

Integrating Information and Communication Technology (ICT) in the Farming System for livelihood improvement, “a case of Kieni East constituency, Nyeri County, Kenya”

Paul Mwari Maina,
St Paul's University
P.O BOX 62886 -00200
NAIROBI
+254722651297, mainapaul72@gmail.com

Abstract

In many developing countries, the agriculture sector is dominant in raising incomes among the poor by as much as four times than other sectors. According to the World Bank, 2013, annual report, agriculture reduce poverty, raise incomes and has improved food security for 80% of the world's poor who depend on farming. The sector realized about 17% of the GDP and 40% of exports. This achievement is attributed to improve agricultural productivity through integration of ICT in the farming system to address SDG number two on zero to hunger. Questionnaires, focus group discussions and interviews were the methods used to collect data. The data was collected from 90 respondents sampled across Kieni East Constituency. The research targeted producer organizations, change teams, extension agents and key stakeholders. The overall objective of the research was to investigate the role of ICT to small holder farmers to harness the benefit of information and communication technologies to maximize returns on agriculture production system. The research examined the role of ICT mainly using market price information through short message service or web portal, open data kit, internet and use of geographical information system in enhancing growth and efficiency in agri-business transactions. The research findings indicated that there is a correlation between increase in information and communication technology and increase in returns on agricultural production system. It also indicated that use of ICT enhanced growth and efficiency in agri-business transactions by empowering the farmer and producer organizations with real time marketing information. The research demonstrated the role of ICT in the systematic dissemination of agricultural information to provide comprehensive, up-to-date and detailed knowledge and information. The research witnessed tremendous advancement in information dissemination among smallholder farmers. Use of ICT in Agricultural extension and education provided an efficient and effective way to reach out to small holder farmers.

Key Words: ICT, Agricultural extension, Agricultural information, market, mobile technology

Introduction

The use of ICT in Agriculture plays a vital role in the social and economic development of most African countries and is the main contributor to economic growth and stability, Hilda Munyua, et al (2008). According to Chukwunonso et al (2013), the main impediments to ICT adoption is the sophistication of the technology which requires human capital investment to synchronize efficiently challenges faced by small holder farmers that includes production and marketing. ICTs have a positive impact on the development of any nation especially in the food security sector (Kuhlmann, 2005). There is a strong link between integrating ICT in farming systems and achievement of sustainable development goal number two which targets to end hunger, achieve food security, improve nutrition and promote sustainable agriculture.

The farmers, especially the youth seem inclined towards going online on computers to access market and production information while the older generation respond better to audio and visual ICTs. Most of the stakeholders have also taken a keen interest in some of our technical solutions like Frontline SMS used for mobilizing farmers and use of the technology to answer farmers' queries via phone as well as accessing agronomic information. Agriculture involves the conceptualization, design, development, evaluation and application of innovative ways to use information and technologies in rural domain with a primary focus of livelihood improvement (Manish Mahant et al, (2012). According to Alexander B. Sideridis (2010), poverty and hunger in developing countries can be addressed through increasing farm productivity and ICT in particular can contribute in the achievement of the goal.

The application of ICT in agriculture is an important pillar of agricultural extension (B. L. Dhaka and K. Chayal (2010). The desire to strengthen farmer's access to market has seen the emergence of a number of interventions that employ ICT tools in the provision of agricultural marketing information, Julius J. Okello (2012). Market access is one of the most important factors influencing the performance of small holder agricultural farmers (Barret, 2008; Kirsten, 2010). Ezeh Ann Nnenna (2013), stated that its imperative to provide adequate training on the use of ICTs to all stakeholders strengthening more the use of phones and internet and this needs collaboration with research institutions on information dissemination and training,(Spyros Fountas ,2014).

The ICT technologies accessed include use of using market price information through frontline short message service or web portal, open data kit, internet and use of geographical information system, (H.A.C.K Jayathilake et al 2015). This enhances growth and efficiency in agri-business transactions through timely marketing and technical information to both individual farmers and producer organizations. This is a data base for disseminating market and agronomic information to farmers. Other technologies included creating awareness through the radio and various foras and use of farmers/buyers interactive platform. Others included use of a mobile platform to provide location based information to farmers on topography, rainfall, temperature, farm management practices, crops range and soil types. This was supported by Anthony G. (2013) in the journal on information technology and rural development in Africa, experiences in Kenya.

Objectives of the research

1. To find out if there is a correlation between increase in information and communication technology and increase in returns on agricultural production system.
2. To investigate whether use of ICT enhanced growth and efficiency in business transactions through dissemination of timely marketing and agronomic technical information to both farmers and producer organizations
3. To examine the role of ICT as a driver of economic agribusiness indicators in the agricultural value chain, climate change and resilience intervention and to assess the views of farmers regarding use of ICT in Agriculture.

Research methodology

The study was carried out through a desk review of secondary sources of information covering small scale agriculture and a wide range of ICT related experiences and initiatives. The primary data was collected in Gakawa, Kiamathaga and Thegu ward in Kieni East Constituency. The research wanted to investigate if there is a correlation between increase in information and communication technology and increase in returns on agricultural production system. The paper accessed the role of ICT to enhance growth and efficiency in business transactions through dissemination of timely marketing and technical information to both farmers and producer organizations. The research was based on key indicators which included the number of farmers trained, numbers actively using the SMS service, numbers of producer organization using ICT in

their programing, marketing and income generated at various levels as a result of integrating ICT.

The researcher used regression and correlation analysis to explore the nature of the relationship that exists among dependent and independent variables. The researcher did hypotheses tests and conducted analysis of variance in accordance to the research objectives. The study followed exploratory research design. Quantitative and qualitative research methods were adopted to collect data from the study respondents. Survey research approach was implemented to collect data from the study participants. Quantitative data included open ended and closed-ended information. Data collection methods included use of questionnaires, focus group discussions and interviews. The data was collected from 90 respondents sampled across Gakawa, Kiamathaga and Thegu ward in Kieni East Constituency. The research targeted producer organizations, change teams, extension agents and key stakeholders.

Research instrument

The survey instrument comprised demographic data items, Likert-scale survey items, dichotomous questions and checklists which were designed to collect data on the issues under investigation.

Reliability of the instrument;

Reliability is the degree to which an assessment tool produces stable and consistent results when administered at different time intervals to the same respondents. For an instrument to be considered reliable to making statistical inference, the Cronbach's alpha of at least 0.7 is required.

Reliability Statistics

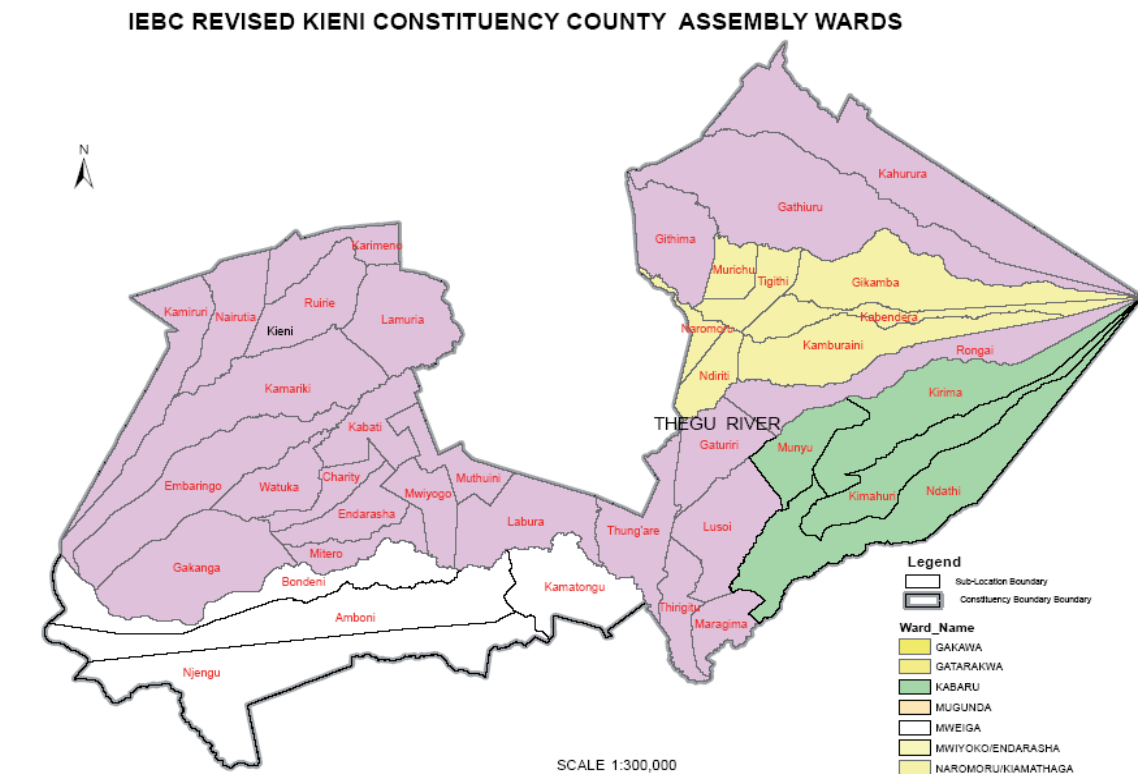
Reliability Statistics

Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	N of Items
.722	.579	23

From Table the alpha of 0.722. The alpha obtained is above the minimum threshold of 0.7 which imply the questionnaire tool used was reliable to make inference and generalize the results.

Scope of the study

The study was conducted through case study targeting 90 participants. The farmers were identified through stratified random sampling. This included farmers that were using mobile technology.



Map indicating the research area – Kiini East constituency

Target population and sampling method

The data was collected from 90 respondents sampled across Gakawa, Kiamathaga and Thegu ward in Kiini East Constituency who had high concentration of farmers using ICT. The sampling process yielded a sample of 90 farmers out of the 300 population size.

Table 001: Stratified random sampling technique employed to select study participants

Sub Location	Farmers involved	Sample Size
Kabaru	70	21
Kiamathaga	100	30
Narumoru	50	15
Lusoi	30	9
Gakawa	50	15
TOTAL	300	90

The research used stratified random sampling since it's a method of sampling that involves the division of a population into smaller groups known as strata. The population in this case is the five sub locations. The proportionate sample size method that was used to justify the sample size $(70/300 \times 90 - 21)$ $(100/300 \times 90 - 30)$ $(50/300 \times 90 - 15)$

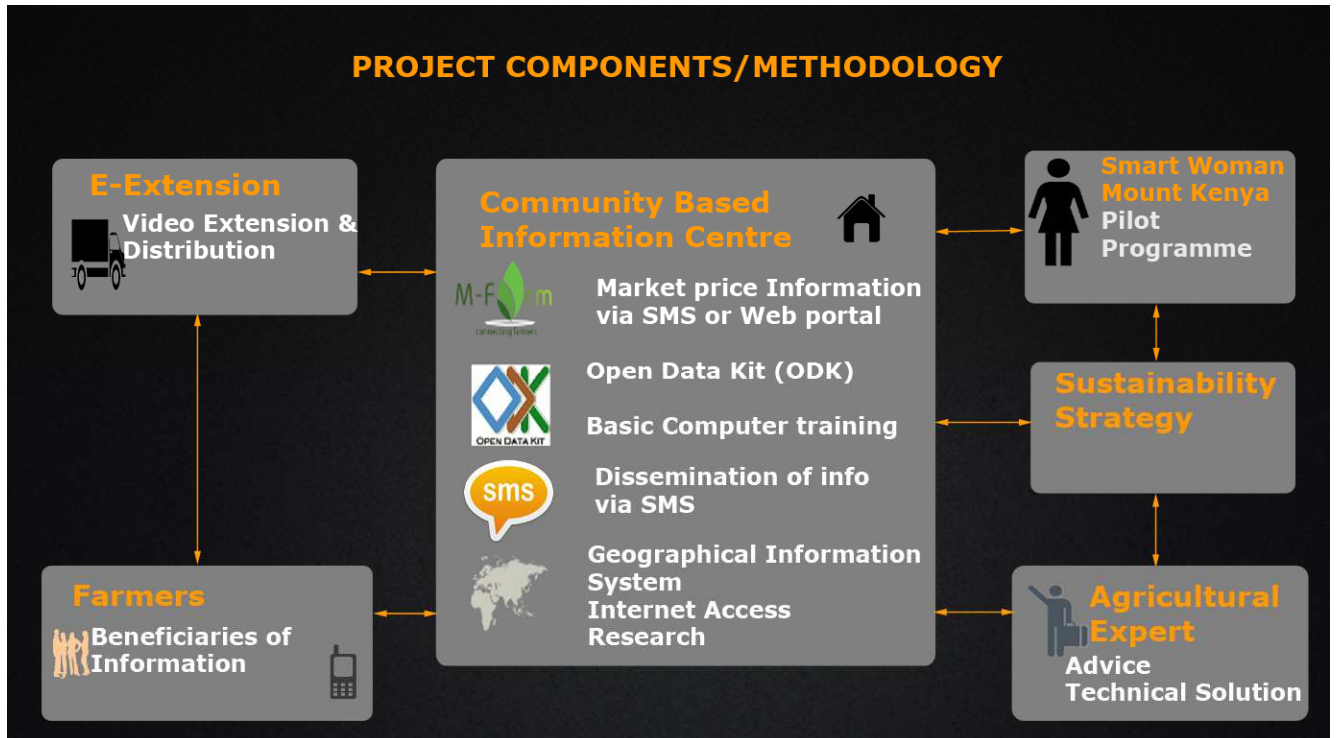
$(30/300 \times 90 - 9)$ $(50/300 \times 90 - 15)$

Total selection: 90 respondents from the population of 300 farmers. The researcher used the systematic or the nth method where every nth farmer was selected from the randomized list.

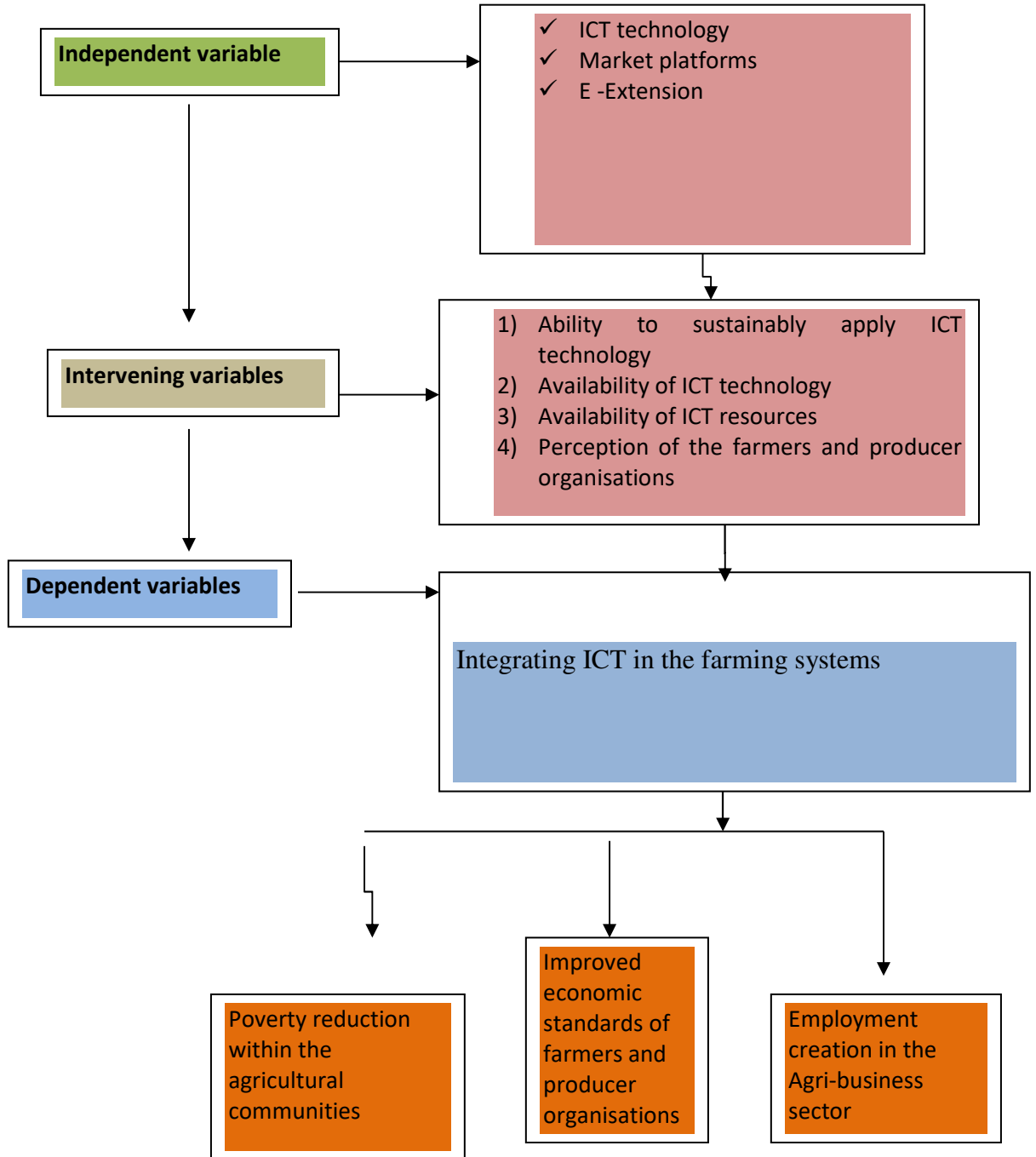
Data collection tools used

- a) Questionnaires
- b) Interviews
- c) Focus groups discussion.
- d) Observations

Research Component/ Methodology



Conceptual Framework



The regression model

$$Y = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \varepsilon$$

Y = Integrating ICT in the farming system

β_0 = Y intercept

β_1 to β_3 = regression coefficients

X_1 = ICT technology

X_2 = Market platforms

X_3 = E-Extension

ε = error term.

Whereby Y represent the Integrating ICT in the farming system, X_1 is ICT technology, X_2 , Market platforms and X_3 .E- Extension. B_0 is the model's constant, and $\beta_1 - \beta_3$ are the regression coefficients while ε is the error term form the model's significance. Holding other factors (Integrating ICT in the farming system) constant, a unit increase in use of ICT technology would lead to an increase in marketing hence encouraging farm productivity and improve on livelihoods.

Key outcomes: Use of ICT in agricultural productivity

	Use of ICT in agricultural productivity	
Rating	Checking market rates	Obtaining agronomic information
To a very little extent	0.0%	8.7%
To a little extent	0.0%	11.1%
To some extent	55.6%	32.1%
To a great extent	44.4%	48.1%
TOTAL	100%	100%

The table shows that almost half of the farmers use mobile phones to a great extent (48.1%) to access agronomic information to boost productivity. Over 50% use the mobile phones to some extent to check market rates using short message service or internet. All the farmers interviewed used the mobile phone to check the market rates

Satisfaction with use of mobile technology to boost production

Satisfaction level	Level of information reliability	Level of application of information obtained
Very dissatisfied	24.0%	0.4%
Somewhat dissatisfied	11.1%	3.7%
Neither satisfied or dissatisfied	0.0%	9.7%
Somewhat satisfied	28.9%	29.6%
Very satisfied	36.0%	56.6%
TOTAL	100%	100%

Over 50% of the farmers interviewed applied the information obtained through the ICT technology. However 3% did not trust the information and were dissatisfied.

Conclusion and Recommendations

The research findings indicated majority of farmers had positive attitude towards use of ICT and there was a correlation between increase in information and communication technology and increase in returns on agricultural production system. The research concluded that use of ICT calls for good infrastructure, adequate ICT skills, good and affordable connectivity and appropriate ICT policies. Use of ICT enhanced growth and efficiency in business transactions through dissemination of timely marketing and technical information to both farmers and producer organizations. Use of ICT in Agricultural extension and education provided an efficient and effective way to reach out to small holder farmers. The research concluded that without the enabling environment and infrastructure, no much can be achieved.

There must be right policy formulation and capacity building of farmers and extension workers on ICT usage in agriculture related software and provision of market information platforms. The researcher recommended the need to strengthen Agriculture ICT curriculums in the formal and informal educational and training programs. The governments should invest more on the acquisition of advanced ICT skills targeting agriculture extension staff in the rural areas. There is need to establish community based village knowledge centers to act as clinic for farmer's needs. There is also need to design phones that can be solar powered to reduce dependency on electricity which is less available in some remote areas. The research recommended that promotion of high technology such as ICTs for communication with farmers should be targeted to youth in agriculture because they are already familiar with the communication tools and require little additional training for their use and the fact that older farmers have less understanding of the benefits of ICT adoption.

Reference

- Alexander B. Sideridis (2010) ICT and farmers: lessons learned and future developments
- Aderbigbe (2014) - ICT in Agricultural Sustainability And Food Security Bello
- Asingwire, N. (2003). Electronic delivery of agricultural information to rural communities in Uganda
- Adejo, P.E and U. Haruna, (2009) - Access of farmers to ICTs for agricultural development in Bauchi local government area
- Aker, C.J. (2008). 'Does Digital Divide or Provide?' The Impact of Cell Phones on Grain Markets in Niger; Center for Global Development Economics Department, Fletcher School of Law and Diplomacy, Tufts University
- Anthony G. (2009); Information Technology for Agriculture and Rural Development in Africa: Experiences from Kenya
- Bracha Gal Et Al (2003); Adoption of Information Technology for Farm Management, A Case Study.
- B. L. Dhaka and K. Chayal (2010); Farmers' Experience with ICTs on Transfer of Technology in Changing Agri-rural Environment
- Batchelor, S and Norrish, P. (2005). Framework for the assessment of ICT pilot projects
- Baryamureeba, V. (2007). ICT as an Engine for Uganda's Economic Growth: The Role of and Opportunities for Makerere University
- Barret, (2008) – Market Access for small holder farmers
- Ezeh Ann Nnenna (2013); Access and application of information and communication technology (ICT) among farming households of south east Nigeria
- Market access is one of the most important factors influencing the performance of small holder agricultural farmers
- Chukwunonso et al (2013) The adoption of information and communication technology in Agriculture, Nigeria state
- Gelb E, Parker C, (2006). Is ICT adoption for agriculture: a summary of the EFITA ICT adoption
- Hilda Munyua, Edith Adera, and Mike Jensen(2008); Emerging ICTs and Their Potential in Revitalizing Small-Scale Agriculture in Africa

H.A.C.K Jayathilake et al (2015); ICT Adoption and Its' Implications for Agriculture in Sri Lanka

Jones, M. (2006) An agricultural research perspective on poverty, innovation policies and agricultural development in Sub-Saharan Africa.

Julius J. Okello (2012); Drivers of Use of Information and Communication Technologies by Farm Households: The Case of Smallholder Farmers in Kenya

Kirsten, (2010) Farmers market access in developing countries

Kuhlmann, F (2005). IT Applications in Agriculture: Some Developments and Perspectives.

Kidane, W., M. Maetz, and P Dardel (2006); Food security and agricultural development in Sub-Saharan Africa

Kweku, A.K. (2006). Demystifying ICT diffusion and use among rural women in Kenya.

Manish Mahant, Abhishek Shukla, Sunil Dixit, Dileshwer Patel (2012) Uses of ICT in Agriculture.

Nicole Taragola and Ehud Gelb (2013): Information and Communication Technology (ICT) Adoption in Horticulture: A Comparison to the EFITA Baseline

Oladipo, A. (2013). Investment Opportunities in Nigerian Economy: The Fastest Growing Economy in Sub-Saharan Africa

Padraig Wims (2011); ICTs in Irish Agriculture: Can ICTs Improve Communication Between Agribusiness and Farmers?

Richardson, (2006) ICTs policies and infrastructure in developing countries

Ramatu M. Al-Hassan, Irene S. Egyir and James Abakah (2013); Farm household level impacts of information communication technology (ICT)-based agricultural market information in Ghana

Sideridis (2009) -Education, training and e-services

Spyros Fountas (2014); ICT in Precision Agriculture – diffusion of technology