# INFORMATION COMMUNICATION TECHNOLOGY (ICT) AND AGRICULTURAL DEVELOPMENT PROJECTS IN KENYA

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A research project presented in partial fulfilment of the requirement for Master of Business Administration at the University of Nairobi

**DECLARATION**

I declare that this research project for the degree of Masters of Business Administration at the University of Nairobi hereby submitted, has not been submitted by me or anyone else for a degree at this or any other university. That it is my own work and that materials consulted have been properly acknowledged.

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## DEDICATION

I dedicate this paper to my wife, Maryanne, who has stood by me through my research study and writing. Without her continued support and counsel I could not have completed this process.

**ABSTRACT**

This study examines the use of Information Technology & Communication in agricultural development in Kenya and evaluates its impact, obstacles to ICT use and strategies to overcome these obstacles. In order to determine this linkage, a livelihood approach has been adopted. The livelihoods framework for analysis provides a way of thinking which views the poor as operating in a context of vulnerability. Within this context, the poor have access to certain assets or poverty-reducing factors. These gain meaning and value through the structures and processes of the prevailing institutional, organizational, and social environment.

A cross-sectional survey was carried out using a questionnaire that focused on the level of ICT usage and the level of impact measured using the livelihood assets of human, social, physical, finance and natural. The impact indicators were based on these assets which are widely defined as objectives for each agricultural development project.

The findings show a fair level of ICT usage in agricultural development and its positive impact widely realised in achieving the short term expectations of the projects. The study also reveals that obstacles to ICT usage were adequately addressed by the strategies to enhance ICT usage employed by individual projects. There is further need to analyse each ICT component and link it to its quantifiable contribution to the livelihood impact indicators.

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# CHAPTER ONE: INTRODUCTION

## 1.1 Background of the Study

One of the biggest challenges that nations in the developing world face is finding successful solutions to the problem of poverty by improving the human development condition and livelihoods. Development is perceived differently by different people depending on their contexts and needs. Information Communication Technologies (ICTs) have been drawn into the 'development' field as potential tools for poverty alleviation, economic and social development in urban and rural areas of developing countries (Kuriyan & Bussell, 2008). Tech-terms (2010) refer ICTs to technologies that provide access to information through telecommunications. Masiero (2010) defines development in terms of empowerment and participation rather than on sheer economic growth. She argues that a context-based approach to Information Communication Technology for Development (ICT4D) should be used, which is capable of overcoming the mismatch between generalist theories and on-field reality. The recent decade has seen exponential growth in Information Communication Technologies (ICTs) with computers, digital organizers, mobile phones, internet and wireless computing spreading all across the globe (Thirumavalavan & Garforth, 2009). ICT has become a potent force in transforming social, economic and political life globally.

Steinen, Bruinsma, and Neuman (2007) acknowledge that the agricultural sector faces major challenges of enhancing production in a situation of dwindling natural resources necessary for production. The growing demand for agricultural products, however, also offers opportunities for producers to sustain and improve their livelihoods. Steinen et al further explain that Information and communication technologies play an important role in addressing these challenges and uplifting the livelihoods of the rural poor. According to the World Bank (2011), 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 farmers. ICT is one of these solutions, and has recently unleashed incredible potential to improve agriculture in developing countries specifically. With the booming mobile, wireless, and Internet industries, ICT has found a foothold even in poor smallholder farms and in their activities. The World Bank also reports that 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 upsurge of organizations committed to the agricultural development agenda.

The potential benefits of ICT have been acknowledged by several stakeholders (Gunga, 2008; Muriithi et al, 2009; Parmar, 2009; Steinen et al, 2007; Thirumavalavan & Garforth, 2009, World Bank, 2011). There has been a growing consensus globally on the positive role ICTs play in development particularly of developing countries. Parmar (2009) though observes that we should view ICT as a tool, and not as the solution, toward building knowledge-based societies. He proposes that a user-centred framework approach will provide understanding into user requirements and into developing customized content through involvement of rural users in the early stages of the development cycle. In order to reap the opportunities offered by ICT, Taylor (2007) states that countries may find it necessary to identify a set of policies to encourage the creation, diffusion and use of knowledge, this should form the basis of a sustained growth strategy. He suggests that a vast range of social impacts such as lifestyle, living standards, social inclusion, needs to be measured and monitored. This would in turn help inform stakeholders on change of these impacts after adoption of ICT

### 1.2 The Agriculture Development Projects and ICT in Kenya

According to the Government of Kenya, (GoK, 2010) the agricultural sector is the backbone of Kenya's economy and the means of livelihood for most of the rural population. The sector contributes 26 per cent of the Gross Domestic Product (GDP) directly and another 25 per cent indirectly. Muriithi, Bett and Ogaleh (2009) acknowledge that smallholders form the bulk of agricultural producers in Kenya. Improving smallholder agriculture is therefore important to poverty alleviation, and information and knowledge are critical to this effort. The sector is acknowledged as one of the major employers of rural people, with an estimated 3.8 million Kenyans directly employed in farm, livestock production, and fishing while another 4.5 million are employed in off farm informal sector activities (Gok, Vision2030, 2008).

Most agricultural development projects in Kenya are donor-driven (Ministry of Agriculture, GoK, 2012) that focus on improving productivity, research, extension

systems, produce value addition and rural poor livelihoods mainly through increased household incomes. The livelihoods concept is widely adopted by these projects because it views the poor operating in a context of vulnerability. Duncombe (2007), explains that in the vulnerability context, the poor have access to certain assets or poverty-reducing factors. These gain meaning and value through the structures and processes of the prevailing institutional, organizational, and social environment. The Kenya Government (GoK, 2010) through various initiatives is creating an enabling environment and implementing projects that aim at sustaining these livelihoods and reduce vulnerability.

In the Kenya Government's Information Communication Technology (ICT) policy guidelines, (Ministry of Information & Communication, 2011), ICTs play an increasingly critical role for economies and society. They have proven to be a powerful driver of innovation, growth and productivity globally. High-speed Broadband access to ICTs provides significant opportunities for improving government services, health care, agricultural services, education and the environment. They also open new channels for sharing of global knowledge resources and the free flow of ideas and opinions. The Government (Gok, Vision2030, 2008) also acknowledges that there are some challenges facing the ICT sector that hinders it full potential. Some of them include; lack of an institutional and legal frame work to implement automated services including electronic transactions; Lack of standardisation of components and systems being procured and applied across the Government; Limited country-wide ICT awareness that hinders cultural and attitudinal change; A wide internal digital divide between rural and urban areas as well as low bandwidth; Financial and human resource constraints; Bridging the "islands of automation" by allowing sharing of information among agencies; High costs of ICT utilisation and maintenance; High costs of migrating from analogue to digital broadcasting; Challenge of obtaining a better integration of ICT solutions into company and public policies. To address these challenges, the government's objective in its Vision 2030 strategy is to ensure that the country has a competitive telecommunications industry which delivers reliable and affordable services and products for the economic and social benefit of citizens.

The agricultural sector in Kenya (GoK, 2010) is constrained by a number of factors of which agricultural development projects have been created to address. Some of them

include: High cost of inputs; limited application of agricultural technology and innovation; weak farmer institutions: poor livestock husbandry practices; limited extension services; over-dependence on rain fed agriculture; inadequate exploitation of Value Addition; inadequate Credit facilities; poor post harvest handling; lack of market driven production; poor handling of the supply chain of the finished products; and limited access of Business Development Services (BDS) by farmers. In an effort to reverse the decline, and fastrack growth efforts within the Agriculture sector the Government has embarked on several development projects and programmes that focus on; agricultural research and development, extension services, the cooperative sector, seed and breed quality improvement, promote irrigation technologies and institutional and legal reforms.

Some of these challenges can be addressed by implementing ICT services that improve the service delivery process, increase efficiency and effectiveness of programmes and enable efficient linkages between various agriculture sector stakeholders. An understanding of the factors associated with IT adoption and use in agriculture development will enable the development of strategies to promote IT adoption and increase the effectiveness and efficiency of information used in agriculture. While the argument stands that ICT remain an important component of development in developing countries, what calls for consideration is how they can be applied effectively in agricultural development to produce the desired impact. Agriculture being the backbone of Kenya's economy, the rapid growth of the ICT sector in Kenya creates huge potential for organizations in Kenya to invest in ICT initiatives in agriculture. This creates a good opportunity for researchers to carry out studies and fill the knowledge gap on the impact of ICTs on transforming the agriculture sector in Kenya.

## 1.3 Statement of the Problem

The potential of ICT in the improvement of lives is a human-given that is yet to be fully realized in developing countries in general and Kenya in particular. Gunga (2008) states that one of the major challenges to the realization of the power of ICT potential in human livelihoods is the relative unawareness of the majority of the populace about the role ICT plays in socio-economic and cultural environment. A key observation by Gitau, Plantinga, & Diga, (2010) in a study about research by African is that the African

contribution to international academic research in Information Communication Technology for Development (ICT4D) is very low, typically between 1% and 9% percent of publications across sub-disciplines. Gitau et al further observe that the low output of African authors in the ICTD field suggests that theories around the appropriate design, mechanisms of adoption, and impact of ICTs in developing countries are being formed without significant influence by African scholars. Heeks (2007) points out that most research on ICT4D has a bias to action and not knowledge, therefore most of the ICT4D research being produced is therefore descriptive not analytical. It might make some interesting points but it lacks sufficient rigor to make its findings credible and it can often be repetitive of earlier work. Heeks suggests that to make it more analytical, ICT4D research contribution is generally possible only where the research draws on some pre-existing conceptual framework.

A review of literature suggests that several initiatives have been undertaken to use ICT such as computers, internet, mobile phones, TV and radio media to increase information access and dissemination to farmers in recent years (Gitau, 2010; Gunga, 2008; Muriithi et al, 2009; World Bank, 2011). Though this achievement, sufficient findings on the impact of these in Kenya have not been fully explored. With agriculture being a key economic pillar and a robust ICT sector, the knowledge gap of the impact of ICT adoption on agricultural development projects needs to be further explored. This study aims to address this problem and contribute its findings for further research.

To explore the usage and effect ICTs have on agricultural development projects in the areas of productivity, farmer economic & social empowerment and service delivery, the study is designed to answer the following questions: What are the ICT-based initiatives undertaken by various agricultural development projects? What obstacles to ICT adoption have they faced while trying to improve efficiency and effectiveness in agricultural productivity, economic empowerment and service delivery? Does the use of ICTs have any impact on agricultural productivity, service delivery, social empowerment and improving farmer livelihoods?

## 1.4 Research Objectives

The general objective of the study is to investigate ICT adoption in agricultural development projects in Kenya. The specific objectives being:

a. To determine the extent of ICT usage in agricultural development projects;
b. To determine the obstacles to ICT usage;
c. To establish the impact of ICTs on agricultural development projects.
d. To establish the strategies on how to improve ICT adoption;

## 1.5 Value of the Study

The research findings can guide future agricultural development projects on strategies of implementing and using ICT to improve agricultural development service delivery and increase agricultural productivity.

The findings can be used by agricultural-based projects that are experiencing challenges using information technology, to identify solutions and adopt best-practices to address those challenges.

It can be used as a reference for agriculture sector managers to select ICTs that have the most impact on agriculture, by implementing those that are cost effective, easy to build capacity and understand, and provide quick feedback for informed decision making.

The findings of this study will contribute to the ongoing research in the field of Information Communication Technology for Development (ICT4D) in Africa

# CHAPTER TWO: LITERATURE REVIEW

## 2.1 ICT for Development (ICT4D)

The International Telecommunication Union (ITU, 2003) adapts a service-based definition of ICTs as "the new breed of information technologies generated by the progressive merger between telecommunications and computing" (p. 12) and includes VoIP, the Internet, e-applications such as e-government services, e-business, telemedicine and e-learning. ICT4D (Information and Communications Technologies for Development) is an initiative aimed at bridging the digital divide (the disparity between technological "have" and "have not" geographic locations or demographic groups) and aiding economic development by ensuring equitable access to up-to-date communications technologies (Techtarget, 2012). Heeks (2010), proposes that ICT4D projects and policies can best be understood through a value chain model. As shown in Figure 1 below, this builds on a standard input—process—output model to create a sequence of linked ICT-for-development resources and processes. The ICT4D value chain focuses on four domains; readiness (skills, infrastructure and policy), availability, uptake, and impact (outputs, outcomes and development impacts).

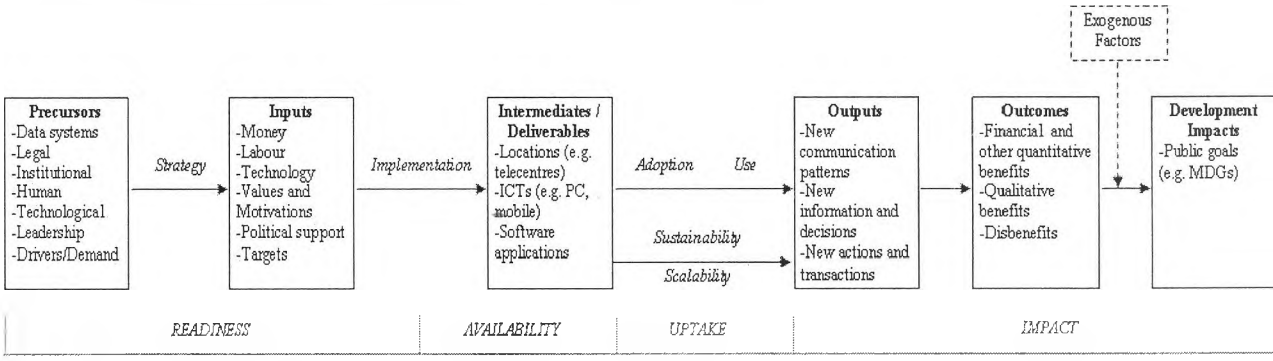


**Figure 1: The ICT4D Value Chain**

Source: Heeks (2010)

Lund & Sutinen (2010), advocate for a bottom-up ICT4D approach which starts by identifying communities that are ready to participate in a process to use technology to transform their own strengths to new levels by designing appropriate technologies with experts of technology and design. This approach defers with the traditional ICT4D approach agenda that starts from a readily available technology, such as mobile phones and SMS, the feasibility of which is evaluated in a context of a developing country. This approach will ensure the targeted communities interests are addressed wholly.

Wangwe (2007) acknowledges that assessment of the impact of ICT on development and economic transformation should take into consideration the continuous interaction between technical and social processes. Transformations in the ICT environment are both technically and socially determined whereby the processes of technical change interact with the institutions in which people are differentially empowered to act. A study by Putnam & Kolko (2010) noted that technology is much more likely to substantively contribute to development if we understand how technologies are likely to diffuse and be adopted – and those patterns of diffusion and usage hinge on the social meaning of those technologies and how they inhabit a larger technological ecology.

Torero and von Braun (2005) argue that ICTs offer an opportunity for development, but not a panacea. For the potential benefits of ICTs to be realized in developing countries, many prerequisites need to be put in place: prompt deregulation, effective competition among service providers, free movement and adoption of technologies, targeted and competitive subsidies to reduce the access gap, and institutional arrangements to increase the use of ICTs in the provision of public goods. Torero and von Braun claim that given the diverse potential benefits of ICTs, especially in the provision of public goods, subsidies traditionally used for poverty alleviation could be adapted to create incentives for the use of ICTs.

## 2.2 ICT and Agriculture

Information and communication have always mattered in agriculture. Farmers have always sought information from one another at the local level and external sources. What type of seed to use? Where can you get the best market price? Which crops to mix to produce highest yield? What type of farm inputs to apply? According to the World Bank (2011), agriculture is facing new challenges such as climate change, globalization and integration of food markets has herald intense competition and efficacy which can lead to marginalization of certain markets, and growing populations. The role of ICT to enhance food security and support rural livelihoods is increasingly recognised and was officially endorsed at the World Summit on the Information Society (WSIS) 2003-2005, (Stienen, Bruinsma, & Neuman, 2007). Nui, Zhang and Qu (2010) suggest that there are evidences that ICT can improve livelihoods of farmers by the way of increasing their

access to potential markets. In this area, use of ICTs facilitate contact between sellers and buyers, promote agricultural exports, facilitate online trading, and make producers aware of potential market opportunities including consumer and price trends in domestic markets. By increasing awareness among producers on consumer trends and new production techniques, ICTs can contribute to the diversification of production, which is in favor of food security.

A study by Muriithi, Bett and Ogaleh (2009), shows that agricultural decisions on: timely land preparation, planting, weeding, irrigation, harvesting, storage and marketing have always been central concerns to agricultural stakeholders. ICT especially mobile telephones can speed the way farmers in rural areas of Kenya get, exchange and manipulate information. They rework the way farmers interact with markets and cities. Muriithi et al further illustrate that a variety of innovations that integrate ICTs into the dissemination of agricultural information to farmers (Farmers Information Services – FIS) have been developed at local, national and regional levels. They have currently demonstrated a promising field of new research and application in e-agriculture whilst bringing new sources of information and new tools for local knowledge dissemination. They are increasingly enabling farmers to focus, search and extract useful and up-to-date market information.

The World Bank (2011) illustrates different ways ICT can be used and have an impact on agricultural productivity: Firstly, ICT can fill the knowledge gap between availability of yield technologies and how to use them effectively to address productivity challenges. Secondly, ICT can be used to monitor pest thresholds in integrated pest management, provide relevant and timely information and agricultural services, map agrobiodiversity in multiple-cropping systems, forecast disasters, and predict yields. Crop losses diminish as farmers receive relevant and timely information on pests and climate warnings through SMS technology. Thirdly, ICT can also lead to more optimal use of inputs. Increasing producers' knowledge of how to use and manage water, equipment, improved seed, fertilizer, and pesticide has improved the intensification of farm practices around the world, and finally ICT can be used to match cultivars to appropriate environments, increase the understanding of genotype-by-environment interactions, and adapt cropping strategies to the changing climate. Each

of these applications increases the profitability of agriculture, reduces transaction costs, facilitates climate change adaptation, and improves livelihoods for the rural poor.

Gunga (2008) observed that ICT may be used to assist the poor by providing: Better access to market and other production technology information such as prices for their inputs and outputs; Better understanding of the distribution systems, rights and policy enforcement mechanisms; Better enhancement of social networks measured in terms of improved perceptions of connectedness, empowerment and reduced isolation; Exposure to the E-mail/Internet/Websites appropriate to the livelihoods of the members of the particular cooperative society or group; Enhanced use of the telephones, SMS text, beeping and creation of a telephone address using mobile communication facilities; Improved social interaction which contributes to efficiency; Improved information flows and communication services; Improved strategy for education and training through strategic application of technologies and ICT enabled skills development and in-service support.

### 2.3 ICT Initiatives in Agriculture in Kenya

According to the Communications Commission of Kenya, CCK (2012), by December 2011 there were a total of 28.08 million mobile subscriptions. Mobile penetration was recorded as 71.3 per cent during the period (October to December 2011) up from 67.2 per cent recorded during the previous period (July to September 2011). CCK also notes that Internet has become an important tool of accessing information and communicating. Its usage has been on a rising trend currently estimated at 17.38 million users. This translates to 44.12 per cent of the population that have access to the Internet with majority accessing the service through their mobile phones. With the steady growth in mobile subscriptions, the growth in Internet usage is likely to continue as operators seek to leverage on new and emerging technologies to offer attractive packages aimed at garnering more subscribers to use this service.

Most Agriculture-ICT initiatives in Kenya are run by government led projects or programmes. The Kenya Agricultural Information Network (KAINET, 2012), is an information network set up to promote information exchange among stakeholders in the agricultural sector in order to support decision making, promote innovation in agriculture and subsequently improve livelihoods. It aims to modernise and increase

productivity of the agricultural sector. KAINET was initiated in April 2006 in response to demand from the national and international community to promote information exchange and access among stakeholders in the agricultural sector. Private driven initiatives like Kenya Agricultural Commodity Exchange (KACE, 2012) was launched in 1997 to facilitate linkage between sellers and buyers of agricultural commodities, provide relevant and timely marketing information and intelligence, provide a transparent and competitive market price discovery mechanism and harness and apply information and communication technologies for rural value addition and empowerment.

Mobile phone applications have also found their way in agriculture. From an article in the Business Daily by Sunday (2011), the iCow is a voice-based WAP enabled application that keeps farmers abreast of essential animal breeding and feeding methods through technology. A farmer can register his cows free of charge through the iCow portal and gets regular SMSs about the breeding and production patterns of the livestock. Details of elements like the estrus cycle, feeding patterns, prevalent diseases, milking calendar and calf management practices that are essential for dairy cattle rearing are relayed through the system. M-Farm (2011) is web start-up that seeks to improve the economic condition of Kenya's farmers. Using a basic SMS interface, M-Farm helps farmers by providing them with access to current market prices, aggregating their needs into discount orders with suppliers, and giving them direct, collective access to both regional and export markets for their products.

Non-governmental organizations also play a big role in the agriculture sector. Pride Africa (2010) runs a project DrumNet which is a research project focused on addressing issues such as farmers access to reliable markets, buyers access to adequate quantities of produce, ability of intermediaries such as banks to provide cost-effective services, as well as others slowing agricultural development in East Africa. DrumNet utilizes an ICT-enabled platform to serve the agricultural community and its key actors. The platform increases information flow, decreases transaction costs and diminishes risk across the supply-chain. Pride Africa through DrumNet used a comprehensive finance, production, delivery and payment process that linked actors involved with sunflower cultivation in Kenya predominately via the use of SMS and an IT system that provided

internal control to track and report on compliance throughout the process. The impact of this lead to improved efficiency in the supply chain as illustrated in Figure 2.

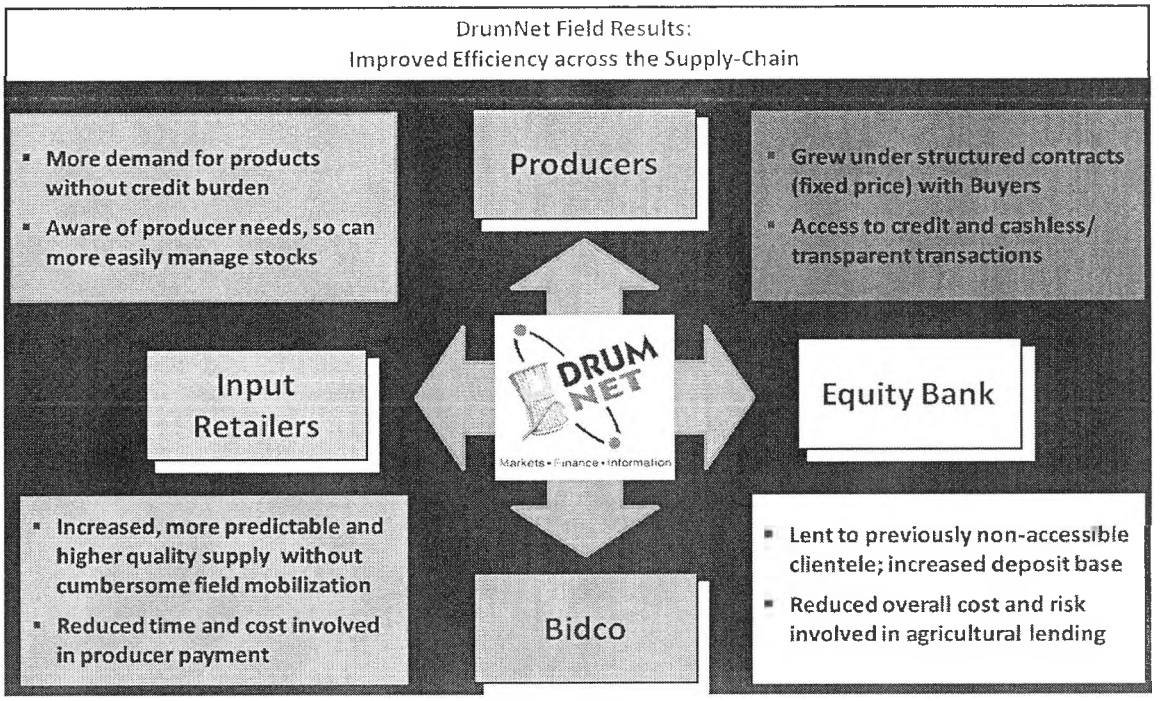


**Figure 2: DrumNet results in Kenya's Sunflower Sector. DrumNet Project (2010)**

## 2.4 Theoretical Frameworks for ICT4D Impact Assessment

With the growing level of ICT application on development, impact analysis is crucial. The International Institute for Communication and Development (IICD, 2006) has been involved in projects and policy trajectories and consistently monitors the progress and impact of the use of ICTs. Although the evidence of the contribution of ICTs to agricultural development and poverty alleviation is becoming increasingly available, the positive impact can seldom be demonstrated. There is little point in allocating resources to expand or replicate it. Given the difference in the regions in terms of livelihood and vulnerability patterns, it is vital to follow a region-specific approach to ICTs application. From their study Nie, Zhang, & Qu, (2010) observed that the best practices are giving priority of the ICT application to the community uses. In addition, impact evaluation of ICTs for poverty reduction initiatives is problematic because most initiatives utilize ICTs as tools in a broader strategy rather than as 'solutions' in themselves. A key issue is the extent to which the application of ICTs brings competitive advantage in comparison to projects with similar goals that do not use ICT in the same way. Nie et al deduced that the evaluation of ICT for agricultural livelihood

and poverty reduction include the following aspects of targeting farmers and the rural poor; expandability/replicability, sustainability, multi-sector partnerships, community engagement, gender sensitivity, cultural/social sensitivity, innovative combination of ICTs, and human capacity building.

Heeks & Molla (2009) classify impact of an ICT4D project into five categories; total failure, largely unsuccessful, partial success/failure, largely successful, and total success. They acknowledge that impact assessment frameworks are categorised in four as show in table 1 below.

| ***Framework Type*** | ***Sub-Type*** | ***Focus Area*** |
|---|---|---|
| GENERIC | | *Cost-Benefit Analysis* |
| | | *Project Goals* |
| DISCIPLINE-SPECIFIC | Communication Studies | *Communications-for-Development* |
| | Development Studies | *Capabilities* |
| | | *Livelihoods Framework* |
| | Information Science | *Information Economics* |
| | | *Information Needs/Mapping* |
| | Sociology | *Cultural-Institutional* |
| ISSUE-SPECIFIC | | *Enterprise (Growth)* |
| | | *Gender* |
| APPLICATION-SPECIFIC | | *Tele-centres* |

**Table 1: ICT4D Impact Assessment Frameworks Heeks & Molla(2009)**

The Integrative framework developed by Sein and Harindranath (2007) presents three different conceptualisations of ICT: its use, how it is viewed and how it impacts development (see Figure 2). This model posits that new technologies impact society through three effects: the first order or primary effect (i.e., simple substitution of old technology by the new), the second order or secondary effect (i.e., an increase in the phenomenon enabled by the technology) and the third order or tertiary effect (i.e., the generation of new technology related businesses and societal change).

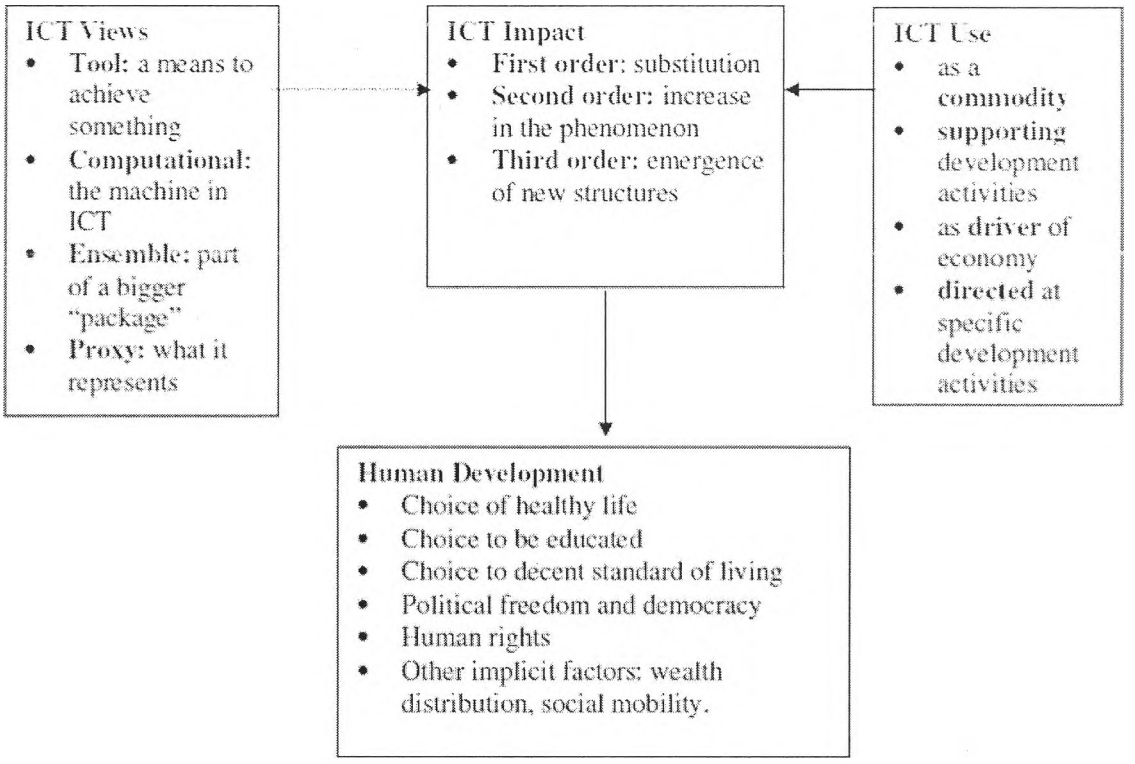


**Figure 3: Integrative framework of ICT4D (Sein & Harindranath, 2007)**

While the Sein and Harindranath framework aims to describe how ICT should be viewed, used and what effect to observe, it does not ask who the primary actors are in the ICT for development process. For example, who should conceptualise ICT, or who should observe the effects? Second, it does not question the ideologies and logic behind the behaviour of these actors. In other words, what motivates or propels them to take these perspectives? They propose using multiple frameworks to fill the inadequacies of individual frameworks

## 2.5 Literature Summary

There is a noticeable inadequate analysis on the impact of ICTs for development in Kenya. The requirement for further multidimensional research has been recognised by many writers (Heeks, 2010; Taylor, 2007; Grunfeld, 2007), to fill the knowledge gaps relating to the benefits or impacts of ICT on development projects. Most of the documentation sourced was mostly on policy and very little on ICT4D. It is evident from the review that several ICT projects in agriculture are being undertaken but little is documented on the impacts.

Most of the agricultural development projects in Kenya are project goal and livelihood based. A set of project development goals or objectives primarily targeting livelihoods are evaluated at the end of the project to determine the level of success or failure (see

Figure 4). The livelihoods framework provides an all-embracing framework for assessing the impact of ICTs on individuals and communities: context, assets, institutions, strategies and outcomes (Figure 5). Chapman and Slaymaker (2002) as quoted by Duncombe (2006), suggest time-dependent roles for information in contributing to livelihood strategies. The first role relates to long-term capacity building through education, training, and technical support, such as has been traditionally provided through government-run extension services. Within a livelihoods perspective a broader role should also be considered: information for enhancing the long-term rights and entitlements of the poor in areas such as health, education, participation, and empowerment. The second role relates to information concerning short-term decision making. By being very broad, the livelihoods framework portrays ICTs as being one of the many factors that contribute to development thus acts to prevent the danger of any undue overemphasis on either information or its related technologies.

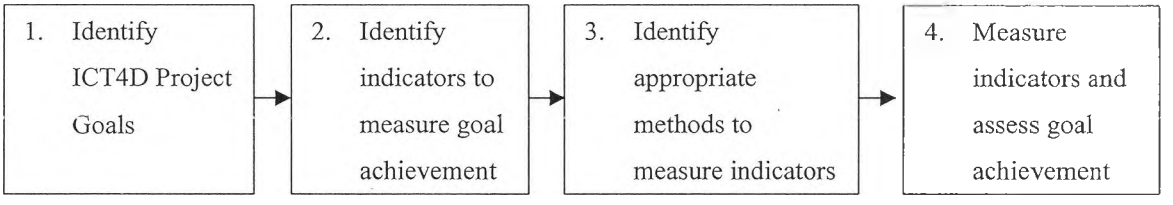


**Figure 4: Project Goal framework**

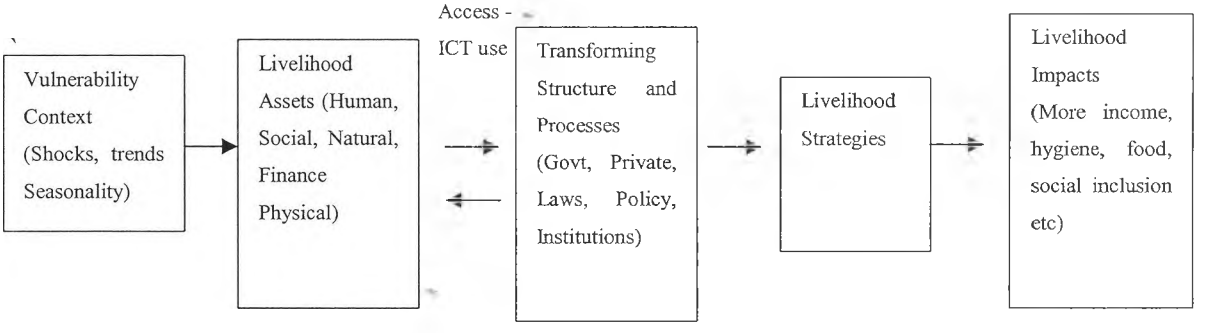


**Figure 5: Livelihoods framework (Heeks & Molla, 2009)**

The conceptual model adopted in this study has a mix of project goal and livelihoods framework approach to ICT4D impact assessment, though more emphasis was place on the livelihood framework. The project goal approach is sensitive to the particular priorities and context of an individual project, while the livelihoods approach focuses on individuals and communities. The livelihoods approach places people and their

priorities at the centre of development. It focuses on ICT usage in poverty reduction interventions on empowering the poor to build on their own opportunities, supporting their access to assets, and developing an enabling policy and institutional environment. The adopted conceptual framework reflects the view of ICT as a tool for empowerment, the building of capabilities and achieving sustainability at individual and community levels.

# CHAPTER THREE: RESEARCH METHODOLOGY

## 3.1 Research Design

In order to address the research questions a cross sectional survey was adopted. A cross sectional study was used to determine the relationship between ICT usage and its impact on agricultural development projects since most impact indicators in agriculture are one-dimensional (either positive or negative) and rarely change over time. What varies is the level of impact.

## 3.2 Population

Most agricultural development initiatives are managed by government led projects under the Ministries of Agriculture and Livestock. Several non-governmental organizations and private sector led ICT projects are actively investing in agriculture. From the literature review, an estimated population of 50 agricultural development projects were identified (Ministry of Agriculture, GoK, 2012), (USAID, 2012) (EbookSource, 2007) (Appendix 3). The targeted respondents were Programme Officers/Coordinators who are in charge of planning, execution and monitoring of project activities.

## 3.3 Sampling

The sampling frame was categorised into groups that were the basis of stratified random sampling. The stratums or units of analysis consisted of Government donor-funded projects, non-government organizations projects, and public-private/private projects in the agriculture.

To get out sample size a simplified formula for proportions (Yamane, 1967) was used:

$n = N/1+N(e)^2$ where N=population and e = desired precision level(5%)

$n = 50/1+50(0.05)^2 = 44.44$

The target of the sample was therefore 44 of the population. The sampling fraction is 36/50 = 0.88 (88%). The elevation factor is 50/44 = 1.136 (Each unit represents 1.1 other units). The sample size in each stratum was calculated using the formula:

$n_i = n*Ni/N$ where n = total sample size, Ni = population in strata and N = total population

| Strata | Population | Sample |
|---|---|---|
| GoK/Donor-funded Projects | 24 | 44*24/50 = 21 |
| NGOs | 16 | 44*16/50 = 14 |
| Private/Public-Private | 10 | 44*10/50 = 9 |
| Total | 50 | 44 |

**Table 2: Samples from the strata**

The samples were grouped this way because of the different approach to project implementation or execution. Stratified random sampling also strengthens the external validity of the sample.

### 3.4 Data Collection Method

A structured non-disguised questionnaire was utilised for this research (Appendix 2: Sample questionnaire). It was self-administered. The questionnaire consisted of closed-ended questions. To address the objectives of the study, Likert and Nominal scales was widely adopted in each section of the questionnaire as shown in table 2. The use of a survey and questionnaire was adopted because they can: be versatile; gather a great deal of data; eliminate the bias that can occur during interviews; be widely distributed; be easy to quantify; and facilitate creation of graphs and charts.

| Section/Research Objective | Data Collection Measure |
|---|---|
| 1. Nature of Project | Nominal scale |
| 2. Level of ICT usage | Likert scale (Single option variable) |
| 3. Obstacles to ICT use | Likert scale (Single option variable) |
| 4. Impacts realized | Likert scale (Single option variable) |
| 5. Strategies to improve ICT usage | Likert scale (Single option variable) & Open-ended |

**Table 3: Data collection Measures**

The data collection procedure included the following steps: Deliver the questionnaires to the targeted respondents; provide the respondents adequate time to complete the questionnaires accurately and with completeness collecting questionnaires, checking the completeness and clarifying unclear responses.

### 3.5 Data Analysis

Data analysis involved three stages. Firstly data preparation which involved data validation, checking the data for accuracy, entering the data into the computer; transforming the data, and developing and documenting a database structure that integrates the various measures. Secondly descriptive statistics was used to describe the

basic features of the data in the study. It provides simple summaries about the sample and measures. Univariate analysis was used to examine across cases one variable at a time. The variable's characteristics of distribution, central tendency and dispersion will be determined. To evaluate the relationship between ICT usage and the impact on agricultural development projects, simple linear regression was used.

| Section/Research Objective | Data Measure | Analysis Method |
|---|---|---|
| 1. Nature of Project | Nominal scale | Univariate |
| 2. Level of ICT usage | Likert scale (Single option variable) | Regression/Correlation (Variable - ICT type) |
| 3. Obstacles to ICT use | Likert scale (Single option variable) | Univariate |
| 4. Impacts realized | Likert scale (Single option variable) | Regression/Correlation (Variable- impact type) |
| 5. Strategies to improve ICT usage | Likert scale and Open-ended | Univariate & Content |

**Table 4: Data analysis methods**

Finally to make conclusions that extend beyond the collected data, analysis of variations were determined to evaluate the variability of the means of the different stratums or groups in the sample.

# CHAPTER FOUR: DATA ANALYSIS, RESULTS & DISCUSSION

## 4.1 Introduction

This chapter presents the findings from the data collected using a structured self administered questionnaire. Hand delivery of each questionnaire was preferred because it enabled the respondent to be briefed on the contents of the questionnaire and provide clarification of any questions that may arise during administration. From a total of forty four (44) target respondents, thirty three (33) were fully completed and collected. Six did not respond and five could not be located or contacted. The average age of the projects surveyed based on their year of inception is four years.

## 4.2 General Information Findings

### 4.2.1 Gender and Age

This section of the questionnaire focused on general information and bio data of the respondents. The tables below give a summary of the gender representation.

| | | Frequency | Percent |
|---|---|---|---|
| Gender | MALE | 23 | 69.7 |
| | FEMALE | 10 | 30.3 |
| | Total | 33 | 100.0 |

**Table 5 Respondents Gender**

This represents a third gender (close to 33% for female) threshold being met. Agricultural projects are not predominately dominated by one gender. The respondents were mostly programme officers and coordinators for government run projects and managers for private run projects.

| | | Frequency | Percent |
|---|---|---|---|
| Valid | 15-30 | 3 | 9.1 |
| | 31-45 | 16 | 48.5 |
| | 45-60 | 12 | 36.4 |
| | Above 60 | 2 | 6.1 |
| | Total | 33 | 100.0 |

**Table 6: Respondents Age**

Most respondents were in the middle ages of 31 – 45 (48.5%); this indicates that most respondents have good work experience and knowledge of agricultural development.

### 4.2.2 Type of Project

| | | Frequency | Percent | Target |
|---|---|---|---|---|
| Type | GOK | 20 | 60.6 | 24 |
| | NGO | 6 | 18.2 | 16 |
| | PRIVATE | 7 | 21.2 | 10 |
| | Total | 33 | 100.0 | 44 |

**Table 7 Type of organization/project**

From table 7 above the least response category was NGO where only 6 out of the targeted 16 returned completed questionnaires. Also this category had three respondents that could not be located. From the conceptual model used for impact assessment, 9 of the 33 respondents were modeled around the project goal framework and the other 24 around the livelihoods framework. In the project goal model, project activities were centered on achieving the project's goals and objectives. The other 24 project objectives directly target the beneficiaries' livelihoods.

### 4.2.3 Working Areas

This represents the spread of project activities within Kenya. It focused on the location of the targeted beneficiaries using Counties as the unit of analysis.

| No of Counties | Frequency | Percent |
|---|---|---|
| 1-10 | 11 | 33.3 |
| 11-20 | 14 | 42.4 |
| 21-30 | 5 | 15.2 |
| ALL 47 | 3 | 9.1 |
| Total | 33 | 100.0 |

**Table 8 Target areas (Counties)**

With 42.4% of the 33 respondents covering between 11 and 20 counties, the spread of agricultural development projects fairly covers almost half to Kenya, noting that about 80% of Kenya is arid and semi-arid (GoK, 2010). Most projects sample Counties to pilot their activities then replicate the positive achievements in the other Counties

## 4.3. ICT Type and Level of Usage

The second section of the questionnaire addressed the first objective of the study focusing on the type of ICT and level of usage by the agricultural development projects as shown in table 9 below.

| Type of ICT Used | Mean (Usage: 1-None, 2-Low, 3-Fair, 4-High, 5-Very High) | Standard Deviation |
|---|---|---|
| Internet for information awareness | 3.48 | 1.093 |
| Internet for marketing | 2.42 | 1.062 |
| Internet for project progress reporting | 3.27 | 1.008 |
| SMS services | 3.15 | 1.584 |
| Mobile Apps | 2.06 | 1.456 |
| GIS/GPS for mapping & remote sensing | 3.03 | 1.380 |
| Information systems for M&E | 3.58 | 1.226 |
| Information system for data analysis & reporting | 4.00 | 1.118 |
| Information dissemination - leaflets, Newspapers, Brochures | 3.85 | .939 |
| Telephone (Mobile & Fixed) | 3.64 | 1.113 |
| Radio | 2.24 | 1.146 |
| Television | 1.48 | .712 |
| Other | 1.00 | .000 |

**Table 9: ICT type and usage levels**

From the table above the highest usage of ICT was recorded in "Information systems for data analysis and reporting" and the least usage was by means of "Television". The earlier technologies of communication (Newsprint and telephone) still dominate in information dissemination. Television is low probably due to the cost of the service.

## 4.4. Obstacles to ICT Usage

Section 3 of the questionnaire tackled the second objective of the study which identified the obstacles to efficient and effective use of ICT as shown in table 10 below.

| Obstacle | Mean (1-none, 2-low, 3-fair, 4-high, 5-very high) | Std. Deviation |
|---|---|---|
| Poor IT infrastructure | 3.06 | 1.088 |
| Cost of ICT services | 3.03 | 1.403 |
| Insufficient user skills | 3.64 | .895 |
| Inadequate training | 3.24 | .969 |
| Poorly sourced systems | 2.27 | 1.329 |
| Inadequate IT support | 2.76 | 1.437 |
| Fear of Job replacement | 2.18 | 1.286 |
| Complexity of technologies | 2.70 | 1.015 |

| | | |
|---|---|---|
| Lack of Need | 1.76 | .830 |
| Inadequate policy framework | 2.76 | 1.458 |
| Others | 1.00 | .000 |

Table 10: Obstacles to ICT usage

From these findings the biggest obstacle was "insufficient user skills" and the least was the "lack of need". This signifies that the biggest challenge revolved around building capacity of users on the use and benefits if new technologies.

## 4.5 Impact Realised after ICT Usage

Section 4 addressed the third objective of the study examining the impacts realised after use of ICT on agricultural development as illustrated below.

| Impact Type | Mean | Std. Deviation |
|---|---|---|
| Increased adoption of newly informed practices and technologies | 3.36 | 1.084 |
| Improved market access | 3.39 | 1.248 |
| Increased market driven production | 3.55 | 1.277 |
| Increased household income | 3.42 | 1.200 |
| Increased saving in the supply chain | 2.94 | 1.059 |
| Increased access to financial services | 2.76 | 1.275 |
| Improved farm management practices | 3.39 | 1.171 |
| Enhanced social status | 3.61 | .864 |
| Increased negotiating power of beneficiaries | 3.09 | 1.011 |
| Improved social interaction between farmers | 3.21 | .960 |
| Reduced dependancy on agriculture extension | 2.24 | .902 |
| Other | 1.00 | .000 |

Table 11: Impact of ICT on agricultural development

A mix of financial, social, physical and human assets was used to define the indicators measured to determine impact. As shown in table 11 the social and physical indicators scored above the 3 average.

To determine the relationship between ICT usage and Impact on agricultural development a scatter graph was plotted as illustrated in figure 6 below. The mean across the various ICT types and impact variables were calculated for the thirty three respondents. The X and Y axis scales spans from 1 to 5 where 1-none, 2-low, 3-fair, 4-high, and 5-very high. To conduct a simple linear regression the following assumption were made and tested:

- The relationship between the predictor variable Y (ICT usage) and the response variable X (Impact level) is linear in nature.
- For each population denoted by values of variable X, the distribution of Y values is normal, i.e. for each theoretical value of ICT usage level, the level of impact realized is normally distributed. Visually tested through the scatter plot of the data below, and also through an examination of residuals.
- For each population denoted by values of the variable X, the variances of these populations are equal. This assumption often goes by the name of *homoscedasticity*. If distributions are not homoscedastic, then a problem of *heteroscedasticity* is said to exist
- The errors both within conditional distributions of Y given X and between conditional distributions of Y given X are independent. This means that no single observation in the data is probabilistically dependent on any other observation.

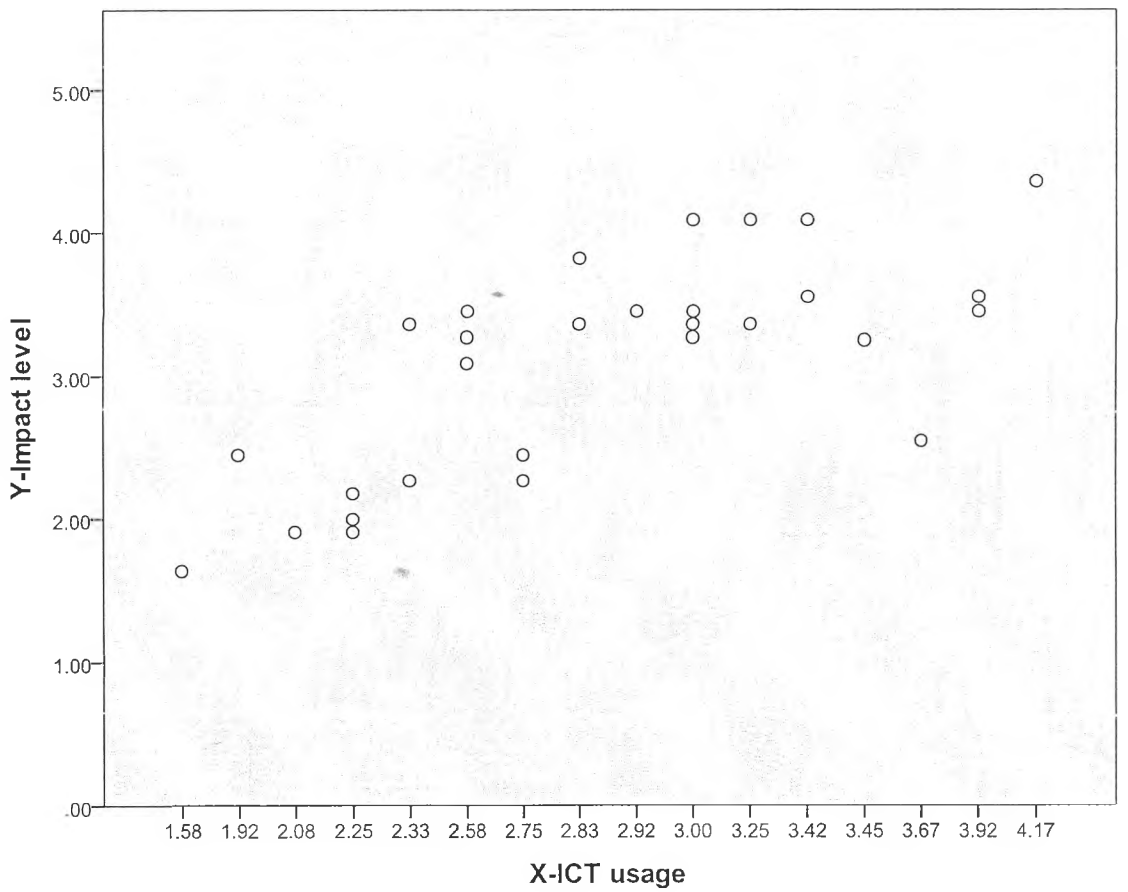


Figure 6: Scatter plot of ICT usage vs Impact level

As can be seen from the plot, the relationship between X and Y appears to be linear, which satisfies the first assumption of linearity. We can also see that for each value of X (e.g., X = 2, X = 3, etc.), the distributions of Y (i.e., the conditional distributions), though not identical or exactly normal by any means, nonetheless do not appear to signal any major problems with normality or homoscedasticity.

The regression model summary was also generated and produced the following results in the table below.

| Model Summary | | | | |
|---|---|---|---|---|
| Model | R | R Square | Adjusted R Square | Std. Error of the Estimate |
| 1 | .679[a] | .461 | .444 | .54595 |
| a. Predictors: (Constant), X-ICT usage | | | | |

**Table 12: Linear regression model summary**

In the model summary table above we see that R is equal to .679. Since this is a simple linear regression, R is actually equal to the Pearson Product-Moment correlation coefficient between X and Y, as shown in the bivariate correlation table 13 below. R Square in the model summary is computed as R to the power of 2. That is, it is equal to (.679)2. This is equal to 0.461. This expresses the proportion of variance in Y that is "explained" or "accounted for" by knowledge of X. For the data, this means that approximately 46% of the variance in Y can be accounted for by knowledge of X. Also we observe that 44.4% (adjusted R squared) explains the variance in the dependent variable explained by variations in the independent variable.

| Correlations | | | |
|---|---|---|---|
| | | X-ICT usage | Y-Impact level |
| X-ICT usage | Pearson Correlation | 1 | .679** |
| | Sig. (2-tailed) | | .000 |
| | N | 33 | 33 |
| Y-Impact level | Pearson Correlation | .679** | 1 |
| | Sig. (2-tailed) | .000 | |
| | N | 33 | 33 |
| **. Correlation is significant at the 0.01 level (2-tailed). | | | |

**Table 13: Variable Correlations**

The significance level of .000 reflects a very linear relationship between the two variables. It indicates the coefficient estimate is reliable.

| ANOVA[b] | | | | | | |
|---|---|---|---|---|---|---|
| Model | | Sum of Squares | df | Mean Square | F | Sig. |
| 1 | Regression | 7.907 | 1 | 7.907 | 26.528 | .000[a] |
| | Residual | 9.240 | 31 | .298 | | |
| | Total | 17.147 | 32 | | | |

a. Predictors: (Constant), X-ICT usage
b. Dependent Variable: Y-Impact level

**Table 14: Analysis of variance**

The coefficient of determination is Sum of square (regression) / Total Sum of squares. 7.907/17.147 = 0.4611 which is the same as the R square in table 12 and also known as the explained sum of squares. The significance of the model from the table above (.000) indicates how good model fit the data.

A combination of the means for the two variables is shown in the table below

| | N | Mean | Std Deviation | Std Error Mean |
|---|---|---|---|---|
| X- ICT usage | 33 | 2.9303 | .65115 | .11335 |
| Y-Impact level | 33 | 3.1439 | .73200 | .12743 |

**Table 15: Combination of means**

The closeness of the means indicates an almost perfect linear relationship between the dependent and independent variable.

## 4.6 Strategies to Address ICT Usage Obstacles

The strategies put in place to tackle the obstacles to ICT usage were addressed by section 5 where the sum of the strategies selected were measured.

| **Strategy** | **Projects that use Strategy** | **Occurrence %** |
|---|---|---|
| User and training needs assessment | 29 | 87.9 |
| Conduct sensitization and training workshops | 33 | 100 |
| Conduct site visits to ICT sites | 12 | 36.4 |
| Long term service provider contracts | 18 | 54.5 |
| Adopt technologies with local support | 20 | 60.6 |
| Hire adequate IT staff | 14 | 42.4 |

| | | |
|---|---|---|
| Upgrade technologies to market trends | 22 | 66.7 |
| Engage in PPP to finance projects | 7 | 21.2 |
| Collaborate with others who have adopted ICT services | 2 | 6.06 |

**Table 16: Strategies to overcome ICT obstacles**

From the table above the highest number of response (100%) where all respondents selected was the use of workshops for sensitization and trainings on the type, use, effect and benefit of ICT in agriculture. Collaboration of projects scored lowly (6%) signifying the independence of each project. Training needs assessment which precedes and informs training workshops also scored highly

## 4.3 Discussion

The discussion seeks to address the research questions of the type of ICT usage, obstacles, and impact on agricultural development projects. The analysis is based on the key findings within the context of the literature presented. There are some emerging issues that are addressed here such as the perception of social impact because of the lack of quantifiable data on social change. From the general information obtained there is no significant difference in response for projects that are either government, private or non-government run.

### 4.3.1 Understanding the ICT Type and Usage

With the rapid growth of ICT in Kenya (Communications Commision of Kenya, 2012), internet is becoming more and more readily available, less costly, and a preferred medium of communication. All respondents whose projects focused on marketing activities use the internet (mean of 2.4) and mobile SMS services (3.15) as a preferred tool to reach to their target market. A further study of these projects revealed that marketing based projects are involved in the sale of livestock (beef and export), grains (maize, wheat, sorghum, and legumes), fresh produce (horticulture) and floriculture. These projects focused on eliminating the middle man and creating direct access to markets for the producers. By doing this producers can get higher prices than through brokers and stimulate market-driven production, therefore increasing household income. The low mean of 2.4 for internet marketing is because out of the 33 respondents only 5 focus on market development activities.

9 projects modelled around the project goal framework mostly use information systems for data analysis, monitoring & evaluation and reporting. These systems are inputted with data collected from field work and analyzed to report on progress of implementation. 5 agricultural research based projects mostly use ICT for dissemination of knowledge, information and technologies. When new technologies emerge, farmers are sensitized on its adoption and benefits. Though leaflets or brochures are still highly used with a mean of 4 representing high usage, (standard deviation below 1) mobile and internet technologies are rapidly being adopted as explained by the Communication Commission of Kenya (2012) quarterly report. This argument is also supported by Harindranath & Sein (2007) who argue that new technologies impact society through

three effects- primary (substitution of old technology), secondary (increase in use) and tertiary(generation of new business and societal change). The use of GIS/GPS is also growing rapidly as insight into most projects objectives require mapping of either community livelihood micro-projects, market sites, research investments and production sites. This is also evident by the World Bank (2011) studies on ICT in agriculture where emphasis is place on investment geo-mapping. Television communication scored lowly because of its reach as most beneficiaries of these agricultural projects are the rural poor who do not own one. The high cost element of using television could also contribute to its low usage for communication.

### 4.3.2 Assessing Impacts on Livelihood Assets

Information and communication activities are a fundamental element of any rural development activity. Nie, Zhang and Qu (2010) acknowledge rural areas are often characterized as information-poor and especially, the rural poor typically lack access to information vital to their lives and livelihoods. The impacts measured during the study focussed on the five assets (Human, Social, Natural, Finance, and Physical) in the livelihood framework as described by Heeks & Molla (2009). The selection of impact indicators was derived from an assessment of each project key objectives. Most impacts measured in agricultural development are financial and social based as indicated in the agriculture sector strategy paper (GoK, 2010). According to Duncombe (2006) the physical assets involve acquisitions and investments, though impact of ICTs is limited. Human capital involves skills, knowledge and its application but can be difficult to measure. The project-goal framework projects also indirectly the livelihoods of the beneficiaries. These projects look at creating an enabling environment and undertaking investments that create efficient linkages between sellers and buyers, or producers and consumers.

High impact was realised in improved market driven production due to better information (3.55) and enhanced social status (3.61). These are human and social asset indicators that are commonly tracked in agricultural development and are significantly changed as indicated by IICD (2006) experiences in assessing impact of ICT on poverty reduction. The weakness of the social indicator in this study is the subjective nature of the response since it is based on perception as revealed by Putman & Kolko (2010). Two financial asset indicators focusing on the supply chain and access to financial services were lowly scored with 2.9 and 2.76 means because of the lack of quantifiable

data to assess their impacts. This is supported by the nature of the projects goals and outputs tracked during activity implementation.

Two respondents indicated experiencing negative impact centred on mistrust of new ICTs introduced to beneficiaries. It required them to conduct several sensitization meetings to assure them of the benefits of adopting ICT. This slowed down the rate of ICT usage in these projects.

Short term impacts such as increased market access, access to new technologies, informed practices leading to better yields can easily be quantified as supported by Gunga's (2008) findings. With baseline information collected before any project interventions are carried out, the percentage change can be calculated and analysed. The projects surveyed are on average more that four years old therefore information on short term impacts experienced can be quantified. Social impacts though require an impact assessment survey that involves getting peoples perceptions on the use of ICT services as advocated by Grunfeld (2007). The respondent's views on the social impact indicators are based on their experiences and interactions with their targeted beneficiaries. This could be the reason for the general fair impact (average of 3) on the social impacts. The high impact level on the physical assets such as market access, human assets such as increased knowledge on yields and finance assets like increased income could be a result of easily collectable data on the before and after status of market price, income earned and yields produced.

The linear relationship between the dependent (impact level) and independent variable (ICT usage) and the low significance (.000) indicates that ICT usage has a positive bearing on impact on agricultural development. The coefficient of .461 or 46% explains the variance in Y that can be accounted for by the knowledge of X indicates that ICT is just one of the many variables that contribute to agricultural development. The low significance shows how the data fit very well with this model. The broad nature of the livelihood framework as explained by Duncombe (2006) indicates that several intervening variables play a key part in achieving development goals. This supports Sein & Harindranath (2007) push for multiple impact assessment framework use to evaluate the full impact of ICT on development.

### 4.3.3 Obstacles to ICT Usage and Combat Strategies Used

To explain the research objective of the obstacles to ICT usage we combine this finding with that of the strategies used to address these challenges. From the findings, obstacles did not highly hinder the use of ICT by the surveyed projects. Insufficient user skills obstacle is widely expected when new technologies are introduced to beneficiaries as reflected in the findings. The "lack of need" obstacle with 1.76 mean response scored low indicating that a need for ICT has been identified and the type selected before implementation.

The high response on the "conduct sensitization and training workshops" strategy with 100% response was because most projects involve undertaking comprehensive training and sensitization programmes on the implementation of activities at project inception. Therefore the targeted beneficiaries of ICT initiatives are first capacity built on its use and then supported during its adoption. The high response on the "insufficient user skills" (mean of 3.64) and "conduct sensitization and training workshops" (100%) strategy reflects a direct relationship between the most common obstacle experience and the widely adopted strategy employed to address it. One important observation to take note of is the low (only 6% of the respondents) collaboration between projects using common ICT platforms where they can share experiences and challenges. These findings therefore indicate that most agricultural development projects have managed to tackle issues around obstacles to ICT usage thus mitigating its efficiency and effectiveness.

# CHAPTER FIVE: SUMMARY, CONCLUSION & RECOMMENDATIONS

This chapter summarizes the experiences and findings of the study and derives conclusions that provide recommendations for further studies.

## 5.1 Summary

There is great potential for agricultural development project to fully utilize ICT do deliver services and products to the intended beneficiaries. From the findings and discussion in the study there is a clear observation that the higher the use of ICTs in agricultural development the higher the impact realised on the livelihood assets. In order for the beneficiaries to fully adopt ICT initiatives and overcome obstacles to ICT usage, there is need to emphasize on continuous capacity building and provision of support services to ensure sustainability and relevance. The rapid growth of the ICT sector in Kenya creates a good opportunity for these projects to introduce ICT initiatives at the onset of their programmes.

The type of ICT used will depend on the nature of activities and the desired outputs. The key objective though is the positive impact it has on either the human, financial, social, physical or natural capital assets of the targeted beneficiaries. The evidence from the study indicates that ICT is predominantly used to boost efficiency of agricultural development. This also improves efforts to promote investments in ICT. The barriers to ICT usage have significantly been reduced by the growing investments in infrastructure and improved service delivery by various service providers. It should also be noted that the evaluation of impact of ICT on agricultural development through the livelihoods framework cannot be singly linked because of the various intervening variables in agricultural development.

## 5.2 Conclusion

The use of ICTs in agricultural development projects shows that it is growing as the need to be more efficient and effective in project implementation is paramount to achieving the project development objective and realising the impact desired. However, availability of technologies and the real impact on communities' development are not synonymous. This research set to answer this question along with other questions relating to obstacles and strategies to improve usage. The overall findings indicate that a linear relationship exists between ICT usage and impact on agricultural development but taking in mind that other intervening variables contribute to this impact. It can be acknowledged that the use of ICT is critical for each agricultural development project in achieving it expected objectives. This is supported by several studies on ICT application in agriculture (DrumNet, 2010; Gunga, 2008; Nie et al, 2010; Steinen et al, 2007; World Bank, 2011).

In this study though the 'traditional' forms of communication, newsprint, radio and television are still widely used, the growth of the new technologies, mobile and internet, are rapidly spreading as the Government of Kenya puts in place measures that create an enabling environment for big investments in ICT. Agriculture being the mainstay of Kenya's economy of which the bulk of the rural population depending on emphasis should be placed on the use of ICTs as tool of development or a means to achieve the development objectives. There being limited negative impact, which from the study were eliminated through awareness campaigns and sensitization workshops reflects the vital role ICTs can play in the development of agriculture in Kenya. Though the challenges of ICT usage from the study were low, there is need for community participation and capacity development to reduce them to a bear minimum. Forging partnerships between beneficiaries, policy makers, implementers will provide for equal access to ICTs for all.

## 5.3 Recommendations

Based on the findings, the recommendations that need to be considered in future ICT strategies should consider the following;

Though the types of ICT and usage level indicated an average response combined, focus should be placed on each individual type of ICT and its impact of agricultural development. This will make attribution and measurement easier. To tackle obstacles to ICT usage community participation is required to address perceived negative attitudes and behaviour towards ICT. This eliminates the idea of technologies being damped on users. ICT initiatives should be people centred.

The findings reveal a good relationship between ICT usage and impact realised considering other intervening variables. Since the livelihood framework looks at broader impacts, there is need to narrow down to project outputs impacted by ICT usage.

In conclusion, getting the most out of the benefits of ICTs for agricultural development is a goal that comes with challenges and continuous change and learning. Therefore we need to keep in mind that the learning process is an ongoing and dynamic course of action. The lessons brought together in this research study can be viewed as potential contributions to the ICT for development field as well as help new ICT initiatives exert the knowledge of experience on a wider scale.

## 5.4 Limitations of the Study

Issues that had an impact on the findings include;

The livelihoods framework has poor linkage to ICT, making attributing causality difficult because the framework contains a multiplicity of potential independent, dependent and intervening variables. Livelihoods framework focuses on broader outcomes and impacts rather than specific causal outputs in projects; Some of the social impact indicators are based on the respondents' perception therefore being subjective;

Some respondents hurriedly filled the questionnaire because of their busy schedules therefore compromising accuracy.

## 5.5 Suggestions for further Research

Further research particularly on the five capital assets of the livelihood framework is required in order to determine quantifiable impact for each livelihood asset after the use of ICTs in agricultural development. For each asset, collection of baseline information if critical for one to analyse trends or changes after ICT use.

To fully acknowledge the impact of ICT usage in agricultural development a contingent of approaches need to be considered that will analyze the different contributing variables to the impact on agricultural development.

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# APPENDICES
## APPENDIX 1: INTRODUCTION LETTER

Date:

Respondent's Organization

Respondent Address

Dear Sir/Madam,

**RE: RESEARCH ON ICT AND AGRICULTURAL DEVELOPMENT PROJECTS**

I am a graduate student at the University of Nairobi conducting a study titled "*Information Communication Technology (ICT) and Agricultural Development Projects in Kenya*".

Attached is a self-administered questionnaire which is divided into five sections. Section 1 consists of general information about the project, Section 2 has questions relating to type of ICTs used and level of usage, Section 3 focuses on obstacles experienced when using ICT, Section 4 contains impacts realised, and Section 5 has strategies to improve ICT usage and general comments.

All the responses will remain anonymous and will only be used for the purpose of this research. Kindly assist by completing all sections as your participation will be highly appreciated. If you require additional information or have any questions about the study, please feel free and contact me.

Yours Sincerely,

Lawrence M. Muchena
lmuthuuri@gmail.com
0722-244560

## APPENDIX 2: SAMPLE QUESTIONNAIRE

### Section 1: General Information

1. Name of Organization/Project.....
2. Respondent's Gender

☐ **Male** ☐ **Female**

3. Respondent's Age

☐ **15-30** ☐ **31-45** ☐ **46-60** ☐ **Above 60**

4. Type of Organization/Project (Select one)

☐ **Government/Donor-funded** ☐ **Non Government Organization (NGO)** ☐ **Public-Private** ☐ **Private**

5. Brief purpose of the Organization/Project

_____

_____

6. Year of Inception.....
7. Who are your core target groups/beneficiaries? (Please tick all that apply)

| | |
|---|---|
| **a. Farmers/Pastoralists (Producers)** | ☐ |
| **b. Processors** | ☐ |
| **c. Distributors** | ☐ |
| **d. Wholesalers/Retailers** | ☐ |
| **e. Exporters** | ☐ |
| **f. Service Providers (Financial, Extension, Research & other institutions)** | ☐ |
| **g. Consumers** | ☐ |
| **h. Other (Specify)_____** | ☐ |

8. How many Counties is your project/Organization targeting or working in?

☐ **1-10** ☐ **11-20** ☐ **21-30** ☐ **31-40** ☐ **41-46** ☐ **All 47**

**Section 2: Level of ICT usage**

1. What is the level of usage of the following ICTs to deliver services for agricultural development activities?

(For each issue please tick one where 1-Not used, 2- Low, 3- Fair, 4-High 5-Very High)

| | No Usage | Low Usage | Fair Usage | High Usage | Very High Usage |
|---|---|---|---|---|---|
| a. **Internet for information awareness** | ☐ | ☐ | ☐ | ☐ | ☐ |
| b. **Internet for marketing** | ☐ | ☐ | ☐ | ☐ | ☐ |
| c. **Internet for progress reporting** | ☐ | ☐ | ☐ | ☐ | ☐ |
| d. **SMS services** | ☐ | ☐ | ☐ | ☐ | ☐ |
| e. **Mobile application (apps) services** | ☐ | ☐ | ☐ | ☐ | ☐ |
| f. **GIS/GPS technologies for mapping and remote sensing** | ☐ | ☐ | ☐ | ☐ | ☐ |
| g. **Information Systems for Monitoring & Evaluation** | ☐ | ☐ | ☐ | ☐ | ☐ |
| h. **Information Systems for data analysis and reporting** | ☐ | ☐ | ☐ | ☐ | ☐ |
| i. **Information dissemination through Leaflets, Newspapers, Brochures or Pamphlets** | ☐ | ☐ | ☐ | ☐ | ☐ |
| j. **Telephone communication (mobile, fixed)** | ☐ | ☐ | ☐ | ☐ | ☐ |
| k. **Radio broadcasting** | ☐ | ☐ | ☐ | ☐ | ☐ |
| l. **Television broadcasting** | ☐ | ☐ | ☐ | ☐ | ☐ |
| m. **Others (Specify)** _____ _____ | ☐ | ☐ | ☐ | ☐ | ☐ |

**Section 3: Obstacles to ICT usage**

1. Select the level of effect for each obstacle to ICT usage that you have experienced during implementation of your project activities. (For each issue please tick one where 1-No effect, 2- Low, 3- High)

| | No Effect | Low Effect | Fair Effect | High Effect | Very High Effect |
|---|---|---|---|---|---|
| a. Poor IT infrastructure | ☐ | ☐ | ☐ | ☐ | ☐ |
| b. Cost of ICT services | ☐ | ☐ | ☐ | ☐ | ☐ |
| c. Insufficient end-user skills | ☐ | ☐ | ☐ | ☐ | ☐ |
| d. Inadequate user training | ☐ | ☐ | ☐ | ☐ | ☐ |
| e. Poorly source systems that do not address user needs | ☐ | ☐ | ☐ | ☐ | ☐ |
| f. Inadequate IT support services | ☐ | ☐ | ☐ | ☐ | ☐ |
| g. Fear of Job replacement | ☐ | ☐ | ☐ | ☐ | ☐ |
| h. Complexity of technologies | ☐ | ☐ | ☐ | ☐ | ☐ |
| i. Lack of need | ☐ | ☐ | ☐ | ☐ | ☐ |
| j. Inadequate policy framework to guide ICT usage | ☐ | ☐ | ☐ | ☐ | ☐ |
| k. Other (Specify) _____ _____ | ☐ | ☐ | ☐ | ☐ | ☐ |

**Section 4: Impacts experienced after ICT adoption.**

1. What level of impact has ICT usage had on agriculture development activities (For each issue please tick one where 1-None, 2- Low, 3- Fair, 4-Good, 5-Very Good)

| | None | Low | Fair | Good | Very Good |
|---|---|---|---|---|---|
| a. Increased adoption of newly informed farming practices and technologies | ☐ | ☐ | ☐ | ☐ | ☐ |
| b. Improved market access for produce (closer linkage between sellers and buyers) | ☐ | ☐ | ☐ | ☐ | ☐ |
| c. Increased market-driven production due to improved market information | ☐ | ☐ | ☐ | ☐ | ☐ |
| d. Increased household income due to better market price information | ☐ | ☐ | ☐ | ☐ | ☐ |
| e. Increased savings in the distribution supply chain | ☐ | ☐ | ☐ | ☐ | ☐ |
| f. Increased access to financial services | ☐ | ☐ | ☐ | ☐ | ☐ |
| g. Improved farm management practices due to easier access to information on extension, research, pests and diseases | ☐ | ☐ | ☐ | ☐ | ☐ |

| | | | | | | |
|---|---|---|---|---|---|---|
| h. | Enhanced social status through reduced isolation | ☐ | ☐ | ☐ | ☐ | ☐ |
| i. | Increased negotiating power of farmers | ☐ | ☐ | ☐ | ☐ | ☐ |
| j. | Improved social interaction between farmers which contributes to efficiency | ☐ | ☐ | ☐ | ☐ | ☐ |
| k. | Reduced dependency on agriculture extension services | ☐ | ☐ | ☐ | ☐ | ☐ |
| l. | Others (Specify) _____ _____ | ☐ | ☐ | ☐ | ☐ | ☐ |

2. Have you experience any negative impact after use of ICT in agricultural development activities

| | |
|---|---|
| ☐ **Yes** | ☐ **No** |

If yes please indicate which one(s).

_____

_____

_____

**Section 5: Strategies**

1. What strategies have you adopted to improve ICT usage in agricultural development projects? (Select all that apply)

| | | |
|---|---|---|
| a. | Conduct thorough user and training needs assessment to identify gaps to be addressed | ☐ |
| b. | Conduct regular sensitization and training workshops | ☐ |
| c. | Conduct site visits to areas that have successfully adopted ICT | ☐ |
| d. | Engage service providers in long term service level agreements | ☐ |
| e. | Adopt technologies that have adequate local support | ☐ |
| f. | Hire adequate IT support staff | ☐ |
| g. | Upgrade technologies to latest market trends | ☐ |
| h. | Engage in public-private partnerships to finance projects | ☐ |
| i. | Others (Specify) _____ _____ | ☐ |

## APPENDIX 3: LIST OF PROJECTS/ORGANIZATIONS

| | |
|---|---|
| Govt/Donor funded Projects | National Agriculture and Livestock Extension Project |
| | Kenya Rural Development Project |
| | National Accelerated Agriculture Input Access Program |
| | Enhancement of Food Security through Water Harvesting |
| | Promotion of Private Sector Development in Agriculture |
| | Agriculture Sector Programme Support |
| | Community Agricultural Development Project in Semi-Arid Lands |
| | Smallholder Horticultural Empowerment Project |
| | Arid Lands Livestock Productivity Programme |
| | Small-scale Horticulture Development Project |
| | Kenya Agricultural Productivity and Agribusiness Project |
| | Kenya Arid and Semi-arid Lands Research Programme |
| | Kenya Agricultural Productivity and Sustainable Land Management |
| | Central Kenya Dry Areas and Smallholder Community Services Development Project |
| | Mount Kenya East Pilot Project for NRM |
| | South Nyanza Community Development Project |
| | Lake Victoria Environmental Management Project |
| | Kenya Climate Change Adaptation Project |
| | Green Zones Development Support Project |
| | East Africa Agricultural Productivity Project |
| | Western Kenya Community Driven Development |
| | Kari- McGill project |
| | Arid Lands Resource Management Project |
| | USAID FTF programme |
| | Natural Resource Management Project |
| Private/Public-private partnerships | I-Cow |
| | M-farm |
| | M-Kilimo, Kilimo-Salama |
| | E-soko |
| | Mace-foods |
| | OXFAM Kenya |
| | Kenya Farmers Association of Producers |
| | Kenya Agricultural Commodities Exchange |
| | Forum on Organic Resource Management and |

| | |
|---|---|
| | Agricultural Technologies |
| | Kenya Livestock Marketing Council |
| NGO | Regional Agricultural Trade Intelligence Network |
| | Kenya Agricultural Information Network |
| | AfriAfya |
| | African Foundation for Research and Development |
| | Agri-Health Initiative |
| | Agricultural Information Resource Centre |
| | African Agriculture Technology Foundation |
| | Farm Concern International |
| | Afirca Green Revolution in Agriculture |
| | Export Promotion Council |
| | AGRODEV |
| | International Livestock Research Institute |
| | Food and Trade Network for East Africa |
| | Arid Lands Information Network - Eastern Africa |
| | ASARECA Animal Agriculture Research Network |
| | Fresh Produce Exporters Association |