ST. MARY'S UNIVERSITY

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Practices and Challenges of Using ICT in Agro-processing Firms: The Case of Ethio Agri-CEFT Plc

Samuel Gebremeskel Teka

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This is to certify that the thesis prepared by Samuel Gebremeskel Teka, entitled "PRACTICES AND CHALLENGES OF USING ICT IN AGRO-PROCESSING FIRMS: THE CASE OF ETHIO AGRI-CEFT PLC" and submitted to the School of Graduate Studies Presented in Partial Fulfillment of the Requirements for the Degree of Master of Business Administration in Project Management complies with the regulations of the university and meets the accepted standards with respect to originality and quality.

Chair Man (Institute Dean) Signature

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DECLARATION

I declare that this thesis for the Masters of Business Administration in Project Management at St. Mary's University of Addis Ababa, hereby submitted by me, is my original work and have not previously been submitted for a degree at this or any other University, and all references materials contained therein have been duly acknowledged.

Name: Samuel Gebremeskel Teka

Signature _____

ENDORSEMENT

This Thesis has been submitted to St. Mary's University, School of Graduate Studies for examination with my approval as a university masters student adviser.

Dr. Maru Shete (Assoc. Prof.)

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List of Abbreviations and Acronyms Used

ATA: Ethiopian Agricultural Transformation Agency

ETC: Ethio Telecom

EAC: Ethio Agri-CEFT plc

EC: Ethiopian Calendar

EAP: Ethiopian Agricultural Portal

ECX: Ethiopian Commodity Exchange

EICTDA: Ethiopian ICT Development Agency

EIAR: Ethiopian Institute of Agricultural research

FAO: Food and Agriculture Organization

ICT: Information Communication Technology

IPMS: Improving Productivity and Market Success

IDS: Internet Database System

IVRS: Interactive Voice Response

LIC: Lower Income

LMIC: Lower Middle Income

MOARD: Ethiopian Ministry of Agriculture and Rural Development

MILS: marketing information and linkage System

MRC: Market Resource Centers

MCIT: Ethiopian Ministry of Communication and Information Technology

OCDE: Organization for Economic Co-operation and Development

SMS: Short Message Service

UMIC: Upper Middle Income

UNIDO: United Nations Industrial Development Organization

UNDP: The United Nations Development Program

UNSD: United Nations Statistics Division.

USEPA: United States Environmental Protection Agency

USAID: United States Agency for International Development

UNESCO: The United Nations Organization for Education, Science and Culture

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Abstract

This research project aims to describe the practice and challenges of adopting information communication technology in agro-processing firms. In order to achieve the objective of this study and answer the research questions the researcher implemented mixed research approach. This descriptive and exploratory research was conducted based on the data gathered using questionnaire, observation checklist and semi-structured interview, from five different locations of Ethio Agri-CEFT plc which is a MIDROC Ethiopia investment group company participated in agro processing sector. The data collected was analyzed using descriptive method of analysis. The finding of this study revealed that practice of using ICT infrastructures mobile phone, Internet and computer for agricultural activities are indicated reluctant progress due to the network, resource, skill, electric power interruption and high service price tariff problems. Correspondingly the monopoly system of the service provider also discussed as a basic challenge on using ICT for agriculture. Based on the findings, the researcher recommends that the company should focus on continuous ICT training, updating computer and related technological equipment, adopting new ICT system from other countries experience, creating ICT based agricultural knowledge management, TQM and agricultural value chain management systems. Also, acclaim about creating awareness on agricultural information hotline SMS service.

Key Words: ICT, Agriculture, Agro-Processing

CHAPTER ONE
INTRODUCTION

1.1 Background of the Study

The strategic application of ICT to the agricultural industry, the largest economic sector in most African countries, offers the best opportunity for economic growth and poverty alleviation to the continent. Food security is paramount for the survival of individuals, families and ultimately nations, yet Africa's agriculture sector has been in decline over the past 40 years (Yonazi, 2012).

According to FAO (2012), agro-processing industry is a subset of manufacturing that processes raw materials and intermediate products derived from the agricultural sector. Agro-processing thus means transforming products that originate from agriculture, forestry and fortified wine. The Standard Industrial Classify cation categorizes divisions like food, beverages, paper and paper products, wood and wood products, textiles, wearing apparel, furniture, tobacco, rubber products, footwear and leather and leather products under the agro-processing industry.

Ethio Agri-CEFT, one of the largest private players in the agricultural and agro-processing industries in the Federal Democratic Republic of Ethiopia, established in January 1, 1998 under the MIDROC Ethiopia Investment Group Company engaged in the production and processing of various agricultural products. Throughout its ten farms located across the country and its processing center located in the capital, the company has continued to play an important role in realizing the investment group's developmental goals. Ethio Agri - CEFT, at both the head office in Addis Ababa and in the farms located in the different Regions of Ethiopia, has so far created job opportunities for 14,822 citizens out of which 2,282 are permanent, 247 are contract and 12,291 are casual workers (EAC 2016). At this time information and communication technology application in agriculture plays a vital role in supporting productivity and production. In the meantime, Ethio Agri-CEFT plc is one of the biggest agro-processing company in Ethiopia therefore there is a great deal of using ICT in respect to modern agro-processing.

ICTs certainly play a key role to contribute to reduce asymmetries of information and communication between stakeholders of an agricultural value chain, and to help reduce the vicious circle of rural poverty. However, the positive impact that ICTs may play in agricultural value chains depends in large part on the boost of supportive public policies and innovative initiatives in the use of ICT that tend towards equitable access to the most socially disadvantaged and vulnerable groups in rural communities, particularly, agricultural producers, as the fundamental link in the value chain (Kyoko & Toshiro, 2009).

Since Ethio Agri CEFT produces and process large verity of agricultural products in different rural areas of the country (EAC, 2016), it's important to integrate its activities with ICT to improve competitiveness, traceability, process control, transparency in market information, reducing production costs, and identification and tracking of consumer needs.

1.2 Statement of the Problem

New technologies in the information and communication field are seen as guide in a new age. However, they have not moved enough in all global activities. The existing influence relations in the agro-processing sector determine possibility of utilizing the benefits from ICT, but it needs to run in timely fashion. In Ethiopia, even if progress is being made in using ICT to provide a wide range of knowledge and information, it is comparatively low from other sub-Saharan countries (UNDP, 2012).

According to Yola et al, 2012, in recent times agriculture constantly experiences advanced technologies. The use of information communication technology (ICT), such as e-mail and the World Wide Web, has become obligatory to support the sector. ICT builds an opportunity for agricultural industry by increasing information flow to all stakeholders at a decreased cost. adopting ICT in agriculture will allow the industry, especially managers, to increase information flow and the demand for a firm's products and services. ICT is another physical infrastructure which has a tremendous role to play in agriculture in respect of bridging the communications boundary which is created by geographical blocks.

Most of the time it is realized that knowledge for using ICT in agriculture is not a prerequisite adoption, despite the approach that agriculture is a comprehensive business as any other, most farming businesses limit their management efforts to production aspects. In comparison to other businesses, farming is usually isolated in location and it's challenging for professional decisions. This is a critical situation that encourages changes in production methods and changes in business management methodology by adopting ICT systems to every activity ahead (Yola et al, 2012).

Information Technology have now become the drivers of globalization of the economy, with their complementarities of liberalization, privatization and tighter intellectual property rights. As we entered into the 21st century, the realm of electronic communication, which encompasses telecommunication, broadcasting, information technology, and services and industries, is undergoing profound changes, leading to a Global Information Infrastructure (GII), which will be capable of carrying any type of information, be it text, data, voice or video. Information is now broadly defined to embrace voice in telephony, text in fax and newspapers, images in video and TV broadcasting, and data in computers. ICT can play a decisive role in benefiting the resource strapped farming industry with up to date knowledge and information on agricultural technologies, best practices, markets, price trends, and weather conditions (Kayiska, 2012).

The power of ICT in agriculture is its ability to catalyze a wide range of interventions that are core to transforming the sector. For example, ICT can leverage mobile information for farming advice, enable mobile money to exchange and save capital, or rapidly alert farming society in emergency situations such as severe weather, diseases and pests. The main objective of the ICT for Agricultural Services program during GTP II is to develop and support ICT related solutions for all agricultural challenges encountered by government institutions, smallholders, privet investors and other key stakeholders. Drawing upon insights and recommendations from Ethiopia and abroad, the program will also actively support the establishment and implementation of a comprehensive ICT in agriculture strategy to enhance innovation, efficacy, knowledge sharing, and transparency in the sector (ATA, 2011).

According to the above sources ICT and agriculture has a very high meaningful relationship. Since ICT is a very rapid developing concept it needs a continuous assessment and research to become more updated, accurate and reliable to produce significant change in the development of agriculture and agro-processing sectors. This research needs to verify the best practice and challenges faced in order to improve the agro-processing activities in considering ICT as a basic element to increase economic benefits, quality and an operation advancement.

The target firm of this study Ethio Agri-CEFT plc which is a MIDROC Ethiopia Investment group company has a 19 years of experience in agro-processing and agricultural development practice in producing processed tea, cereals, coffee, flower, fruits, vegetables, fattening, dairy, beekeeping and forestry farming in Amhara, Oromia and Southern regional states. Therefore, the research was conducted based on the practice and challenges that the firm has in the past 19 years of operation as regards to adopting ICT applications. This study examines how ICT and related technologies can be used as a potential support to agro-processing firm's activity underlying productivity, quality and communication issues that have affected agro-processing in Ethio Agri-CEFT plc. According to Chapman and Slaymaker (2002), ICT increases access to relevant information for agriculture on production, technology, weather, finance and marketing of farm products. Such information is instrumental in making important farming and marketing decisions such as what sort of crops and commodities to grow in the future and the best time and place to sell and buy agricultural inputs and outputs. Any relevant agricultural information which is driven by ICTs can help agricultural firms and farmers to make informed decisions about their farming enterprise, could potentially increase agricultural productivity and income. ICT is now being used in agriculture to disseminate personalized and timely expert advice without necessarily offering face-to-face services to the farming stakeholders.

Therefore, as per the primary research information on the given area, the problem is almost untouched and there is a knowledge gap on using ICT in agriculture development, adopting the ICT system for agriculture is extremely interesting subject but the available researches are not enough to overcome the existing problem and still there is a space to make additional investigation which will contribute ideas for the extent. The ICT practice and challenge in agro-processing activities that are discussed in this research will contribute more point of views to satisfy the gap on the area of study.

1.3 Basic Research Questions and Objectives

1.3.1 Research Questions

Since ICT is not widely used in the agro-processing sector the field is not growing as fast as expected. ICT has a key role in determining the sustainable growth of the agro-processing sector. This research was assessing the achievement and challenges that the target company experienced on using ICT and related infrastructure to meet a better performance, profit, standard quality and efficiency. In order to answer the problem statement, it is helpful to first answer the following research questions:

1) What are the ICT implementation practices of Ethio Agri-CEFT?
2) What are the different types of ICT infrastructure available in Ethio Agri-CEFT?
3) What are the success and challenges met by Ethio Agri-CEFT in using ICT?

1.3.2 Objectives of the Study

The research is intended to address the following basic objectives:

1.1. To assess the practices of ICT implementation in Ethio Agri-CEFT.
1.2. To explore the different types of ICT infrastructure used in the company.
1.3. To find out the achievements and challenges of using ICT in the company.

1.4 Definition of Terms Used

ICT: is technology that supports activities involving information. Such activities include gathering, processing, storing and presenting data. Increasingly these activities also involve collaboration and communication (Megha, 2012). In this study it refers mobile telephone (analog and smart), Internet (wired and wireless) and computer (desktop, laptop, tablet).

Information: is the particular instances of reality as experience, perceived or understood by an individual in a specific context (Kornai, 2008).

Communication: can be defined as the process of transmitting information and common understanding from one person to another (Lunenburg, 2010).

Internet: The term internet comes from the word inter-network an interconnected set of networks (Miller & Slater, 2010).

Computer: Computer is an electronic device that is designed to work with Information (Michael, 2010). In this study it refers desktop, laptop and tablet computers.

Mobile Telephone: a wireless handheld device that allows users to make calls and send text messages, among other features, connect to a terrestrial cellular network of base stations (cell sites), whereas satellite phones connect to move around satellites (Kahaner and Green, 2010).

Tablet: is a mobile computer with a touchscreen display, which is usually in color, processing circuitry, and a rechargeable battery in a single thin, flat package. Most tablets also have sensors, including digital cameras, a microphone (Hartley, 2011).

Fiber Optics: fiber optics is a medium for carrying information from one point to another in the form of light. Unlike the copper form of transmission, fiber optics is not electrical in nature (Massa, 2012).

Agriculture: Agriculture is the systematic raising of useful plants and livestock under the management of man (Bareja, 2014).

Agro-processing: definition of agro-processing industry refers to the subset of manufacturing that processes raw materials and intermediate products derived from the agricultural sector (Wilkinson & Rocha, 2008).

E-Agriculture: is a global Community of Practice, where people from all over the world exchange information, ideas, and resources related to the use of information and communication technologies (ICT) for sustainable agriculture and rural development (World Bank, 2012).

ICT Base Agricultural Information Knowledge Management: defined as the fact or condition of knowing something with a considerable degree of familiarity acquired through experience, association or contact (William and Michael, 2005).

Agricultural Value Chains: a value chain is a set of linked activities that work to add value to a product; it consists of actors and actions that improve a product while linking commodity producers to processors and markets (Calvin and Linde, 2013).

WoredaNet: is major government initiative connecting local government offices to the internet and each other (Adam, 2010).

1.5 Significance of the Study

The company selected for this study, Ethio Agri-CEFT plc has advanced and remarkable share on the Ethiopian agricultural sector the practice and challenges of the firm regarding to ICT will provide a significant result about the current status of the ICT in agro-processing. Thus, the findings of this study will provide a decisive point on the success and challenges of using ICT in agro-processing sector, which will help to improve the practices of using ICT in the area by indicating the progress and challenges that the target company handled while adopting ICT in the corporate process.

1.6 Scope of the Study

This research was conducted on five assorted units of Ethio Agri-CEFT plc located in different areas of the country, it includes the head office and tea processing and Packing Factory located in Addis Ababa, Holeta flower farm located at Holeta city, Bir Serials farm located at Fnote-Selam, Gojam, WushWush tea farm and semi process factory located at Wush Wush, Kefa Zone. Specifically, the study intends to investigate the use and availability of three classes of ICT modules; mobile telephone, internet and computer on the selected units of the target company.

1.7 Limitation of the Study

The study has engaged with some sort of limitations. The target areas which the research conducted are located in different regional states of the country which had impacts on data collection period, the other limitation were some respondents gave incomplete response and not returned the questioners due to confidentiality problem and inflexible time to respond, also this research faced unavailability of well-organized observation arrangement that can be easily accessed for the purpose of this study. Shortage of time and budget are the major limitation to undertake the study.

1.8 Organization of the Thesis

The research was organized in to five chapters. chapter one presents introduction, which is the basic of the study, chapter two contains a review of the related literature on agro-processing and ICT terms, in chapter three the research design, data collection instruments, sampling techniques and methodology were presented, results and discussion with the help of descriptive and explanatory analysis were presented in chapter four Finally, chapter five presents conclusions and recommendation that helps for stakeholders and further study on the area.

CHAPTER TWO

REVIEW OF RELATED LITERATURE

2.1 Introduction

This thesis is intended to study the potential roles of ICT for agro-processing and agribusiness in terms of accessing and disseminating relevant and timely information to the target beneficiaries. Specifically, it is designed to investigate how ICT contribute a change in agro-processing activities. The study was exploring the firm's awareness or knowledge on using ICT in Agricultural processing. Effective adoption of Information and Communication Technologies (ICT) has a proven record of attaining significant economic, social and environmental benefits at local, national and global levels. In the developed world, ICT demonstrated that it is the pivot of socioeconomic development. With the help of ICT, the developed countries have successfully transformed their economy to be knowledge based. Today there is almost no economic sector that is not supported by ICT applications (OECD, 2005).

This part is, therefore, designed to review literature related to the conceptual framework of the study and, on the other hand, embodies the specific direction by which the study was undertaken. In the literature review the theoretical frame work of the study was also discussed. The literature includes these main concepts ICT and its application in agro-processing firms in Ethiopia and some model countries. These topics are discussed as follows.

2.2 ICT (Information Communication Technology)

According to Porter (1985), ICT adoption is an organization's approach to the acquisition and use of ICT. Because of the power of technological change to influence industry structure and competitive advantage, an organization's ICT strategy becomes an essential ingredient in its overall competitive strategy. ICT refers to forms of technology that are used to transmit, process, store, create, display, share or exchange information by electronic means and includes such technologies as radio, television, video, DVD, telephone (both fixed line and mobile phones), fax, satellite systems, and computer and network hardware and software, as well as the equipment and services related with these technologies, such as video conferencing and email (UNESCO, 2007).

Information and communication technologies facilitate the processing and transfer of information, i.e. communication by electronic means. ICT generally link Information processing devices like computers with telecommunication technologies like telephones, wired or wireless networks. ICTs

are a range of electronic technologies which when converged in new configurations are flexible, adaptable, enabling and capable of transforming organizations and redefining social relations. The range of technologies is increasing all the time and there is a convergence between the new technologies and conventional media (Don, 2010).

ICTs are essential in the area of development. Chapman (2002) opposes that information needs to be predictable effectively to assist those making decisions that affect the sustainability, productivity and profitability of people's livelihoods. Thus, correct and updated information can be needed by farmers and agricultural institutions so that they have abundant time to make decisions on issues of agriculture at household and other levels. However, improved information systems can help decision making at all levels so as to achieve effective livelihood strategies. That is why the provision of information in agriculture is important because it informs livelihood strategies to the poor, policy makers, agencies and agricultural institutions that are accountable in the process of reducing poverty. Improved ICTs can enable individuals to organize themselves, use information to hold institutions accountable and put pressure on relevant authorities to deal with their problems.

The communication of information is an important part of the agricultural domain. Throughout its history, farmers and agricultural stakeholders have shared knowledge about everything from growing strategies to market prices. Pest epidemics, droughts, and other farming issues are bound to arise and advice from other farmers can help with handling these problems. With modern technology, farmers and agricultural sectors can quickly communicate questions about adapting to sudden weather changes or other concerns. Applications and devices have improved accuracy, such that research related to the supply chain, item tracking, increasing yields, etc. With the rising global food market, information and communication technology (ICT) has become increasingly important for agriculture. An ICT is a tool or application that allows the exchange of data through transmission. ICTs can include anything from a small device such as mobile phones, or nanotechnology for food safety, or even satellite imagery (World Bank Group, 2012).

Nowadays, agricultural sectors and farmers have direct access to computerized weather forecasting, this allows them to properly manage their lots to maximize yield. Much of this weather forecasting is done with computers. The most important tool to predicting weather in the future is observing the current state of the weather. Forecasters use observations taken from satellites

(which take up to 210 million observations per day) to predict what might happen. These observations are recorded in a computer, and are ready to be used in the computer models. Using data based on temperature, pressure, precipitation, and more, forecasters can run one of hundreds of computer models designed to predict what might happen. The models are based on past weather events as well as local geography (elevation, high or low pressure, etc). The farmers and institutions in turn use the forecast predicted by the computerized weather model to scale how much rain will be coming in, as well as how dry the upcoming weather will be, amongst other factors (Preeti, 2011).

The information and communication technologies (ICT) sector has seen a rapid development since the last ICT sector strategy of the World Bank Group (WBG) was prepared in 2000. The total number of mobile phone subscriptions in developing countries jumped from 200 million in 2000 to 3.7 billion in 2010, and the number of Internet users grew more than ten times. As reveled by the group's study in 2010, the proportion of population in the less developed countries with access to fixed or mobile telephone has reached 70 percent; and more than 20 percent of the population of developing countries use internet. ICT is therefore, no longer a luxury infrastructure but a necessary utility for developing countries (World Bank, 2011).

2.2.1 ICT Infrastructure Dissemination Practice in the World

According to Huber (2009), by given its new way of linking and accessing information, the Internet will bring a new era of economic prosperity, lead to the development of intelligent search engines that will deliver to us just the information we desire, solve the problems of mass education, put us in touch with all of actual reality, enable us to explore virtual worlds that enable us to have even more flexible identities than we have in the real world and thereby add new dimensions of meaning to our lives.

According to ITU (2016) the European and Americans are on the top level in using the internet while Africa is the list, figure 2.1 show the internet usage in the world in 2016 and figure 2.2 also shows the dissimilarity of internet usage in developed and developing countries which has 40% variance.

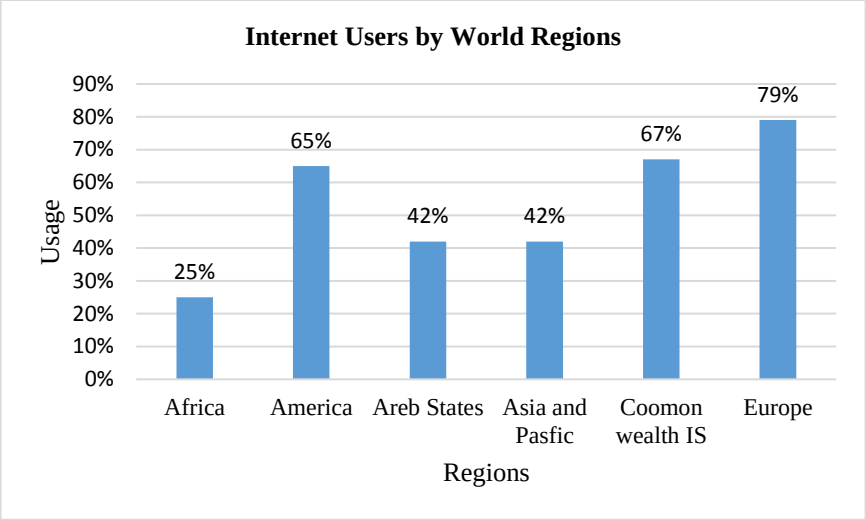

Figure 2.1: Internet users by world regions (ITU, 2016).

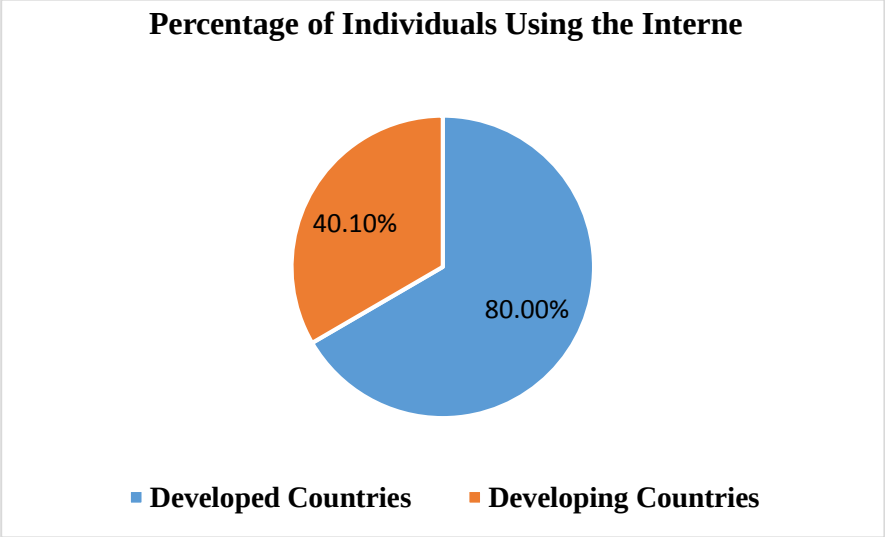

Figure 2.2 Internet users in developed and developing countries (ITU, 2016)

According to the International Telecommunications Union (ITU), the use of cellular telephones has grown faster than fixed-line telephones in developing countries. The mobile phone and new processes using video are mentioned as the most popular modern ICT for farmer-to farmer communication and innovation sharing, noting that video normally requires the involvement of an intermediary. While communication at this level has always existed, and ICT can simply supplement these channels, with increased communication there is a much greater need for individuals (e.g. extension agents, intermediaries) to validate and further disseminate the information, and support its adoption (ITU, 2011).

Mobile services based on GSM technology were first launched in Finland in 1991. Today, more than 690 mobile networks provide GSM services across 213 countries and GSM represents 82.4% of all global mobile connections. According to GSM World, there are now more than 2 billion GSM mobile phone users worldwide. GSM World references China as "the largest single GSM market, with more than 370 million users, followed by Russia with 145 million, India with 83 million and the USA with 78 million users (ITU, 2016).

2.2.2 ICT Infrastructure Dissemination Practice in African

A study by Farrell & Isaacs (2009) on ICT in 53 African countries revealed the wide use of ICT in the region with countries such as Algeria, Egypt, South Africa and Botswana leading in ICT use. In East Africa, Rwanda is probably the most advanced country in terms of ICT use with 65% of its population being covered by mobile telephony. The country has also a high level of internet use and access to television and radio broadcasts. In Kenya, Uganda and Burundi the use of ICT is also well advanced, especially for mobile phone subscribers, TV and radio listeners. This high use of ICT is likely to stimulate economic development in developing countries, including the agricultural sector where a high proportion of the African population derives their livelihoods.

The figure 2.3 below shows the ITU (2016), report on the usage of internet in some of the sub-Saharan countries. According to this report Ethiopia is the list on using internet in respect to kenya, Uganda, Ghana and South Africa.

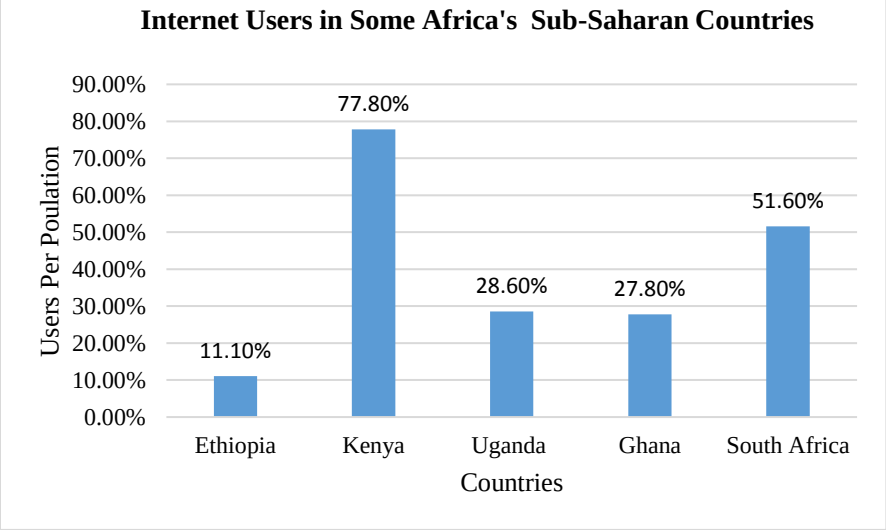

Figure 2.3 Internet users in some Africa's sub-Saharan countries (ITU, 2016)

Mobile-broadband penetration levels are highest in Europe and the Americas, at around 78 active subscriptions per 100 inhabitants Africa is the only region where mobile broadband penetration remains below 20 percent (ITU, 2016). See also figure 2.4 for mobile subscription information in some Sub-Saharan countries.

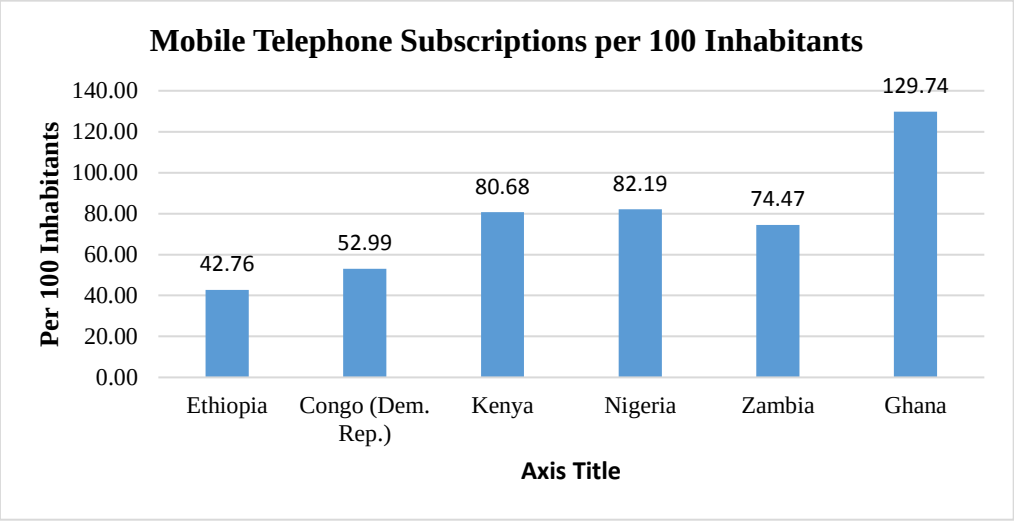

Figure 2.4 Mobile subscription in some Sub-Saharan countries (ITU, 2016)

2.2.3 ICT Infrastructure Dissemination Practice in Ethiopian

According to ITU, 2015, Internet coverage in Ethiopia has been improving in recent years. The number of subscribers has doubled in 2009 along with the introduction of mobile access using CDMA 1X, EVDO and 3G. There were 11,538,000 subscribers, which translates into 11.1% of the population but still Ethiopia is way behind the world average Internet usage of 25.9%. Ethiopia has Africa's last big telecoms monopoly. The absence of competition has seen a country of more than 80m lag badly behind the rest of the continent in an industry that has generally burgeoned alongside economic growth. Mobile-phone penetration, which averages 70% of the population elsewhere in Africa, is closer to 25% in Ethiopia. A paltry 2.5% of Ethiopians have access to the internet, compared with 40% in neighboring Kenya. The diffusion of the Internet is partly hampered by the monopoly on its market that has elsewhere been liberalized. In August 2005, the government issued a directive that allows private companies to provide Internet service through the ETC's infrastructure, but the regulations to implement Virtual Internet Service Provision (VISP) were not promulgated. Consequently, Internet services remained a monopoly of the incumbent, often resulting in frustratingly. In the same hand ITU, 2016, indicate that the average value for Ethiopia's mobile subscribers are 42.31 million in 2016.

Ethio Telecom announced that Ethiopia has been building its fiber backbone which is helpful to deliver a fastest internet service throughout the country (see appendix B). The national backbone fanning out from the capital Addis Ababa in seven directions has been under construction following the signing of a loan agreement with ZTE. The 10,000km fiber network connects 78 towns with a capacity of STM-1 (i.e. 155 Mb/s), 46 towns with a capacity of STM-16 (i.e. 2.5 GB/s) and 9 towns with a capacity of 10 GB/s. A total of 113 towns out of the envisaged 500 have been connected to the optical fiber transmission link by the end of 2009 EC. Figure 2.5 shows the route of the national backbone, which is expected to be completed by the end of 2010 EC. Phase I of the network was completed in 2008 EC and phase II was completed by mid-2010. The ETC is implementing Phase III at the moment (ETC, 2008/2009).

Internet pricing in Ethiopia has undergone several revisions in 2002, 2006 and 2009 to encourage further usage. Prior to 2002, Internet pricing was based on five subscriber categories which are individual home users, private businesses, international organizations, public institutions and local non-profit organizations. A fee structure that was based on volume of usage was introduced in 2002. At the time 30 hours (1800 minutes) of use was US$40. In 2006, the ETC revised the price downward, leading to a reduction of the set-up fee to US$20, a compulsory monthly usage charge of US$7 and volume use-based tariffs. The revision in 2006 brought the price of 30 hours Internet usage down by almost a half (US$26) from its value in 2002. Further downward revision took place in 2009, by which stage 30 minutes of Internet use cost US$14 (ETC, 2008/2009).

2.1.3.1 ICT Policies in Ethiopia

As EICTDA clarifies, ICT has become an integral part of Ethiopia's development programs over the last decade, following initial indifference to the development of the sector. The country faces a substantial gap between interest in the ICTs and the policy and regulatory tools available to enable its development. ICT is one of the major components of the Sustainable Development and Poverty Reduction Program (SDPRP) of the Ethiopian government. The most consolidated and recent policy framework is the Plan for Accelerated and Sustainable Development to End Poverty (PASDEP) that runs between 2005 and 2010. Five major initiatives were designed with regard to the ICT sector development in the PASDEP document, first promoting human resource development in the ICT field, second mainstreaming the use of ICT in all sectors of the economy,

in the administration of government, and in the education system, third developing the necessary telecommunications infrastructure, forth promoting research and development through ICT and the last one is creating enabling legal and regulatory framework (EICTDA, 2010).

These include the 1996 proclamation providing for the introduction of competition and licensing for multiple operators. The private sector has since been active in providing ICT and related goods and services, and several firms provide computer hardware and software and services at present. Consistent with its policy objectives, the Government has been licensing large numbers of private sector operators to set up cyber-cafes and to engage in sales, installation and service of communications equipment. Although the private sector is expected to take the lead in ICT development, it has so far remained largely undeveloped with operations confined to major urban centers, particularly Addis Ababa, with limited or no activities in the rural areas of the country.
Reform of Ethiopia's telecommunications industry also resulted in the establishment of the Ethiopian Telecommunications Corporation, a public telecom operator providing services in fixed, mobile, Internet and data communications. The establishment of the Corporation was followed by the introduction of Internet service in 1997 and mobile telephone service in 1998. The Corporation has been aggressively expanding rural connectivity in tandem with the Government's decentralization, public and civil reform programs (ITU, 2010).

2.1.3.2 Challenges of ICT Implementation in Ethiopia

According to Deberetsion (2012), there are different major challenges in ICT implementation in Ethiopia. As he revealed in his report connectivity, bandwidth, computer penetration, insufficient mobile/landline, computer literacy, high service cost, limited resource/finance in developing nations are the digital boundary between developed & developing countries. The ICT infrastructure exist in rural & urban areas are highly different in developing countries. Developing countries have another priority than ICT like poverty, food security, political/democracy, internal conflict, though the infrastructure exist, commitment and skill problem are the barriers of implementing ICT as planned. Ethiopia also faced problems like limited qualified professionals to install, run and maintain the infrastructure and application, lack of ICT skills in the public sector to use the infrastructure and application, inadequate HR training centers and Institutions, and also brain-drain of the qualified professionals abroad or even from public to private, affects government's ICT implementations programs. The major problems listed by the ETC include

difficulties in securing the right of way, vandalism on its fiber network, inadequate supply of the electric power and difficulties with the civil works (ETC, 2008/2009 EC).

2.3 Role of Information Communication Technology (ICT) in Agriculture

Public and private sector actors have long been on the search for effective solutions to address both the long and short term challenges in agriculture, including how to answer the abundant information needs of agribusiness. ICT is one of these solutions, and has recently unleashed incredible potential to improve agriculture in developing countries specifically. Technology has taken an enormous leap beyond the costly, bulky, energy consuming equipment once available to the very few to store and analyze agricultural and scientific data. With the booming mobile, wireless, and Internet industries, ICT has found a foothold in agribusiness even in poor smallholder farms and in their activities. The ability of ICTs to bring refreshed momentum to agriculture appears even more compelling in light of rising investments in agricultural research, the private sector's strong interest in the development and spread of ICTs, and the intensification of organizations committed to the agricultural development agenda (World Bank, 2011).

ICT is not fully utilized in agriculture, scaling up of delivery still remains at experimental stage. Although agricultural sectors and farmers have the real need to access to market information, land records and services, accounting and farm management information, management of pests and diseases, rural development programs and ICT could help accessing these services, but ICT projects dealing with such services are extremely limited. The role ICT can play a part in addressing these challenges since personal ICT devices such as mobile phones or tablet PCs are becoming more widely available. ICT, when embedded in broader stakeholder systems, can bring economic development and growth as it can help bridge critical knowledge gaps. Mobile technology, on the other hand, is increasingly being adopted as the technology of choice for delivery of ICT services and solutions (Richard & Molla, 2009).

According to Mônica Rodrigues (2012), to take advantage of ICTs to reverse the unequal development of agriculture, regional ICT policies must be implemented to overcome the barriers to adoption in the most underdeveloped segments. One possible mechanism is the exchange of successful experiences between countries in the same continents, which share fairly similar realities in terms of the insertion of agriculture in the economy and the origin of sectoral asymmetries. The most extensive experience in different region of the world in terms of facilitating

agricultural sector's access to ICTs has been with telecentres and computer supply and connectivity programs for rural areas. Policy on its own, however, cannot guarantee access to and use of ICTs in these areas. Motivational and educational strategies by the agricultural institution aimed at overcoming resistance, demonstrating the usefulness of the technologies and developing digital skills and content are key. With regard to virtual supply, the most common response in the firms has been to implement data platforms and portals and trainings the use of it. There is also a wide range of experience with cellular messaging, early warning, mobile banking, public procedures, and so on. With regard to training, agricultural stakeholders have benefited from campaigns that position digital education in the context of providing connectivity and specific content for the sector.

The more traditional ICTs, like the radio, in rural households, many projects in the developing countries have been designed to combine both traditional and advanced ICTs, thereby maximizing the number of potential users. For example, many agricultural projects combine Internet use, information gathering based on digital sensors and geo-referencing, contact with key informants, and diffusion via the radio or cellphones. This use of a variety of diffusion mechanisms allows the greatest number of agricultural producers in remote areas to have access to information on prices in regional markets, weather forecasts, planting and harvesting conditions and pest infestations. These producers can also find out about the allocation of public resources, and they can follow the implementation of policies that might benefit them. Impact studies show that the results of this type of project can be significant, especially for agricultural relations. In some cases, the result is an increase in income stemming from higher sales prices, a reduction in losses due to extreme climatic conditions and a greater and more efficient allocation of public resources to rural areas (Francine, 2012).

Agriculture provides the agribusiness with income from the agricultural products. Hence, the need of information by the agribusiness is a necessity because it is used in pursuing livelihood activities and strategies. Institution, for instance, need to have an increase in agricultural productivity. They experience low productivity due to weak communication culture, lack of competitive markets, and lack of inputs such as seed, fertilizers and financial services because of lack of appropriate information (Jason et al, 2010).

ICT can accelerate agricultural development by facilitating knowledge management. Agricultural institutions can take full advantage of ICT to enhance productivity and generate more income by adopting new technologies, including new varieties, adding value and marketing their products. Timely access to market information via communication networks also helps the agricultural management bodies to make well informed decisions about what crops to plant and where to sell their produce and buy inputs. The benefit of ICT extends to economic aspects such as better earnings or production (Cheryll, 2007).

Information and communication tools such as cell phones, the internet, radio, and television can dramatically improve agricultural institutions, farmers and intermediaries access to information relevant for agriculture production and agribusinesses. The tools can be used to raise awareness or to provide specific information in response to questions about agricultural technologies, markets, prices, etc. As such these tools are just a part of the process and are most effective if combined with established good practice (USAID, 2013).

Agro-processing sector for developing countries is currently being reconsidered in the light of two distinct although inter-related trends. On the one hand, important changes have been observed in global food trade with processed products now predominating in developing country exports and imports. Demographic trends, on the other hand, indicate that almost all net, population growth is now concentrated in developing count rise in a context of rapid urbanization in all continents, although at different stages. Growth, which of itself demands a different organization of the food system in which the preservation of foodstuffs becomes strategic is accompanied in middle-income developing countries, by a nutritional transition stimulating new food categories, and by the demand for convenience foods. The importance and roles attached respectively to trade and to foreign investment when discussing the agro-processing sector in developing countries is influenced by the relative weight attributed to each of these two overall trends (Wilkinson and Rocha, 2008).

The enhanced growth of agro-industries in developing countries also poses risks in terms of equity, sustainability and inclusiveness. Where there is unbalanced market power in agri-food chains, value addition and capture can be concentrated among one or a few chain participants, to the detriment of the others. Agro-industries will be sustainable only if they are competitive in terms of costs, prices, operational efficiencies, product offers and other associated parameters.

Establishing and maintaining competitiveness constitute a particular challenge for agro-industrial enterprises and smaller-scale farmers. Although agro-industries have the potential to provide a reliable and stable outlet for farm products, the need to ensure competitiveness favors farmers and agricultural firms who are better able to deliver larger quantities and better quality of products (Silva & Baker, 2009).

According to FAO (2012), within agro-industry, food-processing and beverages are by far the most important sub-sector in terms of value added, accounting for more than 50% of the total formal agro-processing sector in LICs and LMICs, and more than 60% in UMICs. For the African countries included Ethiopia, Eritrea and Senegal, food and beverages represent more than 70% of agro-industry value added and roughly 30–50% of total manufacturing. On the one hand, tobacco and textiles have played an important role in Asian and Middle-Eastern countries, while wood, paper and rubber production are heavily concentrated in Asian countries. Leather products, on the other hand, represent only a marginal share in the total agro-processing value added. throughout the past 25 years, the shares of global manufacturing value addition for food, beverages, tobacco and textiles (which are the main agro-industry manufacturing product categories tracked by UNIDO) generated by developing countries have almost doubled. For textiles, developing countries accounted for 22% of manufacturing value added in 1980, but more than 40% in 2005. The increase was the greatest for tobacco, reaching 44% of global value addition in 2005. In order to focus on sub-sectors that make up almost all the agro-processing value added in LICs, the chapter will concentrate on textiles, tobacco and, above all, food and beverages.

According to the calculations of Aksoy and Beghin (2005), the market shares of developing countries in world agricultural trade in 2000–2001 was around 36%, a slightly lower figure when compared to that of 1980–1981 (Table 2.1). This performance would be worse without the increase in trade among developing countries during the 1990s. Agricultural trade among these countries has been characterized by its heterogeneity. Trade expanded in the case of LICs, primarily driven by imports from other developing countries. As a group, MICs have performed worse, although particular countries are becoming major exporters, such as Argentina, Brazil and Thailand. The increasing presence of Argentina and Brazil in export markets is particularly notable. Brazil's export performance is mostly concentrated on sugar, oilseeds and meats, while Argentina's also covers cereals and dairy products. Other emerging exporters in developing and transition

economies include Russia and the Ukraine for coarse grains, Vietnam and Thailand for rice, Indonesia and Thailand for vegetable oils and Thailand, Malaysia, India and China for poultry (OCDE and FAO, 2007). On the other hand, UMICs in East Asia are becoming major importers. Nevertheless, flows among developed countries still represent the dominant tendency in global agricultural trade, accounting for 50% of the total, with 60% of this being conducted within trading blocs such as the European Union. With the recent explosive growth of China, India and other large developing countries, there has been a sharp increase in commodity exports from middle-income developing countries.

Table 2.1 Shares of developing and developed countries in world agricultural exports

	Developing Countries			**Industrial Countries**		
	1980-1981	**1990-1991**	**2000-2001**	**1980-1981**	**1990-1991**	**2000-2001**
To Developing Countries	13.4%	10.5%	13.7%	18.9%	14.5%	15.6%
To Industrial Countries	24.3%	22.4%	22.4%	43.4%	52.5%	48.3%
Total	37.8%	33.0%	36.1%	62.3%	67.0%	63.9%

Source: Adopted from Aksoy and Beghin (2005).

Agro-processing participation in the overall gross product corresponds to around 4.3% in LICs (which include Agro-industry Trends, Patterns and Development Bangladesh, Ethiopia, Eritrea, India, Mongolia, Senegal and Vietnam) and about 5% in LMICs and UMICs. Considering the importance of artisan production and the informal sector in this activity, particularly in LICs, but generally in the developing world, we can safely interpret this information as heavily underestimating the real picture (UNIDO, 2005).

2.3.1 Agricultural Production and Productivity in Ethiopia

Agriculture is a sector with great potential for stimulating growth and employment and eradicating poverty. Agricultural is the backbone of the Ethiopian economy and underpins its development process. Because of its importance to national food security and poverty reduction, the government has, within the Growth and Transformation Plan (GTP), articulated a clear vision for the sector, placing it at the center aim to stimulate investment and productivity of the sector to promote household and national food security and to rally development partners to deliver effective development aid to the sector. production and productivity by among others promoting domestic and foreign investment through agricultural commercialization, increasing public investment in agricultural infrastructure, promoting technology transfer and adoption, ensuring efficient use of

land, labor, technology and other inputs, and specifically raising the productivity. Agriculture is an important sector with the majority of the rural population in developing countries depending on it. The sector faces major challenges to enhance agricultural production. Challenges of particular concern include among others lack of improved varieties, water shortages, declining soil fertility, effects of climate change and rapid decrease of fertile agricultural lands due to urbanization. Realizing these opportunities requires compliance with more stringent quality standards and regulations for the production and handling of agricultural produce (Meena & Singh, 2008).

The agricultural sector accounts for 41.6 percent of GDP (Birr 474.5 billion in 2011) and employs 85 earnings currently valued at US$2.7 billion. While real agricultural GDP has steadily increased from Birr 31.1 billion (US$3.73 billion) in 1999/00 to Birr 64.7 billion (US$ 3.65billion) in 2010/11, its contribution to GDP has fallen by 10 percentage points to 41 percent of GDP between 1999/00 and 2010/11. In terms of food production, the country produced 22.5 million tons of crop, of which 95 percent is from small holder farms and the remainder from commercial farms. As a major source of calories, cereal production is critical to both household and national food security in Ethiopia. In 2010/11, over 96 percent of cereals were produced by smallholder farmers and 65 percent of this production was consumed within the farm-household and only 16 percent was sold for cash or bartered. Taking the average per-capita calorie requirement of 2.16 quintiles for 2,100 daily calories, the country needs to produce 18.4 million tons of cereals to feed its population of about 85 million people. Since 16 percent of the cereals are produced as seed, 15.5 million tons of the production is consumable within the farm household. This implies a deficit in cereal production of approximately three million tons in 2010/11. This deficit is expected to be much higher when cereal production is converted to wheat calorie equivalence, which is the standard calorie measure. Using these estimates, the number of people that were food insecure in 2010/11 is estimated at 13.3 million people. This number is likely to increase when crops fail due to either adverse weather conditions or conflicts (World Bank, 2012).

2.3.2 Information Technology in Agriculture

According to Chavarría (2012), It is very common for institutions that are in the first stages of developing ICTs to use the majority of their technological tools primarily in management and administrative processes, because digital agendas generally start with the promotion of ICTs for financial accounting systems, operations systems, personnel administration systems, inventory

management systems, logistics management systems, and so forth. However, any process of institutional modernization that is undertaken to strengthen the impact of ICTs in public and private agricultural institutions must establish the end user as the central objective. It is critical for these agricultural institutions to understand that placing ICTs at the service of administration and management delays the impact on the institutions' end clients. Progress in the adoption of ICTs (and the impact on the end client) has been found to be greater if the early efforts at ICT provision and use in public and private agricultural institutions incorporate the specialists who have the most contact with end clients (extension, commercialization, education, plant and animal health, laboratory services).The authorities in charge of the digital agendas must understand that incorporating ICTs under the heading of use or utilities in public and private agricultural institutions would not only increase the profitability and productivity of their economic and human resources, but also incorporate new actors in their technical assistance programs, expand their geographic coverage area and offer products and services that are more tailored to the needs of their trade.

According to Sylvester (2013), new ICTs such as smart phones are also bringing another revolutionary change, the ability for the multiple actors and stakeholders in agricultural production and market chains to participate as a community in information management. Each actor, from the input supplier, the agricultural institution, the wholesaler and processor to the consumer generates information, which, when shared improves the efficiencies of the production system and the market chain, which contributes to innovation. Smart phones support social media or sharing of user generated content such as through forums, blogs, Wikis, social network Podcasts, bookmarking, sharing of videos and photos. A recent development is participatory GIS and mapping. High resolution based maps in applications such as Google Maps/Earth and Microsoft Bing that are available in the public domain can be used to map landownership, soil profiles, watersheds, cropping patterns and profiles at seasonal levels, routes of farm service providers such as for equipment and transport. With locally available interoperable datasets generated through user participation and uploaded through Smart phones.

2.3.3 Mobile as an ICT Device for Agriculture

Mobile technology has pro-vided new opportunities for agribusiness firms and rural farmers to obtain knowledge and information about agricultural issues, problems and its usage for the development of agriculture. Similarly, use of ICTs in agricultural extension services especially

mobile phone services in the agricultural sector has provided information on market, weather, transport and agricultural techniques to contact with concern agencies and department (Aker, 2011). Mobile phones have provided new approach to farming to make tentative decisions much more easily than before. Use of mobile phones leads to greater social cohesion and improved social relationships among farmers and business community. However, short message service SMS and voice record have given improvements in social relations and business activities. Mobile phone based social networking in the developing countries goes to show the growing importance of this aspect mobile phones are considered as an important tool for agriculture development. This technology has a significant feature which gives a security to the owners (Kwaku & Kweku 2006).

The mobile phones could help the agricultural firms as well as farmers to sell their fresh product in the market quickly to avoid waste. This technology has also provided new approach and chance for farmers and agricultural sector investments to decide whether to accept the price offered by buyers by obtaining price information from other sources. Agricultural institutions and farmers rate is expected to increase as information flow increases due to mobile phone network coverage and the size of the impact is larger in remote areas (Smale & Tushemereiruwe, 2007).

According to Laudon & Laudon (2007), cell phones and wireless telecommunication devices, a massive shift toward online news and information, booming e-commerce and internet advertising, and new national security and accounting laws that address issues raised by the exponential growth of digital information. The internet has also drastically reduced the costs of business operating on a global scale. These changes have led to the emergence of the digital firm, a firm in which; most of the firm's significant business relationships with customers, suppliers, and employees are digitally enabled and mediated. According to Miller & Linde (2013), among rural users in developing countries, the trend is to move from mobile phones with basic voice and text message capabilities to feature phones. Feature phones are low-end phones that access various media formats in addition to offering basic voice and SMS functionality, capturing the functionalities of multiple ICT devices that are also available as stand-alone appliances. Rural consumers prefer the combined devices because of their affordability. Features appreciated by consumers in developing countries include digital camera, voice recorder, flashlight, radio and MP3 player, Bluetooth and General Packet Radio Service (GPRS) are the most widely available connectivity options in addition to GSM.

2.3.4 Internet as an ICT Device for Agriculture

According to Oluwabiyi, (2012), agricultural institutions and farmers can find on the Internet a whole range of current and timely information which includes commodity prices and supply, short and long term weather forecast, production, suppliers, equipment, financial planning, exchange and interest rates, business planning, agricultural software programs and marketing links. The Internet is an emerging agribusiness platform to market farm products and also to access other markets. Some websites have free platforms for agribusiness that allow users to promote agricultural products and services on the internet to enhance marketing coverage and exposure, while providing useful knowledge sharing and information. The Internet allows agricultural producers to communicate via email or participate in active discussion groups. While email allows individual producers and organizations to communicate with others. Discussions or news groups are electronic message boards where people post messages about a particular subject to be read and commented by many Internet users. Farmers and agro-industrial enterprises can gain knowledge about new technologies, best practices and latest innovations through websites focused, for example, on new scientific research findings worldwide. The use of ICT is useful for agribusiness in markets and value chains, because ICTs play a critical role in facilitating access to knowledge, information sharing and communication, opening new borders for technology innovation, trade, marketing and cooperation. According to Regan (2013), through internet forums, social networking sites and online knowledge agribusiness get lot of information. With these they contact with other firms and experts and exchange knowhow. There are many online databases, articles, newspapers in which there is lot of information available for farmers which help them in increasing productivity.

2.3.5 Computer as an ICT Device for Agriculture

Computer is an advanced electronic device that takes raw data as input from the user and processes these data under the control of set of instructions (called program) and gives the result (output) and saves output for the future use. It can process both numerical and non-numerical (arithmetic and logical) calculations. A computer is a programmable machine. It allows the user to store all sorts of information and then ‘process’ that information, or data, or carry out actions with the information, such as calculating numbers or organizing words (Roper, 2010).

Computers play an important role in record keeping in the agriculture field. Agro processing firms are using computers to keep track of information such as budget records, animal health and tracking forms, equipment inventories, and maps of land. In livestock a firm can use computer technology to track the health and status of each of their animals, this is called herd recording. Such records include an animal's age, health records, milk production, offspring production, and their reproductive cycle. There is software and programs to help organize and keep record of this information for the agricultural firm making it easy to keep track of their livestock and run the activities more efficiently. Agro-processors need to have a detailed and accurate compilation of records in order for their business to operate smoothly. Computers allow the area to organize information that is easily accessed and presented in a clear, organized manner (Preeti, 2011).

2.3.6 ICT Based Systems for Agricultural Development

2.3.6.1 E-Agriculture

E-agriculture is seen as an emerging field focusing on the enhancement of agricultural and rural development through improved information and communication processes. In this context, ICT is used as an umbrella term encompassing all information and communication technologies including devices, networks, mobiles, services and applications; these range from innovative Internet era technologies and sensors to other pre-existing aids such as fixed telephones, televisions, radios and satellites. E-agriculture continues to evolve in scope as new ICT applications continue to be harnessed in the agriculture sector. More specifically, e-agriculture involves the conceptualization, design, development, evaluation and application of innovative ways to use ICTs in the rural domain, with a primary focus on agriculture. Provisions of standards, norms, methodologies, and tools as well as development of individual and institutional capacities, and policy support are all key components of e-agriculture. E-agriculture, or ICTs in agriculture, is about designing, developing and applying innovative ways to use ICTs in the rural area with a primary focus on agriculture. E-agriculture offers a wide range of solutions to some agricultural challenges. Setting in place a national e-agriculture strategy is an essential first step for any country planning on using ICTs for agriculture. While the need for e-agriculture strategies is acknowledged by many stakeholders, most countries have yet to adopt a strategic approach in making the best use of ICT developments in agriculture. E-agriculture strategies will help to rationalize both financial and human resources, and address holistically the ICT opportunities and challenges of the agricultural

sector while generating new revenues and improving the lives of people in rural communities. It will also help ensure that the goals of national agricultural plans are achieved (FAO, 2016).

According to World Bank (2011), the ICT for Agriculture e-Sourcebook has been developed jointly by the World Bank's Agricultural and Rural Development Sector and Info-Dev, and has benefited from generous funding from the Government of Finland under the Finland/Info-Dev/Nokia program Creating Sustainable Businesses in the Knowledge Economy. It is designed to support practitioners and policy makers in taking maximum advantage of the potential of ICTs as tools for improving agricultural productivity and smallholder incomes, strengthening agricultural markets and institutions, improving agricultural services, and building developing country linkages to regional and global agricultural value chains. It focuses primarily on how ICT can assist small scale producers and the intermediate institutions that serve them, yet it also looks at how to link smallholders to ICT enabled improvements in larger scale farming, markets, and agribusiness to stimulate the broader rural economy. The Sourcebook provides users with a fairly comprehensive overview of current and upcoming ICT in agriculture applications and how they might improve agricultural interventions or strategies. The Sourcebook is not a primary research product nor does it claim to be the definitive treatment of a sector that is evolving so rapidly. The modules are intended to serve as a practical resource for development professionals seeking a better understanding of the opportunities and existing applications offered by ICT as tools for agricultural development. Overall, each module seeks to provide guidance through real examples for development practitioners in providing a landscape of existing ICT applications that assesses applications in their local context, understanding current trends in ICTs as they pertain to agriculture and the contributions that ICT can make to enhance agricultural strategies and their implementation. It also helps on designing, implementing, and evaluating appropriate and sustainable ICT components of agricultural Projects, building effective partnerships in both public and private to promote ICT access and innovation for agriculture and ICT in policy dialogue and planning with country counterparts on agricultural and rural development goals and priorities.

All information can be digitized, transported, stored, retrieved, modified, and then distributed. The application of Information and Communication Technology (ICT) in agriculture is increasingly important. E-Agriculture is an emerging field focusing 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 (ICT) in the rural domain, with a primary focus on agriculture (Wolfert & Kempenaar, 2012).

2.3.6.2 Automating Agriculture

The topic of automated farming is very interesting. It brings combines technology and farming into another dimension. With technology, the farming industry can go to new heights. It is not a very new idea; some farms have been using automated farming equipment for a long time to help boost their numbers of final products. Companies are working to provide affordable automated farming machines. They claim to provide agricultural institutions and farmers with the tools they need to be a successful (Preeti, 2011).

Another important field of interest pertaining to automated farming equipment has to do with autonomy. Economists have studied this issue in detail. Observing at the history of farming, crop growing has come a long way from physically exhausting to machines to the hard work. We see a huge shift in what is desirable as well. Instead of appreciating the hard work from the farmer, we now see appreciation in numbers and size of fruits and vegetables. This reflection of our society gives way to the value of the automated farming machines. We take advantage of technology to do the hard work, and consequently, hold less appreciation for the finished product (Jason, 2014).

According to the September 2008 issue of “Farm Industry News”, farmers can use computer systems to guide the steering on their farm equipment during planting or harvesting; if the system experiences problems, technicians can diagnose and fix the issues remotely from another computer (Preeti, 2011).

2.3.6.3 Geographic Information Systems

According to the United States Environmental Protection Agency (USEPA), geographic Information Systems is "a computer system that allows you to map, model, query, and analyze large quantities of data within a single database according to their location". GIS (Geographic Information Systems) allows you to construct maps, combine information, make scenarios, present ideas and develop solutions. GIS is used in a ranking system called precision agriculture, which evaluates and assesses land. The kind of information stored in this system are soil conditions, drainage conditions, slope conditions, soil pH and nutrient status. These organizational systems allow agricultural professionals and farmers to have insight into conditions that could affect their

crops and their success. Before the use of GIS and precision agriculture, farmers and agricultural firms are required control about essential information that relates to fertilizer application and problems with drainage, insects, and weeds. The use of GIS is a money saver and increases efficiency. It also leads to better decision making about where and when to produce crops. GIS greatly improves communication as farmers can access the vital information and use it to their advantage and produce a higher yield of healthier crops. GIS helps improve agricultural record keeping. It does this by compiling various data in an easily assessable system that farmers can look at. All in all, GIS helps farmers tremendously in the upkeep and functions of their land and crops (USEPA, 2014).

2.3.6.4 ICT Based Agricultural Value Chain Management

The implementation and increasing use of ICTs in most aspects of daily life is irreversible; and while options are more sophisticated in certain levels of agricultural value chains, agricultural producers have increased and improved access to new ICTs, gaining in this way also wider access to information on markets, weather, etc. Governments should promote policies to reduce the digital divide by opening the telecommunications market, as well as supporting legislations to regulate competition and the development of infrastructure to facilitate ICT access to rural areas. It is essential to promote public policies, programs and innovative public and private initiatives that foster equal access to ICTs and to vital information needed by different agricultural chain stakeholders for making economic and environmental decisions, especially, the social disadvantaged groups in isolated and remote areas (Calvin and Linde, 2013).

Given the heterogeneity of the stakeholders in an agricultural value chain, the roles that ICTs can play in each of the levels of the chain may be influenced by factors such as, infrastructure for access and ICT affordability, including Internet connectivity in production and commercial areas. For example, in Chile and Peru, only 10-11% (estimated) of rural population has access to Internet. Factor should be considered regarding to higher concentration and usage of ICTs up to date and innovative technologies in sectors with more economic power, the quality and availability of information content, limitation of the media itself, Individuals' choices and their appropriation of ICTs, support services and training to develop the "culture of use" of ICT and "information literacy" among chain stakeholders. Several experiences in Latin American and the Caribbean (e.g. Uruguay and Chile) show the importance of promoting public policies and fostering partnerships

(public, private and civil society) to reduce the rural digital divide and to improve the competitiveness in value chains; while expanding access to communications infrastructure, developing services and content focused on value chains, promoting a culture for the appropriation of ICT in rural areas and developing information literacy from primary education. In addition, it is beneficial to promote the exchange of experiences between producers and agro-entrepreneurs in the use of ICT to improve their processes (Aparajita &Velosa, 2011).

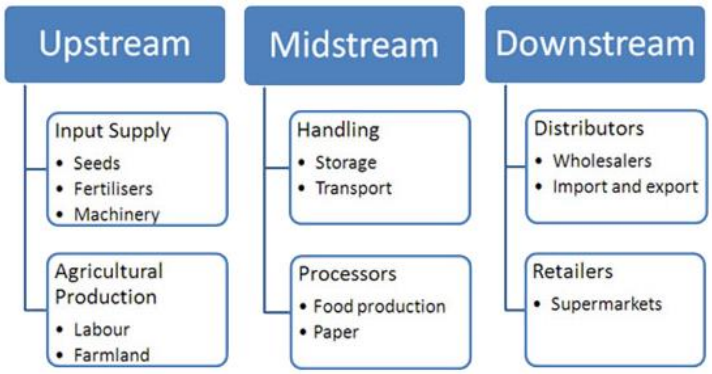

Figure 2.5 Agricultural value chain (Gloy, 2005)

2.3.6.5 ICT Based Agricultural Knowledge Management System

According to FAO (2016) agriculture sector faces many challenges posed by climate change, loss of biodiversity, drought, desertification, increase in food prices and inefficient supply chains. The sector is increasingly becoming knowledge intensive and the availability of the right information, at the right time, in the right format, and through the right medium, influences and affects the livelihoods of many stakeholders involved in agriculture and related fields. The availability, accessibility and applicability of agricultural research outputs are keys to addressing a range of issues related to food security.

Effective knowledge management is achieved when the right knowledge and information is delivered to the right person at the right time in a user friendly and accessible manner that helps the recipients to perform their jobs efficiently Knowledge management deals with the process of capturing, sharing and using of knowledge and techniques. For the circular flow of knowledge management to take place both knowledge, that is sufficiently better than the existing knowledge, and means for transmitting it must be both available. In addition, the consumers of knowledge must be willing and able to use the better knowledge that is now available (Islam, 2010).

Agricultural information and knowledge created from these sources is stored in various forms before it is disseminated for use. The main repositories of such knowledge include publications, audio visuals, and websites. The stored knowledge and information is then disseminated to users, such as public and private agricultural institutions and rural farmers, through intermediaries notably during trainings, field visits, exhibitions, publications, and using traditional forms of ICT (TV and radio), modern forms of ICT (internet, mobile phone, etc), and others. However, in Ethiopia the use of ICT for the accumulation and dissemination of knowledge and information is still low. Currently, among the various ICT related initiatives, radio is widely used to share and inform users on agricultural issues, including new and upgraded farming techniques, production management, market information, and other issues. Apart from such traditional ICT tools (i.e., radio and TV), the use of modern ICT (computer, internet, mobile telephony, etc) remains very low in the country. However, some activities that make use of ICT tools in agricultural knowledge and information management are underway and are worth mentioning (World Bank, 2012).

2.3.6.6 ICT Based Total Quality Management

Information communication technology for Total Quality Management has been significantly implemented on most organizations and each has been widely researched. Many organizations are providing better products and services with the help of introducing Information Technology in Total Quality Management. The global competition has enhanced the role of quality in business world whereas competition is adding to pressure to the organization. These challenges and pressures have placed a renewed focus on quality improvement for the long-term survival of the organization. Technology acts as an enabling mechanism, which results in enriched jobs and increased job satisfaction. TQM is a philosophy of management and asset for customer centric practices for delivering quality. ICT can be defined as computer and telecommunications hardware and software that aid in processing, collection, and transmission of text, voice, and pictorial information Application of ICT in various areas including quality management is growing and continually expands. One of the reasons for this growth rate is the dramatic increase in the cost ratio of all types of computer technology. They argue that, this decrease in cost has made computer processing economical for more and more firms. The value of IT to support quality management capabilities finds a basis in the resources based view of the firm, which argues that to confer competitive advantage, an organization should acquire or develop resources and capabilities that contribute to positive performance. The key practices include specific quality goals,

comprehensiveness of the goal setting processes, importance attached to the quality in relation to other goals and the extent to which quality goals are reviewed and their attachment emphasized. All of the elaborated key practices need information and analysis therefore, it is obvious that IT is required, in all those aspects to be able to implement the key practices. The founder of TQM philosophy Deming shows the importance of extracting the information inherent to quality process variations. The role of information acquisition in quality management by suggesting that experiment must be designed to measure and determine the causes of quality problems (Khanam, Siddiqui & Talib, 2013).

2.3.7 The Role of ICT for Agriculture in Developing Countries

In Philippines the Nutrient Manager for Rice Mobile program provides rice farmers with advice via their mobile phone on the optimal timing, amount, and type of fertilizer to apply to their rice crop to maximize production and profit, and reduce waste. The farmers and extension workers are able to dial a toll-free number and hear a voice instruction in their preferred local language, which will prompt them to use their keypad to answer 12 to 15 questions about their rice crop (UNDP, 2012).

In Ghana, Esoko, a local company, implemented Cocoalink, a pilot program that provides cocoa farmers with useful information about improving farming practices, farm safety, crop disease prevention, postharvest production, and crop marketing. In this program farmers receive information and specific answers to questions at no charge through voice and SMS messages in their local language or English. In India, Reuters Market Light (RML) sends four SMS messages a day to its subscribers. Farmers who subscribe to the system receive information about the weather, crops, current and projected commodity prices at different markets. A study conducted in selected countries in Sub-Saharan Africa (Tanzania, Malawi, Mali, Mozambique, Ghana, and South Africa) showed that rural radios with innovative programs, including dramas and radio forums tailored to local communities, are an effective way of communicating agricultural messages. In spite of being a necessary condition, access to ICT infrastructure by itself is not sufficient for the dissemination of knowledge and information to occur through it. Access to ICT infrastructure must be accompanied by access to ICT services. In this respect, the other challenge is how to make ICT services both affordable and available in venues or modes that are convenient to all agricultural sectors and individual farmers (UNDP, 2011).

The Kenyan Agricultural Commodity Exchange (KACE) collects, updates, analyses and provides reliable and timely marketing information and intelligence on a wide range of crop and livestock commodities, targeting actors in commodity value chains, with particular attention to smallholder farmers and small scale agribusinesses (KACE, 2011). The KACE marketing information and linkage system (MILS) involves harnessing the power and advantages of modern ICT for information collection, processing and delivery. The components of the KACE MILS are: Market Resource Centers (MRCs), Mobile Phone SMS, IVRS, Internet Database System (IDS), National Radio, Rural FM Radio and the KACE Headquarters Central Hub (KCH) in Nairobi. MRCs are information kiosks located in rural markets and serve as sources of KACE market information for farmers and agribusinesses, as well as providing market linkage through matching commodity offers and bids. SMS service applies mobile telephone for market information deliveryto users. The market information currently available through SMS includes daily wholesale buying prices for about 20 commodities, as well as offers to sell and bids to buy. IVRS uses voice mail for delivery of market price information. In this platform, a user dials a special phone number to access the information through simple menu steps, with a choice of language between the local Kiswahili and English. IDS is a system where updated market information is sent daily to subscribers in the database as email messages. The KCH in Nairobi receives processes, manages, updates, disseminates and coordinates market information services through the MILS, using the channels described above (KACE, 2011).

2.3.8 Provision of Agricultural Information in Ethiopia

The role of ICT in enhancing food security and supporting rural livelihoods is increasingly being recognized and was officially endorsed at the World Summit on the Information Society (2003-2005). Several countries in Africa and Asia are now using ICT for the dissemination of agricultural knowledge and information and a number of success stories have been registered that can be replicated and scaled up in Ethiopia (UNDP Ethiopia 2013).

According to the country diagnostic report of the World Bank issued in March 2010, The challenges of access to ICT can be access to ICT infrastructure and services. The access to ICT infrastructure in Ethiopia is still very low despite some noticeable improvements registered in recent years., the coverage of ICT in Ethiopia is one of the lowest in Africa. For instance, the coverage of GSM signal is about 10 percent of the population compared to the 48 percent

benchmark for low income countries. Similarly, in 2010, the Internet bandwidth benchmark for low income countries is about 20 times higher than that of Ethiopia.

Ethiopia has some ICT related opportunities that can be utilized in the dissemination of agricultural knowledge and information to the users. The most notable opportunity is the presence of ICT infrastructure called the Woreda-net that can be easily extended to reach most of the rural farming and to further strengthen the research extension farmer linkage. At present, almost all woredas have the infrastructure that enabled them to be connected to the network and have access to internet, telecommunication, video conference and databases at national level. In addition, more than half of the kebeles in the country were linked to the network (Adam, 2010).

Ethiopia has ample scope to substantially increase agricultural production and achieve household and national food security by increasing the productivity of smallholder farmers and appreciating agricultural investments. This can be achieved by promoting technology transfer and adoption, boosting commercial production, deepening agricultural markets, and improving infrastructure and agricultural policies. Some progress in rising productivity has been made in the last decade, but these changes are far from being transformative. While agricultural yields per hectare is 1.7 tons of cereals and just above the Sub-Saharan Africa average of 1.5 tons, agricultural production systems are largely agrarian and subsistence with over 65 percent of the production consumed within the farm household. Agricultural systems should rapidly be transformed in order to double productivity levels to reach 3.5 tons per hectare recorded in Asia (World Bank, 2011).

According to Ethiopian agricultural transformation agency (2016), much work remains to ensure that ICT interventions in Ethiopian agriculture can overcome ongoing challenges reducing the speed at which its innovations and benefits are realized, including limitations in technology infrastructure, human capacity, and awareness all of which threaten the long term potential for pilots to be fully scaled out. For example, the capacity of individuals who might use new technologies is often overlooked. In addition, ICTs are tools ones that make information easier to access but unless farmers or end users are informed of their purpose, benefits and operation, their usefulness can be overlooked. To make a significant change on the productivity of Ethiopian agriculture production the ICT for agricultural services program helps to develop and support ICT related solutions for all agricultural challenges encountered by government and private institutions, smallholders, and other key stakeholders. Drawing upon insights and recommendations from

Ethiopia and abroad, the program will also actively support the establishment and implementation of a comprehensive ICT in agriculture strategy to enhance innovation, efficacy, knowledge sharing, and transparency in the sector. The ICT for agricultural services program plans to work on the digital technology in the form of Geographical Information Systems (GIS), including the Ethiopian Soil Information System (EthioSIS) and the AMP (Agro-Meteorology Project), which provide relevant information enabling key decision makers to take actionable steps and make more accurate decisions. Similarly connecting farmers to resources and information that can help them increase their productivity and enhancing the ability of farming society to make agronomic decisions that increase productivity. Implementing digital tagging technology as part of the International Market Access also another mechanism which will add value to, and enable the tracing of Ethiopian agricultural products so that consumers in developed countries can understand and make purchasing decisions based on where food comes from (ATA, 2016).

2.3.7.1 The Ethiopian Agricultural Portal

The Ethiopian Agricultural Portal, a project of the MOARD and the aforementioned IPMS project, provides an online database of information on major Ethiopian agricultural outputs. It includes links to articles on production, marketing, and capacity building for major crops, livestock, and forest products. The target audience of the portal includes extension staff, universities, researchers, private businesses, NGOs, and government -i.e., it is aimed at intermediaries, not farmers directly. Documents are available in English, Amharic, and several other local languages. In addition, the portal is designed to be interactive, so stakeholders can upload new results and information (EAP, 2016).

2.3.7.2 The Ethiopian Livestock Market Information System (ET LMIS)

The Ethiopian Livestock Market Information System (ET LMIS) is a collaborative project involving the Global Livestock Collaborative Research Support Program (GL - CRSP), Texas A&M University and Mercy Corps, with funding from USAID. ET LMIS utilizes SMS, email, radio and their website to provide prices for livestock across Ethiopia. Their service is targeted at herders and traders looking to either acquire more livestock or sell their own. The ET LMIS project also examines trends in grain marketing in order to predict potential food shortages (ETLMIS, 2016).

2.3.7.3 The ICT Center of Excellence

The ICT Center of Excellence at Addis Ababa University was developed in 2010 as a resource for ICT development in Ethiopia with the goal of addressing national socio-economic development in a number of sectors including agriculture. Their departments include research, development, education, training, consulting and outreach. While they are still new to the field of ICT in agriculture, they are involved in localization and voice-driven applications with plans to reach out to rural areas. They also partner with other Ethiopian universities to support research on ICT in development and are poised to be a key factor in ICT and agriculture (ICTCOE, 2014).

2.3.7.4 ECX as ICT Based Agricultural Information Transfer Ethiopia's Practice

The Ethiopian Commodity Exchange (ECX) is yet another notable organization that has embarked on some modern types of ICT-based information management system. It carries out trading of the agricultural commodities on its trading floor located in Addis Ababa and disseminates price information in real time to producers, consumers, and traders using electronic price tickers as well as its website. At present, there are 30 price tickers installed in towns across the country and it is projected to reach 150 by the end of 2012. The price tickers are also used to transmit any change of price information directly in real time to the users. In addition, ECX has developed a prototype for data dissemination using short message services (SMS) and interactive voice response (IVR). There are currently about 200 thousand users of the SMS service, and about 50 thousand IVR users per day of which, the majority (65 percent), are from outside Addis Ababa (ECX, 2012).

2.3.7.5 Mobile Hotline Service for Agricultural Information System

According to Ethiopian agricultural transformation agency (2015), despite the strength and volume of agriculture related information and training available through Ethiopia's vast public extension system, ensuring farmers receive up-to-date data and knowledge in a timely manner remains a great challenge. To address this challenge, an Interactive Voice Response (IVR) and Short Message System (SMS) platform was developed to deliver information directly to farmers through mobile phones. In July 2014, the ATA, in collaboration with the MoA, EIAR and Ethio Telecom, launched '8028', Ethiopia's first agricultural hotline. The 8028 hotline seeks to support sustainable agriculture. The system's main objective is to ensure that farmers have real-time and immediate access to pertinent agronomic information, which will help them to make more informed decisions about their farming practices. Farmers can now call into the 8028 automated hotline for free and

receive information on a wide range of agricultural activities on all major cereal, pulses and high-value crops. Keypad menu options allow farmers and Development Agents to select their particular areas of interest and receive automated information whenever they call in. At the same time, the hotline administrator can also "push" customized content. In cases of drought, pest and disease, for example, tailored information can be sent to callers based on crop, geography, or demographic data captured when farmers first register to use the system. Recognizing the diversity of Ethiopia's farmers, the IVR/SMS system functions in three local languages (Amharic, Oromiffa, and Tigrigna) and provides information about crops specific to soil type and altitude. Twelve weeks after its July 2014 launch, the hotline had received nearly 1.5 million calls from 300,000 farmers in the Oromia, Amhara, Tigray and SNNP Regions.

2.4 Conceptual framework

The review of the related literature above discloses that ICT has an impacts on agribusiness and agro-processing activities. The practice of different areas of the world discovered that integrating ICT with agribusiness will resolving market failure by providing information access to food and financial markets. The reviews also exposed that ICT can accelerate agriculture commercialization on enterprises, climate change management by early warning systems, food security improvements, development of knowledge society by closing capacity gap, rural poverty improvement and nutrition and value chain performance in regional/global market integration.

ICTs are a range of electronic technologies which is flexible, adaptable, enabling and capable of transforming organizations and redefining social relations as (Don, 2010) elucidates and Mônica Rodrigues (2012), also implies taking advantage of ICTs to reverse the unequal development of agriculture, regional ICT policies must be implemented to overcome the barriers to adoption in the most underdeveloped segments, the discussed facts shows that Ethiopia is not applied ICT in the area of agribusiness as it demands, there are different barriers to rub on other countries practices due to the problem of ICT infrastructure. Studies are argued that the monopolistic market structure that exist in Ethiopia's fixed, mobile and internet service markets is one of the major factors behind the slow development of ICT. The total coverage of mobile and internet in the country is below the minimum requirement of the world standard which holds back the development of the sector. This study correspondingly finds out the different practices and the major challenges of using ICT in agriculture in the case of agro-processing firms in Ethiopia. identified that the Ethiopian practice is not step up due to various challenges as (EICTDA, 2010) explained the country faces a substantial gap between the interest of using ICT and the policy and regulatory tools available to enable the development.

CHAPTER THREE

RESEARCH METHODOLOGY

3.1 Research Design and Approach

According to Merriam (1998), descriptive research is undertaken when description of a phenomenon is needed and not a prediction based on cause and effect. Glass & Hopkins (1984), also argued that the main aim of descriptive research is to provide an accurate and valid representation of (encapsulate) the factors or variables that pertain are relevant to the research question, such research involves gathering data that describe events and then organizes, tabulates, depicts, and describes the data collection. According to Zikmund (1984), exploration of new phenomena enhances better understanding, may test the feasibility of a more extensive study, or determine the best methods to be used in a subsequent study. This research aims at exploring the level of use of ICT infrastructure, describe the practices and challenges of using ICT in agro-processing industry. For these reasons, exploratory and descriptive research design were adopted to address the research questions of this study.

Creswell and Borrego (2013) described three research approaches, such as qualitative, quantitative and mixed methods. Mixed method involves combining or integration of qualitative and quantitative research and data in a research study. on the other hand, Creswell (1994) stated that by adopting two or more different methods of research, it is possible to achieve a more textured understanding of your object of analysis. In this study, both qualitative and quantitative data should be generated to address the research questions under focus. Therefore, a mixed research approach that allows to collect and analyze quantitative and qualitative data is adopted for the study.

3.2 Population and Sampling

Sampling is defined as the selection of a small group of people from a larger population to represent that population on the basis of a judgment or inference made about the aggregate or totality (Kothari, 2007).

For this study sampling size is determined using Kothari (2007) formula.

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

Where;

N= target population size

n= required sample size

Z= confidence level 95% (standard value of 1.96)

e= margin of error at 5%

p= population proportion at which the sample size is maximum at (p=0.5, q=0.5 and p*q=0.25) where q=1-p

$$n = \frac{3.8416 * 140 * 0.5(1-0.5)}{0.0025(140-1) + 3.8416 * 0.5(1-0.5)} = \underline{\underline{59}}$$

The total permanent employee of the five target location of the company is 1,211(see Appendix A) and the total employee works at the office are 216 the rest of them are field workers, then 140 employees are satisfied the criteria that is, professional employees which are an office worker who has an educational background of diploma and above with a minimum of 4 years of work experience. Using Kothri (2007), sampling size determined formula the sample population become 59. The five sampling units for this study are heterogeneous, therefore this heterogeneous groups are divided into different homogeneous groups(strata) based on the departments that are, agriculture and agro engineering, Finance, Administration & HRM, plan & business development, sales and marketing, procurement & supplies, ICT & training and law. This study used a stratified random sampling to give equal chance for each stratum. The number of population in each allocated group are take in to consideration that higher distribution provides for groups with large number of employees (See Table 3.1).

Table 3.1 Sample size distribution

Target	Number of Departments	Number of Population Work in the Office	Population that Meet the Criteria	Sample Population
Head Office	8	45	38	16
Tea Factory	7	42	27	11
Cereal Farm	6	49	23	10
Flower farm	5	32	28	12
Tea Farm	6	48	24	10
	Total	216	140	59

Source: Selected from EAC employee data

3.3 Data Collection Instrument

The study was based on both secondary and primary data. In this research a combination of structured and semi-structured questionnaire was prepared for interview, and observation checklists were developed to generate primary data. The questionnaire was prepared in English and Amharic languages so that the respondents can easily understand the technology terms used. Items for the questionnaire are partly adapted from relevant literatures reviewed.

To maintain the validity of the tools, professional experts and the advisor reviewed the questionnaires before the data collection. Furthermore, the questionnaires were piloted on 5 department member staffs, 1 from each stratum. The pilot study proved that all the questionnaires designed were appropriate without any error and the researcher decided to conduct the main study using the tools.

Oral consent from the respondents was obtained; and they were clearly and precisely informed about the research purpose so that they will be able to provide as accurate and reliable information as possible for the questionnaires. Similarly, the semi structured interview was directly translated into the results and findings.

3.4 Methods of Data Analysis

Descriptive method of data analysis technique such as frequency distribution and percentage are used to analyze the data generated using questionnaire, as appropriate, and responses from semi-structured interview and observation checklists are transcribed and analyzed qualitatively The Statistical Package of Social Sciences (SPSS) software were used for the analysis. Based on the analysis, results are presented in charts, graphs and tables. Results of qualitative data analysis are presented in statements.

CHAPTER FOUR

RESULTS & DISCUSSION

4.1 Introduction

This study aimed to identify the rehearsal and challenges encountered on using ICT in Agro-processing development. This chapter deals with the findings that the researcher comes across during the study based on the questioner and semi-structured interview responses and observation checklist collected from the study area. These responses were carefully and systematically reviewed and analyzed using appropriate statistical packages. The observation checklist made on the selected five target sites and an interview with ICT and Training Department Manager also discussed qualitatively. From the total of 59 questionnaire distributed 54 (92%) are returned and the remaining 5 (8%) was not returned and incomplete.

4.1.1 Position, Educational Background and Work Experience of the Respondents

As revealed in the table 4.1 below, form the total of 54 respondent professionals are 27(50%) while 18(33%) are division heads, whereas the remaining 9(17%) are top level managements. Besides, 33(61%) of the respondents were first degree holders, however 17(31%) of them are diploma holders, plus 3(6%) are masters degree holders and one respondent had a PhD educational qualification. The respondents educational and experience level reveals that the sample respondents have good educational background that enables them to exercise effective utilizations and applications of various ICT tools. In the same hand the work experience of the respondent shows that most of them are worked for 8 years and above so that they do have a good practice and chance of using ICT infrastructures available in Ethio Agri-CEFT. The respondent's positions are top-level managements, division head and professionals which gives a clear explanation about ICT use practice, benefits and challenges throughout the company's structure.

Table 4.1 Position, educational level and experience of the respondents

Variables	Responses	Frequency	Percentage
Position	Top level Management	9	16.7
	Division Head	18	33.3
	Professional	27	50.0
	Total	54	100.0
Educational level	Diploma	17	31.5
	First Degree	33	61.1
	Masters	3	5.6
	PhD	1	1.9
	Total	54	100.0
Experience	4 years	5	9.3
	5 years	10	18.5
	6 years	13	24.1
	7 years	11	20.4
	8 years and above	15	27.8
	Total	54	100.0

Sources: Own Survey Data

4.2 Status and Practice of Using ICT in Ethio Agri-CEFT

4.2.1 Level of Use of ICT Infrastructure

As shown in the figure 4.1 below, from the total of 54 respondents all 54(100%) of them are mobile users and 41 respondents that means (75.9%) of the sample population are using Internet. When we notice the computer users they are 48(88.9%) of the respondents. This analysis shows that all the respondents are mobile users and also Internet and computer users are more than 75% of the total respondents which indicates a good practice of using the services. This figure indicates that mobile telephone is used as a major communication channel in Ethio Agri-CEFT, while Internet is less in relation to mobile. When we see the level of computer usage of the respondents it also shows a good practice as of Internet. In the same case the interview response about internet connections that the company currently using shows that the company is currently using broad band internet connection through wire and wireless media, that is a fiber optics cable broadband internet for the head office, a cooper wire connection for the tea factory and Holeta flower farm and the company also use a wireless broadband connection for Bir cereal farm, as the researcher observed there is no Internet connection in one of the company's target unit WushWush tea farm located at Kefa zone. As it was discussed in the literature review the problem occurred due to the less ICT coverage of the service provider, this problem also a barrier to get a wired Internet connection to all of the company's remote locations.

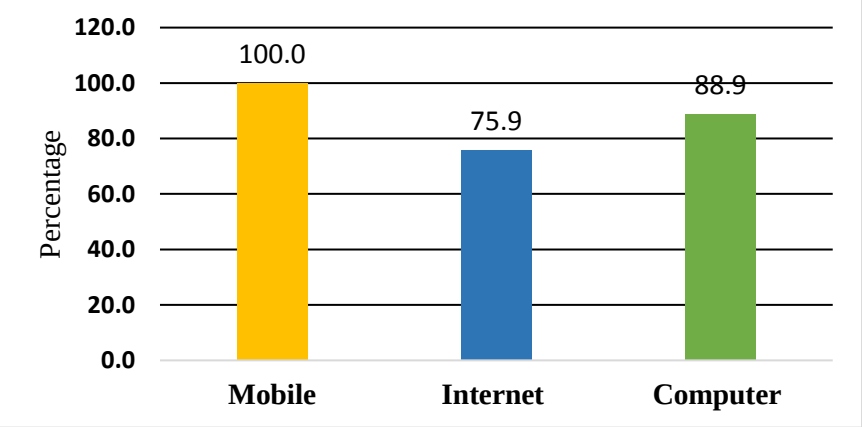

Figure 4.1 ICT models mobile phone, Internet and computer penetration
Sources: Own Survey Data

4.2.2 Availability of Adequate ICT Resource

Table 4.2 shows 19 staffs which represent 35.2% of the responses believe that there is a resource problem on using ICT while, the large percent of the respondents which is 64.8% answered there is a recourse problem to use mobile phone, Internet and computer for their field of work in the targeted agricultural firm. This shows that, there is an ICT resource problem in the company to implement ICT based agricultural systems, it's difficult to adopt different practices with luck of adequate ICT equipment. The interview and observation result for this instance also shows that the resources which is currently available in the company are not enough to carry out the planed agricultural activities in Ethio Agri-CEFT. As the interviewee said currently available mobile phone and Internet resources are also extremely affected by network and power interruption problems, computers and related peripherals are not enough to adopt available agricultural information and communication systems and also can't change the manual system to computerized structure in the organization. To implement full ICT system structure in the company there should be enough accessibility of computers and related accessories in each department heads and the subordinate users, by making the resource available it's possible to change the system to computerized way of information sharing. The interviewee also adds that computers should be frequently updated. The observation result also indicates the same result as of the questioner and interview.

Table 4.2: Availability of sufficient ICT resource

Variables	Responses	Frequency	Percentage
Do you believe that, there is enough ICT (Internet, Mobile, Computer) resource available in your company?	Yes	19	35.2
	No	35	64.8
	Total	54	100.0

Sources: Own Survey Data

4.2.3 Level of Use of Mobile Telephone Services

As presented in the figure 4.2, form the total of 54 respondents all are using voice call and SMS service of mobile telephone, while email users are 14 (25.9%). Other service like mobile banking represent 3(5.6%) of the respondents. This analysis shows that mobile phone has good coverage as communication method through voice call and SMS service. Using email in mobile is very small and lower than voice and SMS services user practice, when we see the mobile banking it's the smallest of all other services and shows a poor practice. Using mobile as an email device is not as the need because, as it was discussed in the literature review session and supported by the interview response the network problem and limited service of mobile technology provided enforced the company only to use a voice call and a short message data sharing. Services like mobile banking, email and video calls through mobile phone are still backward due to the challenge faced but there is some practice of using such services on head office and farms with relatively good mobile telephone network. The findings here entirely show that the problem is not the company's side rather the poor network infrastructure provided by Ethio Telecom. The company also has a big problem on using mobile phone as a permanent data sharing as the interviewee replied.

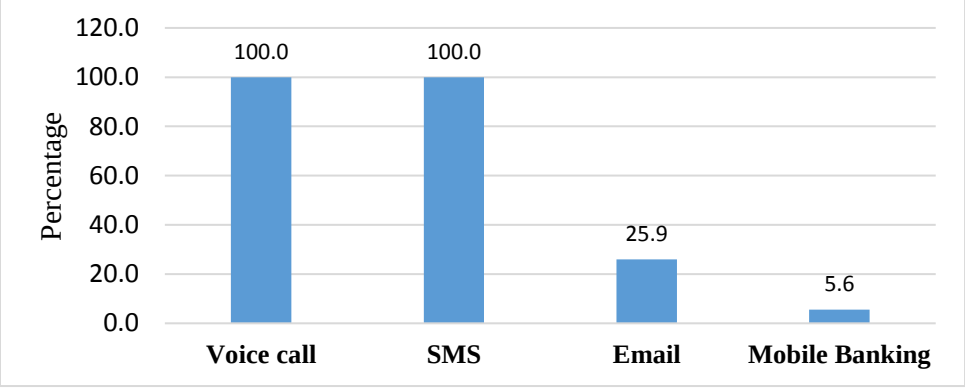

Figure 4.2 ICT Infrastructure usage
Sources: Own Survey Data

4.2.4 Level of Use of Smart Phone and Mobile Internet

Table 4.3 shows that, from the total of 54 respondents 48(88.9%) are using smart phones while 6(11.1%) are not, when we comprehend the Internet on mobile users from the total sample population 44(81.5%) of them are using while 10(18.5%) are not using Internet on their mobile. This analysis shows that majority of the sample population are using smart phone and internet in their mobile devises, the findings confirmed that there is a good practice of using smartphone and its helpful to adopt different new agricultural application systems which will be an input for the information and communication purpose of Ethio Agri-CEFT. The researcher also observed that even if the use of smart phone were covered all the target location of the company, adopting the technology for agricultural application is still low because of knowledge gap and limited network service.

Table 4.3 Smart phone and mobile Internet users

Variables	Responses	Frequency	Percentage
Do you use smart phones?	Yes	48	88.9
	No	6	11.1
	Total	54	100.0
Do you use Internet on your mobile phone?	Yes	44	81.5
	No	10	18.5
	Total	54	100.0

Sources: Own Survey Data

4.2.5 Level of Use of Internet Service

From the list of Internet usage questions the types service using are shown on Figure 4.3 presented 75.9% of the respondents are using social media and respondent with the same size are email users. Respondents who are searching different information are (55.6%), whereas 9.3% of them are using Internet for learning. From this analysis email and social media services user are represent the maximum percentage of the sample population, whereas, learning through Internet service has only 9.3% which is lower than the other services. The findings clearly show that using email as a communication media has a very good practice, in the same hand social media also covers as of the email service and the researcher observes that the company is using some social medias to transmit information in different formats like text, picture, video and audio. Searching information needs a hard work since it is a way of finding agricultural information as it was discussed previously in the literature. The observation result also indicates the company has a web site to make the organizational information ready for search which is a good practice to promote the

service and product given by Ethio agri-CEFT. Learning through internet is not practiced by the company staffs which can be used for training and provision for agricultural information sharing and minimize the knowledge gap occurred. The interview result on these issues also agreed that email and social media service of Internet are the main information sharing mechanisms practiced in Ethio Agri-CEFT plc. The interviewee also adds that searching information from the Internet should be supported with training and adopting Internet for different agricultural skill development packages will also bring a useful change in Ethio Agri-CEFT.

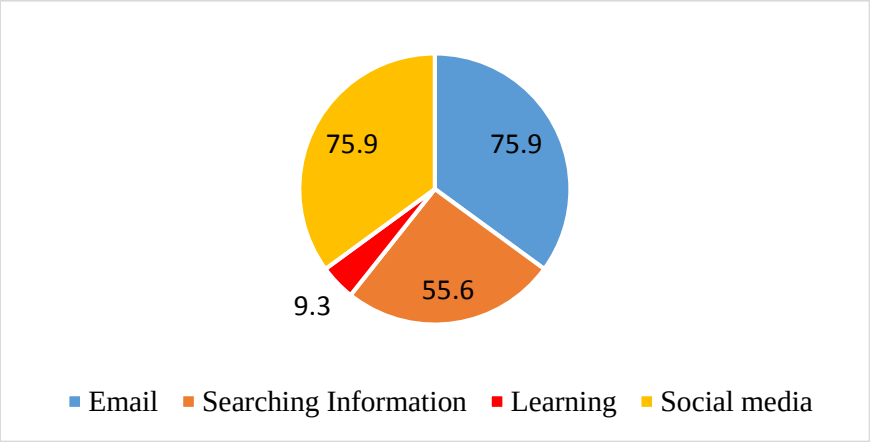

Figure 4.3 Types of service that respondent use from Internet
Sources: Own Survey Data

4.2.6 Types of Information and Interval of Search from the Internet

Table 4.4 shows that 74.1 % of the respondents are using internet daily while 1 respondent which means 1.9% using Internet weekly. On the other hand, 61.1% of the respondents are searching information which is relevant for their work while 38.9% of them are not searching work related information. The table also shows respondents who are searching information about agriculture are 22.2% while marketing denotes 5.6% of the population. When we realize procurement, human resource and mechanization are taking same 9.3% each, whereas finance is 7.4% and law takes only 1.9%. There are also other types of work related information which respondents are using these are, auction 1.9%, E-Tax (Electronics Tax System), 3(5.6%) and ECX 2(3.7%). This shows that there is a good experience of using Internet in daily basis most of the respondents use internet every day which can increase the level of agricultural information flow, in other hand a high number of the respondents are searching for relevant information for their work which means if supported with skill as it was discussed in the interview and observation, this service will help to

access a set of work-related (professional)information. Agriculture shares the maximum number from the types of work related responses since the company is an agricultural firm this finding state agricultural information is mostly gathered from the Internet. E-Tax and ECX information sharing are very low in regarding to other services, which needs an awareness and a training to increase the number of users to the system for sustainable use of such services. A Holland flower Auction (Flora Holland) is one of the service that Ethio Agri-CEFT uses to sale flowers to different part of the world, but the observation result shows there are only few users of such service which will affect the activities in the future.

Table 4.4: The type of information and interval on using Internet

Variables	Responses	Frequency	Percentage
How often do you use Internet?	Daily	40	74.1
	Weekly	1	1.9
	Total	54	100.0
Do you search information from the internet which is relevant to your field of work?	Yes	33	61.1
	No	21	38.9
	Total	54	100.0
what kind of work related information are you searching from Internet?	Agriculture	12	22.2
	Marketing	3	5.6
	Procurement	5	9.3
	Human Resource	5	9.3
	Finance	4	7.4
	Mechanization	5	9.3
	Law	1	1.9
	Other	6	11.2
	Total	54	100

Sources: Own Survey Data

4.2.7 Practice of Agricultural Data Search from the Internet

Among the total of fifty-four respondents 37% of them are using internet to get information about weather conditions, 35.2% of them are using internet to get agricultural management information. Seed, pesticides and fertilizers information are take 29.6%, 31.5% and 38.9% respectively. Among the respondent 1.9% which is 1 respondent is looking for spare part's information from the internet. Pointed at the Question asked about agricultural information source used, Ministry of Agriculture, www.moa.org is used by 5 respondents which is 9.3% and Ethiopian agricultural portal

(www.eap.gov.et) takes 3(5.6%) but Ethiopian Agricultural Transformation Agency (www.ata.gov.et) and e-agriculture (www. e-agriculture.org) are not selected by any of the respondents. Other agricultural and related information provider like FAO and (NMA) National Metrology Agency are represent 3.8% of the respondent. This analysis shows that at Ethio Agri-CEFT there is poor practice on using local agricultural information provider from the internet. Information about weather, seed, pesticides, fertilizers and the like are searched by the respondents which is a good practice for the company's agricultural development. The interview response also agreed on this issue but there should be a measure training and awareness development activities said the interviewee to increase the number of users for the service. This two questions are prepared for those who are working directly to agricultural activities like agricultural department manager and staffs.

Table 4.5: The type of agricultural information and a provider used from the Internet

Variables	Responses	Frequency	Percentage
What kind of agricultural information are you using from the Internet? (Multiple answer allowed)	Weather	20	37.0
	Agricultural management	19	35.2
	Seed	16	29.6
	Pesticides	17	31.5
	Fertilizers	21	38.9
	Other	1	1.9
	Total	54	
Which Agricultural data provider is familiar with you? (Multiple answer allowed)	Ministry of agriculture, www.moa.org	5	9.3
	Ethiopian agricultural portal, www.eap.gov.et	3	5.6
	Ethiopian Agricultural Transformation Agency, www.ata.gov.et	-	
	e-agriculture, www. e-agriculture.org	-	
	Other	2	3.8
	Total	54	

Sources: Own Survey Data

4.2.8 Training and Updating Practice of Computer and Computerized Equipment

It is clearly shown on table 4.6 that out of the 54 respondents 16 employees representing 29.6% of the total are attended a computer skill improvement training whereas, 38 respondents which is 70.4% of the sample size are not attended a computer skill improvement training. This shows that the majority of the respondents doesn't have a computer skill which is supported by a training that will be the result for slow adaptation of ICT in Ethio Agri-CEFT plc. The question about the usefulness of the training for those who had attended the training 12 respondents 22.2% agreed that the training was useful but 4(7.4) responses that the training was not useful. The analysis shows that trainings are useful but there are also problems on the applied trainings. As per the findings of the interview the company do not have a practice on giving ICT training and performance update on schedule, the training is given based on the need and requirement available. Trainings are given when there is a change in a system, applying a new technology and for a specific ICT need only. The interviewee also adds the continuous training must be implemented regarding to available and new technology systems.

According to the findings from the total 54 responses 29(53.7%) of the employees agree that the company frequently up to date computers and related accessories whereas, 25 employees that is 46.3% of the responses are disagreed on the idea (see Table 4.6). This shows that there is still a problem on updating computer systems which will pool the company backward from adopting newly available technology. The observation result also supports this idea, there are equipments which needs an update like computers, printers, computerized machineries, Internet devices and mobile technologies.

As shown in table 4.6, from the total respondents 22(40.e 7%) are using fully/partially computerized machineries at the farm or factories and 32(59.3%) of them are not using fully/partially computerized machineries at the farm or factories. This analysis shows that there is a practice on using computerized machineries. The research observation finds out that there are different computerized machineries in the targeted locations. At the head office a computerized system available for employee attendance control and a GPS car control, the tea processing and packing factory uses computerized machineries for its production, the flower farm uses computerized system for drip irrigation and green house climate control and the cereals farm had a practices of using computerized system machinery that are combiner, liner and tractor which are

used for the farm activities at the farm field. The tea farm had a practices of using computerized system machineries for plucking and processing tea at the farm level. This last question is prepared for those respondents who are directly work on computerized machineries.

Table 4.6: Training and updating of computer and computerized equipment

Variables	Responses	Frequency	Percentage
Have you ever attended a computer skill improvement training?	Yes	16	29.6
	No	38	70.4
	Total	54	100.0
If your answer is yes, do you think the training was useful?	Yes	12	22.2
	No	4	7.4
	Total	54	100.0
Do you think your company frequently up to date computers and related accessories?	Yes	29	53.7
	No	25	46.3
	Total	54	100.0
Do you use fully/partially computerized machineries at the farm or factories?	Yes	22	40.7
	No	32	59.3
	Total	54	100.0

Sources: Own Survey Data

4.2.9 Practice Related to Data Management and Transfer System

As shown on the table 4.7 below, from the total respondents 48 employees which represent 88.9% of the total respondents are using paper format which is a hard copy to manage their information and data. Whereas, 40 respondents which represent 74.1% are using computer to manage their information and data. Other 2(3.7%) of the respondents are using mobile telephone to manage their information. When we see the data transferring method, local area network as a data transfer mechanism represents 72.2% while email is 70.4%, removable disk (Flash and CD) usage is 44.4% and other method like E-Tax and Customs system represent 7.5%. The entire respondents using printed paper for data transferring method. This analysis shows that still 88.9% of the respondents in the target company are using paper format for data management system and the use of computer is less than that of the paper format. All the respondents are using printed paper to transfer data and information while, local area network and Email represent more than 70% of the respondent which is a good practice. There is also a small practice of using removable media as data transfer method. This finding shows that using paper as a communication media has so many problems as it was observed like cost of printed paper is very high and needs large area to store but Ethio Agri-CEFT is still using paper formats which is not helpful to adopt ICT in agriculture.

Table 4.7: Data management and transfer system used

Variables	Responses	Frequency	Percentage
What kind of system are you using to manage information and data?	Paper format	48	88.9
	Computer	40	74.1
	Other	2	3.7
	Total	54	100.0
How do you transfer data and information to other departments and stakeholders outside the office? (Multiple answer allowed)	Local Area network	39	72.2
	Email	38	70.4
	Removable media (CD or	24	44.4
	Printed paper	54	100.0
	Other	4	7.5
	Total	54	100.1

Sources: Own Survey Data

4.3 Success Related to ICT Use in Ethio Agri-CEFT

Regarding on the benefits obtained from using ICT in the company, the interviewee replies that from the slight practice of using ICT the company was benefited on increasing production, productivity and quality, ICT also has an effect on the company's operation cost reduction, time saving and process accuracy. ICT for Ethio Agri-CEFT's agricultural process can play a vital role as the interviewee responds by modifying the way how agricultural operation performs. The company benefited more from the ICT system, replied the interviewee, even if a wide range of problem existed ICT support the company in controlling, developing and managing agro-processing activities and serves as a bridge for everyday communication and information sharing. The interview discussion also shows that the use of mobile, internet and computer are important for the company activities, all the services and media devices are important and very useful for every single activities of company. If available and properly use this ICT models has a remarkable contribution on company's performance and productivity as it was seen on the practice of adopting currently available technologies. But the service should be reliable to apply other developing and developed countries experience on the sector. The interviewee also add Ethio Agri-CEFT is currently planning to use ICT as a basic input to attain its goal by combining ICT with its organizational objectives and goals.

4.3.1 Awareness of the Benefits of ICT for Agricultural System

From the table 4.8 it can be deduced that all of the 54 respondents, agreed that Information and Communication Technology (Internet, Mobile, Computer) has a remarkable role for their work activities, also all of them are agreed on ICT's high contribution on saving time and accuracy of information process and likewise all are granted on ICT's high impact on Total Quality Management (TQM) and productivity. These implies that all the respondents have awareness and knowhow of the use of ICT involvement in their daily agricultural and related office works performance. The interview and the observation checklist result also indicates that awareness on ICT benefit for agriculture is well presented in all the respondents understanding, this shows the company staffs has a knowhow on the ICT benefits which will be easier to implement new technologies and trainings. Similarly, the observation checks show there is no ICT based TQM system to control the standard of the products and service which is a basic for agro-processing activity as it was discussed in the literature previously.

Table 4.8: Awareness of ICT benefits

Variables	Responses	Frequency	Percentage
Do you believe ICT (Internet, Mobile, Computer) can bring a remarkable change to your work activity?	Yes	54	100.0
	No	0	0
	Total	54	100.0
Do you think using ICT system can save time and possess accuracy of information?	Yes	54	100.0
	No	0	0
	Total	54	100.0
Do you think using ICT add value to TQM and productivity?	Yes	54	100.0
	No	0	0
	Total	54	100.0

Sources: Own Survey Data

4.4 Challenges Related to ICT Use in Ethio Agri-CEFT

4.4.1 Challenges Faced During the Use of Mobile and Internet Services

The following section find out and analyze the challenge faced on using ICT infrastructure mobile phone and Internet. Figure 4.4, shows that all the respondents are agreed on mobile network problem, 70.4% of the responses are also agreed on Internet connection network problem, regarding to price tariff 31.5% of mobile and 68.5% of internet responses are agreed that the price

tariff of mobile and internet communications are expensive. Similarly, 24.1% agreed on the problem of Internet resource availability. When we see the useful software availability for the given job 61.1% of the respondents agreed that there is a problem on having a useful software for their job. There are also 9.3% of respondents who do not have time to use ICT systems. This analysis shows that network is a basic problem for all the respondents which is a barrier to use the mobile and Internet services effectively. The price tariff also another problem regarding to use mobile and internet services, its discussed in the literature review that Ethio Telecom (the single service provider) apply a price tariff downward revision but this research shows that the current tariff also not affordable by the majorities. The interview discussion about the challenges on using ICT also support the above findings, the interviewee replies that the major problems faced when company uses the internet services are limited geography distribution of Internet infrastructure, unavailability of the internet service on some of the company's farm investment locations, the poor data transmission speed and intermission of Internet network connection and inaccessibility of domestic website which is supportive for the company's agricultural activities. The interviewee similarly adds that due to these problems the company faced a challenge to centralized the information management system. The observation findings are also shows that there are also problems like electric power interruption, resource unavailability and user skills which is a big barrier to fully accessed the ICT services and equipments.

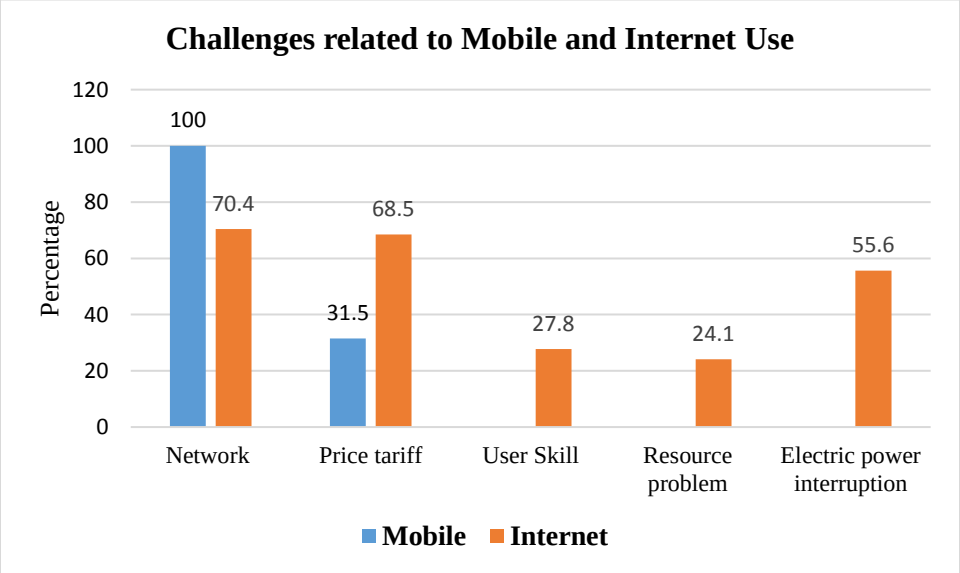

Figure 4.4: Challenges on using ICT mobile and internet
Sources: Own Survey Data

4.4.2 Challenges Faced During the Use of Computer & Computerized Machineries

The above figure 4.5, shows 28.8% of the respondents agreed that there is skill problem, while 18.5% agreed there is a knowledge gap and 5.6% believes the machineries are not useful for such operation, there are 24.1% of the sample population answers maintenance as the problem faced on operating fully or partially computerized machineries. These shows that there are problems on using computer and computerized machineries in Ethio Agri-CEFT particularly in skill problem, unavailability of useful software, electric power interruption and lack of proper maintenance. On the other hand, knowledge gap and the machineries performance for the dedicated job are problem faced. The observation result also shows that there are machineries whish are computerized in each of the targeted locations of Ethio Agri-CEFT plc but there are machineries which are not functional due to lack of maintenance and unavailability of skilled manpower to operate the machines. The electric power interruption problem also observed during the observation time. Likewise, unavailability of sufficient computer and peripherals also observed in four of the research target areas relatively the head office has adequate computer and peripherals.

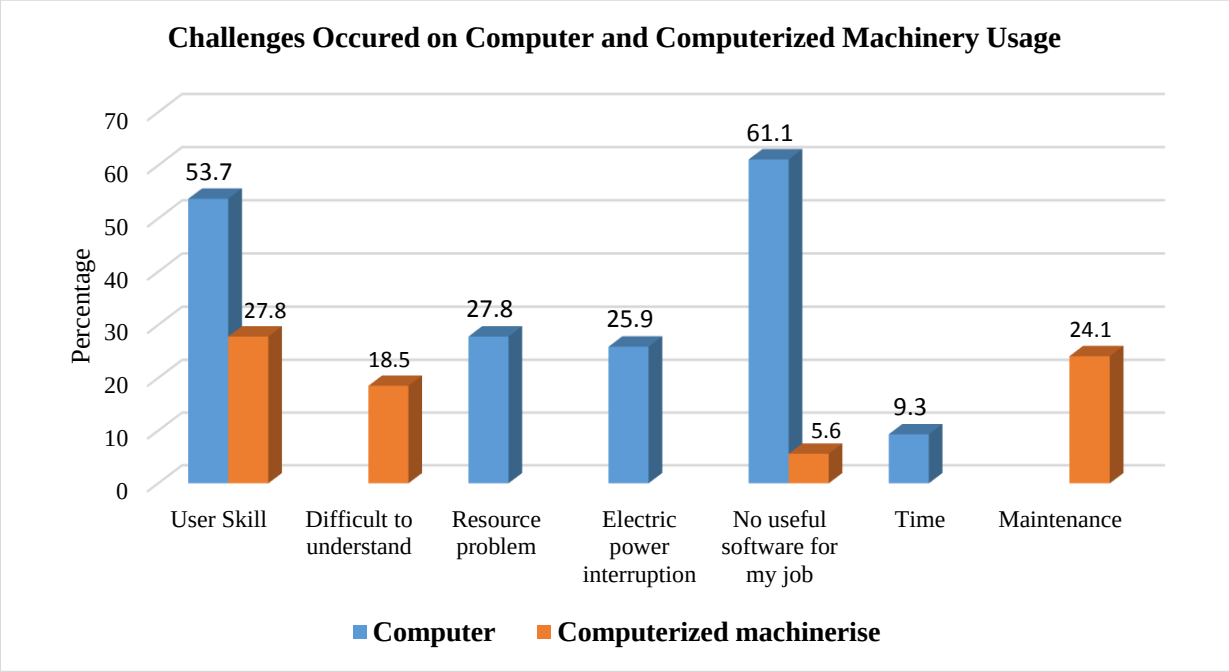

Figure 4.5: Challenges on using ICT computer and computerized machineries
Sources: Own Survey Data

4.4.3 ICT Related Problem Solving Mechanism of Ethio Agri-CEFT

The other issue pointed on the interview was how does the company solve the internet problem happening, the interviewee explains that when such Internet network disruption and service unavailability problem faced the company uses different communication systems like fax and landline telephones which is not proper for the types of data that are sharing through the stakeholders. The company also use the nearby cities internet café and network coverage to use internet communication which leads the company for extra costs. The only means of solving the challenge occurred in Internet connection is reporting to the single service provider Ethio Telecom through telephone calls which takes a long process.

The other issue discussed in the interview session was about getting a quick and reliable service and maintenance from the Internet service provider, according to the reply of the interviewee the service provider has so many hitches on handling the problem occurred on the service. It acquired more time to maintain and the problems are occurred most frequently. The problem handling system is a very long process which passes through different levels and offices of the service provider. The interviewee also marked that the maintenance service for the remote farm areas are not properly handled by the service provider.

The interview result also finds that all the ICT related equipments except the service provider side network problem are maintained by the ICT team developed in Ethio Agri-CEFT plc. The observation also supports this issue; company side network problems are properly handled but there is a problem on giving such service on remote locations of the company due to the distance lined between the farms and the head office which the ICT team exist.

CHAPTER FIVE
CONCLUSION & RECOMMENDATION

5.1. Summary of the Findings

The study focusses on Ethio Agri-CEFT's levels of using ICT models mobile telephone, Internet and computer in agriculture and the challenge faced during applying ICT in daily agricultural activities. The major findings show on using ICT infrastructure are that the company currently had a practice of using computer, Internet, mobile telephone and computerized machineries in daily agricultural activities. There also a practice of using services of ICT models like computer applications, email, voice call, SMS, E-Tax (Electronics Tax), ECX, online auction and a web site. Controlling risk, disaster, production and communications with the help of ICT also another practice. Besides there are different challenges on using these ICT systems like poor Internet and mobile network, absence of continuous skill and performance development training on ICT, absence of sufficient ICT resource, limited Internet and mobile network coverage, knowledge gap of users, electric power interruption, Internet and mobile service price tariff, luck proper maintenance on ICT infrastructure and equipments, unavailability of work related predefined software programs.

5.2 Conclusions

The study aimed at assessing and examining the practice and challenges of using ICT especially mobile phone, Internet and computer on agro-processing activities on the selected agricultural investment firm Ethio Agri-CEFT plc which is a member of MIDROC Ethiopia group companies. Based on the findings of the study the following conclusions were drawn. To achieve this purpose, basic research questions were raised at the beginning of the study inquiring, the ICT implementation practices of Ethio Agri-CEFT, the different types of ICT infrastructure available in Ethio Agri-CEFT and the success and challenges met by Ethio Agri-CEFT in using ICT. The research deeply observed and explore each and every ICT related practice and challenge using different data collection mechanisms.

To answer these basic questions an attempt was made to investigate what researches say about the object in point. It was discussed on different studies that using ICT in agriculture is a very effective mechanism to develop a strong communication among the stockholders which leads the agriculture

sector towards the strong level of development. The research incorporated respondents from different age, gender, educational qualification, job position and work experience then measured the practice, success and challenges faced using ICT in their daily agricultural activities, depend on variables such as access to mobile telephone, computer and internet technology, frequency of use, experience of using the technology, place and purpose of using the technology, sources of agricultural information, awareness of ICT benefits for agriculture and major challenges faced.

Based on the overall findings the researcher concludes that Ethio Agri-CEFT plc has a practice on using ICT infrastructures like computer, Internet, mobile telephone and computerized machineries in its daily agricultural activities. Services like computer applications, email, voice call, SMS, E-Tax (Electronics Tax) to reporting the governmental tax, ECX to search for global markets and Flora Holland online auction to sale horticultural products are used by the company to reduced cost and increase production and productivity. The company is benefited from ICT on controlling risks, overall performance and communications.

Generally, the results from the analysis shows that there is still a digital boundary using ICT for agriculture. The finding showed that practice of using ICT infrastructures mobile phone, Internet and computer for agricultural activities are still shows backward progress due to the poor network, the absence of sufficient resource, the knowledge gap of users, the electric power interruption and internet and mobile service price tariff problems. Even if the mobile telephone voice call and SMS service users are the highest, the poor network service provided is currently a block between the users and the technology. However, there are also problems on proper maintenance and skill training.

The cause of the network problem was the limited network coverage of the controlled service provider, it was discussed in the literature review section that Ethiopia is way behind the world average Internet usage of 25.9% and similarly the use of ICT for the accumulation and dissemination of knowledge and information is still low.

The monopoly system of the service provider and problems like inadequate qualified professionals to install, run and maintain the infrastructure and application, lack of ICT skills and brain-drain of the qualified professionals abroad or even from public to private, affects ICT implementation and set the coverage of ICT in Ethiopia the lowest in Africa. The target company for this research Ethio Agri-CEFT is the one which is affected by such problems.

ICT as an agro-processing tools had a very important role for the development of the sector, it was discussed in this research that the use of ICT for agriculture in Ethiopia still the list comparing to other model developing and developed countries. ICT based knowledge management system, automating the agriculture, use of E-agriculture and creating an ICT based strong agricultural value chain management is the practice of other countries agricultural transformation development mechanism but not the target company's practice.

Unavailability of work related predefined software programs, continuous performance updating training and resource shortage are problems hold the computer users back ward. But even if the problem existed there are practices on using computer as a part of the daily agricultural activities and operations but it needs a long term planned development measure to share benefits from the technology.

There are target areas of the company in which internet and related services are not completely available due to the limited coverage of the service provider. The service provider problem solving mechanism also has many operational and functional challenges which will be the result of previously discussed hitches on the service provider side.

5.3 Recommendation

Basing on the findings of this study, in order to improve the practice of using ICT in agro-processing activities and minimize the challenges discussed, the following recommendations are to be considered.

There is a need for the company to invest more in computers and related technology as means of not only solving accessibility problem but improving the production and productivity of agro-processing utilization. This include GIS (Geographical Information System), automating the agriculture system and the use of E-agriculture. The company should also update computers and related accessories to adopt latest technologies. There is a need of maintain the knowledge gap in the firm and its sections by facilitating a continuous reliable training on ICT based services, this include the use of Internet, mobile phone, computer and its peripherals and computerized machineries.

Adopting ICT based knowledge management system, computerized TQM for production and service, building and controlling a strong ICT based agricultural value chain management will help the firm to increase its computation in the farming business world. Building awareness among the staffs about '8028' Ethiopia's first agricultural hotline SMS launched in July 2014, by ATA, in collaboration with the MoA, EIAR and Ethio Telecom, which gives a full agricultural information on the mobile telephone will help to gather relevant agricultural information specially for those areas which has a challenge on using Internet.

The company should have focused on implementing integrate software programs and packages which will helps to facilitate the overall agricultural process in timely fashion, also awareness about agricultural service provider on global world wide web platform should be created among the staffs and give proper training on how to use such service.

Ethio Telecom should work a lot to improve the capacity, quality and geographical coverage of ICT infrastructure, and also consider the implementation and service cost of these technologies to bring the planned result on agriculture development stated by the government in GTP II.

5.4 Possible Areas for Further Research

Since ICT is somewhat a new in the agriculture process a lot of research is needed to be carried out. This study has exposed many things that could not all be covered. The researcher thus recommends the following possible research areas.

1. The Link Between Technology and Agriculture in Ethiopia
2. The Benefits of ICT Based Agricultural Value Chain Management for Ethiopia

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APPENDICES

Appendix A

The Total Employees of the Target Sites, Source: Ethio Agri-Ceft Plc, (2017)

Target location	Male	Female	Total
Head Office	65	26	91
TPPF(Tea Processing and Packing Factory)	72	55	127
Wush Wush Tea Farm	218	59	277
Bir Cereal farm	230	58	288
Holeta Flower Farm	133	295	428
Total	**718**	**493**	**1211**

Appendix B

National Fiber Backbone in Ethiopia (ETC, 2008/2009 EC)

Appendix C

Questionnaire

Dear Sir/Madam,

My name is Samuel G/meskel Teka, MBA student in the Department of Project Management at St. Mary's University. The aim of this questionnaire is to assess the practice and challenges of using ICT (Information Communication Technology) in agro-processing firms. The results of the study are anticipated to supply to the understanding of the basic practice and challenges of adopting ICT in Ethio Agri-CEFT plc.

I would like to assure you that the information you provide will be used only for the purpose of achieving academic award. Your involvement is regarded as a great input to the quality of the research results. Hence, I believe that you will enlarge your assistance by participating in the study. Your honest and thoughtful response is invaluable and confidential. Thank you for your participation.

Best regards,

Samuel G/meskel Teka
MBA student in Department of Project Management
St. Mary's University
Addis Ababa, Ethiopia

Background information of the respondent

Gender

☐ Male ☐ Female

Age group

☐ 22 -30 ☐ 31-40 ☐ 41-50 ☐ 51-60 ☐ 61 and above

Position:

☐ Top level management ☐ Division Head ☐ Professional

Education level:

☐ Diploma ☐ First degree ☐ Masters ☐ PhD ☐ Other

_____

Experience:

☐ 4 years ☐ 5 years ☐ 6 years ☐ 7 years ☐8 years and above

Part I Mobile Telephone Related Questions

1. **What kind of ICT system you are currently using at your office?**
   ከመረጃና መገናኛ መንገድ በቢሮዎ የትኛውን ይጠቀማሉ?

   ☐ Cell phone (Analog, Smart phone) **- ተንቀሳቃሽ ስልክ**

   ☐ Internet (Broadband, Wi-Fi, Mobile) **- ኢንተርኔት (የመረጃ መረብ)**

   ☐ Computer (Desktop, Laptop, Tablet) - **ኮምፒውተር**

2. **What kind of information do you transfer through mobile phone?**
   በተንቀሳቃሽ ስልክ ምን ዓይነት መልእክት ያስተላልፋሉ?

   ☐ Voice call - **በድምፅ መደወል**

   ☐ SMS- **አጭር የፅሁፍ መልእክት**

   ☐ Email - **ኢሜል**

   ☐ Other - **(ሌላ ካለ)** _____

3. **Do you use smart phones?**
   የመቀጠሚያ ሶፍትዌር ያላቸውን ተንቀሳቃሽ ስልኮች ይጠቀማሉ?

   ☐ Yes **አዎ** ☐ No **አይ**

4. **Do you use Internet on your mobile phone?**
   በተንቀሳቃሽ ስልክዎ ላይ ኢንተርኔት ይጠቀማሉ?

   ☐ Yes **አዎ** ☐ No **አይ**

5. **What kind of problem you face when you use mobile telephone?**
   ተንቀሳቃሽ ስልክ ሲጠቀሙ የገጠመዎት ችግር አለ?

   ☐ Network - **(ኔት·ወርክ)**

   ☐ Price tariff - **(የመጠቀሚያ ክፍያ)**

   ☐ How to use - **(የአጠቃም ክህሎ·ት)**

   ☐ Other **(ሌላ ካለ)**_____

Part II Internet Related Questions

6. **How often do you use Internet?**
   ኢንርኔት በምን ያህል ጊዜ ርቀት ይጠቀማሉ?

   ☐ Daily - **በየቀኑ**

   ☐ Weekly - **በየሳምንቱ**

   ☐ Monthly - **በየወሩ**

   ☐ Other **(ሌላ ካለ)**_____

7. **What kind of service you are using from the Internet?**
ከኢንተርኔት (*መረጃ መረብ*) ምን ዓይነት አገልግሎት ይጠቀማሉ?

☐ Email - **ኢ-ሜል**

☐ Search Information - ***መረጃ መፈለግ***

☐ Learning - **ትምህርት መማር**

☐ Social media - **የማኅበረሰብ ድህረ ገጽ**

☐ Other **(ሌላ ካለ)** _____

8. **Do you search information from the internet which is relevant to your field of work?**
ከሚሠሩት ሥራ ጋር የተያያዘ መረጃ ከኢንተርኔት (*መረጃ መረብ*) ላይ ያወጣሉ?

☐ Yes -**አዎ** ☐ No -**አይ**

9. **If the answer is yes, for Q8 what kind of information you are searching for?**
ለጥያቄ ቁጥር8 መልስዎ አዎ ከሆነ ምን ዓይነት መረጃ ያወጣሉ?

☐ Agricultural- **የእርሻ (ግብርና)**

☐ Marketing - **የገበያ**

☐ Procurement - **ግዢ**

☐ Human Resource - **የሰው ኃይል**

☐ Finance **የሒሣብ**

☐ Mechanization - **የኮምፒውተራይዝድ መሣሪያዎች**

☐ Law - **ሕግ**

☐ Other **(ሌላ ካለ)** _____

10. **What kind of agricultural information you are using from the Internet?**
ምን ዓይነት የእርሻ (የግብርና) መረጃ ከኢንተርኔት ይጠቀማሉ?

☐ Weather - **የአየር ሁኔታ**

☐ Agricultural Management - **የግብርና ሥራ አስተዳደር**

☐ Seed - **ዘር**

☐ Pesticides - **ፀረ-አረም**

☐ Fertilizers - ***ማዳበሪያ***

☐ Other **(ሌላ ካለ)** _____

11. Which Agricultural data provider is familiar with you?
ለእርስዎ ዋና የግብርና መረጃ ቋት የሆነው የቱ ነው?

☐ Ministry of agriculture, www.moa.org **ግብርና ሚኒስቴር**

☐ Ethiopian agricultural portal, www.eap.gov.et **የኢትዮጵያ ግብርና መግቢያ**

☐ Ethiopian Agricultural Transformation Agency, www.ata.gov.et **የኢትዮጵያ ግብርና ማሣደጊያ ኤጀንሲ**

☐ e-agriculture, www. e-agriculture.org **ኤሌክትሮኒክ ግብርና መረጃ**

☐ Other **(ሌላ ካለ)** _____

12. What kind of problem you face when you use Internet?
ኢንተርኔት ሲጠቀሙ ያጋጠመዎት ችግር የቱ ነዉ?

☐ User skill - **ያጠቃቀም ክህሎት**

☐ Network - **ኔትዎርክ**

☐ Electric power interruption - **የኤሌክትሪክ ኃይል ማቋረጥ**

☐ Resource problem (Internet, Mobile, Computer) - **የመጠቀሚያ ቴክኖሎጂ አለመኖር**

☐ Other **(ሌላ ካለ)** _____ **(ኢንተርኔት፣ሞባይል፣ኮምፒውተር)**

Part III Computer Related Questions

13. Have you ever attended a computer skill improvement training?
የኮምፒውተር እውቀት ማስጨበጫ ሥልጠና ወስደው ያውቃሉ ?

☐ Yes **አዎ** ☐ No **አይ**

14. If your answer is yes, for Q13 do you think the training was useful?
ለጥያቄ ቁጥር8 መልስዎ አዎ ከሆነ ሥልጠናው ጠቃሚ ነዉ ይላሉ?

☐ Yes **አዎ** ☐ No **አይ**

15. What kind of system you are using to manage information and data?
መረጃዎችን ለማደራጀት ምን ዓይነት መንገድ ይጠቀማሉ ?

☐ Paper formats - **ወረቀት**

☐ Computer - **ኮምፒውተር**

☐ Other **(ሌላ ካለ)** _____

16. How do you transfer data and information to other departments and stakeholders outside the office? **ወደ ሌላ የሥራ ክፍሎች እንዲሁም ከቢሮ ውጭ መረጃን ለማስተላለፍ ምን ይጠቀማሉ?**

☐ Local area network - **የውስጥ ለውስጥ ኔትዎርክ**

☐ Email - **ኢ-ሜል**

☐ Removable media (CD or Flash) - **ተንቀሳቃሽ መረጃ መያዣ (ሲዲ/ፍላሽ)**

☐ Printed paper - **የታተመ ወረቀት**

☐ Other **(ሌላ ካለ)** _____

17. Do you think your company frequently up to date computers and related accessories?
ድርጅትዎ ኮምፒውተርና ተዛማጅ መገልገያዎችን ከጊዜዉ ጋር ያሻሽላል ብለው ያምናሉ?
☐ Yes **አዎ** ☐ No **አይ**

18. What was the problem you faced regarding to using a computer?
ኮምፒውተርን ለመጠቀም የገጠመዎ ችግር?

☐ Skill - **ያጠቃቀም ክህሎት**
☐ Resource (Computer) unavailability - **መገልገያ (ኮምፒውተር) አለመኖር**
☐ Unavailability of useful software for your job - **ለሥራዎ የሚጠቅም ሶፍትዌር አለመኖር**
☐ Time **ጊዜ**
☐ Other **(ሌላ ካለ)** _____

19. Do you use fully/partially computerized machineries at the farm or factories?
ሙሉ በሙሉ/በከፊል በኮምፒውተር የሚታገዙ መሣሪያዎችን በእርሻ ወይም በፋብሪካ ውስጥ ይጠቀማሉ?

☐ Yes **አዎ** ☐ No **አይ**

20. If your answer for Q17 is Yes, what are the problems you faced on the operation?
ለጥያቄ ቁጥር17 መልስዎ አዎ ከሆነ ለመጠቀም የገጠመዎት ችግር አለ?

☐ Skill **ያጠቃቀም ክህሎት**
☐ Difficult to understand **የመረዳት ችግር**
☐ Not useful for my job **ለሥራዎ ተስማሚ አለመሆን**
☐ Other **(ሌላ ካለ)** _____

Part III Computer Related Questions

21. Do you believe ICT (Internet, Mobile, Computer) can bring a remarkable change to your work activity? ኢንፎርሜሽን ኮምኒኬሽን ቴክኒዬሎጂ (ኢንተርኔት፣ሞባይል፣ኮምፒውተር) በሥራ እንቅስቃሴዎ ላይ ተጨባጭ ለዉጥ ያመጣል ብለዉ ያምናሉ?
☐ Yes **አዎ** ☐ No **አይ**

22. Do you think using ICT system can save time and possess accuracy of information? ኢንፎርሜሽን ኮምኒኬሽን ቴክኒዬሎጂ (ኢንተርኔት፣ሞባይል፣ኮምፒውተር) መጠቀም ጊዜን በመቆጠብ እና መረጃ ጥራት በማስጠበቅ ችግር ፈቺ ነው ብለው ያምናሉ?
☐ Yes **አዎ** ☐ No **አይ**

23. Do you think using ICT add value to TQM and productivity?
ኢንፎርሜሽን ኮምኒኬሽን ቴክኒዬሎጂ (ኮምፒውተር፣ ሞባይል፣ ኮምፒውተር) በአጠቃላይ የምርት የጥራት ቁጥጥር እና ምርታማነት ላይ የጨመረው ውጤት አለ ብለው ያምናሉ?
☐ Yes **አዎ** ☐ No **አይ**

24. Do you believe that, there is enough ICT (Internet, Mobile, Computer) resource available in your company? በድርጅትዎ በቂ የኢንፎርሜሽን ኮምኒኬሽን ቴክኒዬሎጂ (ኮምፒውተር፣ ሞባይል፣ ኮምፒውተር) መገልገያ አለ ብለው ያምናሉ?
☐ Yes **አዎ** ☐ No **አይ**

Appendix D

Observation Checklist Site 1

Code	*Head Office Addis Ababa, Mekanissa*	*Observed?*	*Comment*
1	Internet availability	☐ Yes ☐ No	
2	Broadband connection availability	☐ Yes ☐ No	
3	Adequate quantity of computer availability	☐ Yes ☐ No	
4	Mobile Internet availability	☐ Yes ☐ No	
5	Mobile internet user availability	☐ Yes ☐ No	
6	Mobile Network Problem	☐ Yes ☐ No	
7	Internet Network Problem	☐ Yes ☐ No	
8	Company side Network problem	☐ Yes ☐ No	
9	Service provider side network problem	☐ Yes ☐ No	
10	Mechanized System availability	☐ Yes ☐ No	
11	Computerized TQM system availability	☐ Yes ☐ No	
12	Knowledge about ICT availability	☐ Yes ☐ No	

Appendix E

Observation Checklist Site 2

Code	*Tea Processing and packing factory, Addis Ababa, Mecanissa*	*Observed?*	*Comment*
1	Internet availability	☐ Yes ☐ No	
2	Broadband connection availability	☐ Yes ☐ No	
3	Adequate quantity of computer availability	☐ Yes ☐ No	
4	Mobile Internet availability	☐ Yes ☐ No	
5	Mobile internet user availability	☐ Yes ☐ No	
6	Mobile Network Problem	☐ Yes ☐ No	
7	Internet Network Problem	☐ Yes ☐ No	
8	Company side Network problem	☐ Yes ☐ No	
9	Service provider side network problem	☐ Yes ☐ No	
10	Mechanized System availability	☐ Yes ☐ No	
11	Computerized TQM system availability	☐ Yes ☐ No	
12	Knowledge about ICT availability	☐ Yes ☐ No	

Appendix F

Observation Checklist Site 3

Code	***Holeta flower farm Oromiya region Holeta city 47 km from the capita***	***Observed?***	***Comment***
1	Internet availability	☐ Yes ☐ No	
2	Broadband connection availability	☐ Yes ☐ No	
3	Adequate quantity of computer availability	☐ Yes ☐ No	
4	Mobile Internet availability	☐ Yes ☐ No	
5	Mobile internet user availability	☐ Yes ☐ No	
6	Mobile Network Problem	☐ Yes ☐ No	
7	Internet Network Problem	☐ Yes ☐ No	
8	Company side Network problem	☐ Yes ☐ No	
9	Service provider side network problem	☐ Yes ☐ No	
10	Mechanized System availability	☐ Yes ☐ No	
11	Computerized TQM system availability	☐ Yes ☐ No	
12	Knowledge about ICT availability	☐ Yes ☐ No	

Appendix G

Observation Checklist Site 4

Code	***Bir farm, Amhara Region (Western Gojam) 400km from the capital***	***Observed?***	***Comment***
1	Internet availability	☐ Yes ☐ No	
2	Broadband connection availability	☐ Yes ☐ No	
3	Adequate quantity of computer availability	☐ Yes ☐ No	
4	Mobile Internet availability	☐ Yes ☐ No	
5	Mobile internet user availability	☐ Yes ☐ No	
6	Mobile Network Problem	☐ Yes ☐ No	
7	Internet Network Problem	☐ Yes ☐ No	
8	Company side Network problem	☐ Yes ☐ No	
9	Service provider side network problem	☐ Yes ☐ No	
10	Mechanized System availability	☐ Yes ☐ No	
11	Computerized TQM system availability	☐ Yes ☐ No	
12	Knowledge about ICT availability	☐ Yes ☐ No	

Appendix H

Observation Checklist Site 5

Code	*Wush-Wush tea farm and semi processed factory Kaffa Zone, Southern Region 460km South West of the capita*	*Observed?*	*Comment*
1	Internet availability	☐ Yes ☐ No	
2	Broadband connection availability	☐ Yes ☐ No	
3	Adequate quantity of computer availability	☐ Yes ☐ No	
4	Mobile Internet availability	☐ Yes ☐ No	
5	Mobile internet user availability	☐ Yes ☐ No	
6	Mobile Network Problem	☐ Yes ☐ No	
7	Internet Network Problem	☐ Yes ☐ No	
8	Company side Network problem	☐ Yes ☐ No	
9	Service provider side network problem	☐ Yes ☐ No	
10	Mechanized System availability	☐ Yes ☐ No	
11	Computerized TQM system availability	☐ Yes ☐ No	
12	Knowledge about ICT availability	☐ Yes ☐ No	

Appendix I

Semi-Structured Interview

Dear Sir/Madam

This interview is prepared to collect data with regarding to the practice and challenges of using ICT (Information and communication Technologies) in agro-processing firms. It will provide a major input for my thesis "Practice and Challenges of Using ICT in Agro-processing firms" and it is purely conducted for academic purposes.

Therefore, you are kindly requested to provide your valid responses to the sets of interview questions. All your responses remain confidential. I thank you in advance for your cooperation.

Background Information of interviewee:
Position: _____
Gender: _____
Age: _____
Education level: _____
Experience: _____
For how many years have you been in your current job? _____

1. What types of internet connections your company currently using?
2. What are the major problems you faced when you use the internet service?
3. How do you solve such problem?
4. Do you get a quick and reliable service and maintenance from the service provider of your internet?
5. Do you think there are enough personal computers available in the company?
6. Have you ever been used a mobile telephone for your company's data sharing system?
7. How do you explain the use of mobile, internet and computer for your company activities?
8. Do you frequently give a training related to ICT for your staffs?
9. What are the major benefits you obtained on using ICT in your company?
10. How do you explain the relationship and awareness of the staffs on using ICT?

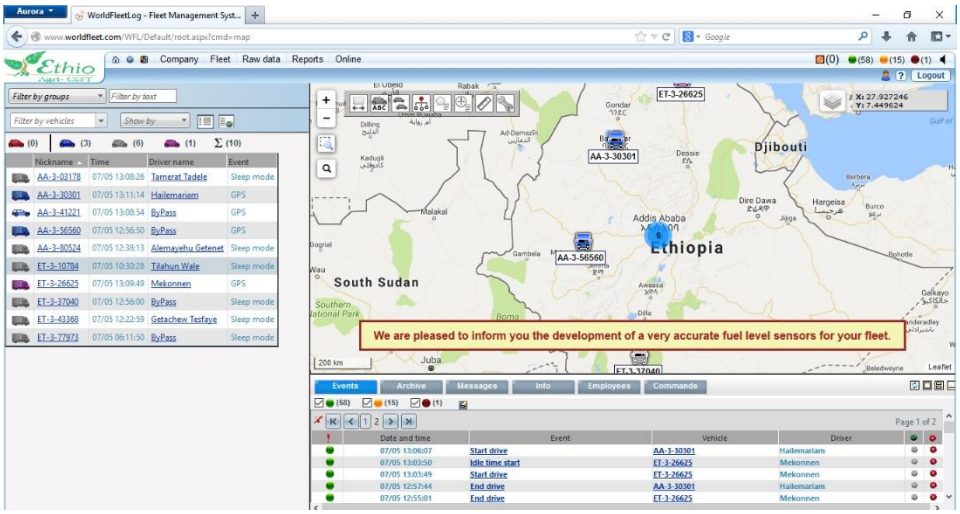
Best regards,

Samuel G/meskel Teka
MBA Student in Department of
Project Management
St. Mary's University
Addis Ababa, Ethiopia

Appendix J

Observation Area Images Representing Some of the Company's ICT Infrastructure

		
Broadband Connection Through Fiber Optics Cable	A Wi-Fi Wireless Connection	Broadband through Copper Cable
		
Computerized Attendance Control System	Computerized Tea Packing Machine at the Factory	Computerized Laboratory Machine at Head Office
		
Computerized Combiner at the Farm	Computerized Combiner at the Farm	Partially Computerized Pivot Watering Machine at the Farm



Computerized GPS Car Controlling System