, 2015)						Before 2 (two) years ago (August, 2013)					
		Very Well (5)	Well (4)	Moderate (3)	Low (2)	Very low (1)	Not at all (0)	Very Well (5)	Well (4)	Moderate (3)	Low (2)	Very low (1)	Not at all (0)
1.	Developing institutional contact												
2.	Linkage with developing departments												
3.	Team spirit												
4.	Leadership quality												
5.	Group consensus to solve problem												
Total													
Total Score = Score of at the time of data collection - Score of before 2 (two) years ago =													

4.3.Political empowerment

Sl. No	Politicalempowerment components	Score											
		At the time of data collection (September, 2015)						Before 2 (two) years ago (August, 2013)					
		Very Well (5)	Well (4)	Moderate (3)	Low (2)	Very low (1)	Not at all (0)	Very Well (5)	Well (4)	Moderate (3)	Low (2)	Very low (1)	Not at all (0)
1.	Participation in social activities												
2.	Membership in the social org.												
3.	Freedom of expression												
4.	Conflict management												
Total													
Total Score = Score of at the time of data collection - Score of before 2 (two) years ago =													

4.4.Knowledge empowerment

Sl. No.	Knowledge empowerment components	Score											
		At the time of data collection (September, 2015)						Before 2 (two) years ago (August, 2013)					
		Very Well (5)	Well (4)	Moderate (3)	Low (2)	Very low (1)	Not at all (0)	Very Well (5)	Well (4)	Moderate (3)	Low (2)	Very low (1)	Not at all (0)
1.	Use of machineries & equipments												
2.	Knowledge on value addition												
3.	Adoption of IPM practices												
4.	Adoption of INM practices												
5.	Adoption of IWM practices												
Total													
Total Score = Score of at the time of data collection - Score of before 2 (two) years ago =													

4.5. Psychological empowerment

Sl. No	Psychological empowerment components	Score											
		At the time of data collection (September, 2015)						Before 2 (two) years ago (August, 2013)					
		Very Well (5)	Well (4)	Moderate (3)	Low (2)	Very low (1)	Not at all (0)	Very Well (5)	Well (4)	Moderate (3)	Low (2)	Very low (1)	Not at all (0)
1.	Motivation in farming												
2.	Self esteem												
3.	Risk taking ability												
4.	Confidence												
5.	Decision making ability												
Total													
Total Score = Score of at the time of data collection - Score of before 2 (two) years ago =													

Thanks for your kind co-operation.

…….Date:
Signature of the interviewer

Appendix-C

Changed mean value difference between Study Group(SG) and Control Group (CG)

Sub-parameter of empowerment	Empowerment indicator	Changed mean value difference	Situation of SG versus CG
Economic empowerment	Increased Income due to yield obtaining	0.281	SG >CG
	Saving Money	0.38	SG >CG
	Investments	0.554	SG >CG
	Availing agriculture loans	0.568	SG >CG
	Purchase of inputs of farming	0.031	SG >CG
Sub total		1.812	SG >CG
Family and social empowerment	Free to work with group members	0.26	SG >CG
	Involvement in decision making	0.243	SG >CG
	Team spirit	0.344	SG >CG
	Leadership quality	0.349	SG >CG
	Group consensus to solve problem	0.51	SG >CG
Sub total		1.707	SG >CG
Political empowerment	Participation in Social well-being activities	0.136	SG >CG
	Membership in the social organization	-0.05	SG <CG
	Freedom of expression	0.427	SG >CG
	Conflict management	0.392	SG >CG
Sub total		0.904	SG >CG
Knowledge empowerment	Use of machineries & equipments	0.417	SG >CG
	Knowledge on value addition	0.412	SG >CG
	Adoption of IPM practices	0.468	SG >CG
	Adoption of INM practices	-0.029	SG <CG
	Adoption of IWM practices	0.269	SG >CG
Sub total		1.538	SG >CG
Psychological empowerment	Motivation in farming	0.352	SG >CG
	Self esteem	0.276	SG >CG
	Risk taking ability	0.246	SG >CG
	Confidence	0.349	SG >CG
	Decision making ability	-0.026	SG <CG
Sub total		1.197	SG >CG