THE EFFECT OF DIGITAL DIVIDE ON ACCESSIBILITY OF AGRICULTURAL INFORMATION AMONG SUGARCANE FARMERS IN MIGORI COUNTY, KENYA

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DECLARATION

I declare that this thesis is my original work and has not been presented for a degree in any other University.

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ACRONYMS

AMS	- Agriculture Mechanization Services
ASDS	- Agriculture Sector Development Strategy
ATC	- Agriculture Training Centres
CEO	- Chief Executive Officer
CRF	- Coffee Research Foundation
ERP	- Enterprise Resource Planning
FAO	- Food and Agricultural Organization
GDP	- Gross Domestic Product
GoK	- Government of Kenya
ICT	- Information and Communication Technology
IEBC	- Independent Electoral and Boundaries Commission
KARI	- Kenya Agricultural Research Institute
KESREF	- Kenya Sugar Research Foundation
KNBS	- Kenya National Bureau of Statistics
KSB	- Kenya Sugar Board
MOA	- Ministry of Agriculture
NAEP	- National Agriculture Extension Policy
NALEP	- National Agriculture and Livestock Extension Program
NASEP	- National Agricultural Sector Extension Policy
SES	- Socio Economic Status
SMS	- Short Message Services
SONY	- South Nyanza Sugar Company
SPSS	- Statistical Package for Social Scientists
SRA	- Strategy for Revitalization of Agriculture
TCD	- Tone of Cane per Day
TRF	- Tea Research Foundation
UK	- United Kingdom
UN	- United Nations

ABSTRACT

Farmers continuously acquire and gather new information to keep with the emerging trends and technologies in their sector in order to realize increased outputs. They store and share this knowledge amongst themselves and with other interested parties. Access to information that is processed to generate the knowledge is therefore a key factor to farmers. This access is achieved through employment of the information and communication technology (ICT) tools. However, rapid developments in the field of ICT in an economy can create a gap, between those individuals or farmers that are early adopters'and those that are late adopters, which is commonly referred to as digital divide. It is the gap between those with regular and effective access to digital technologies particularly the internet, and those without. The purpose of this study wasto empirically examine the effects of digital divide on information accessibility among sugar cane farmers in Migori County. This was done by identifying information sources and tools whereby a combination of company extension agents and neighbours were the main sources and mobile phones were the most popular ICT tool. To accomplish this study, a survey research was employed in gathering information from the sample population, adopted semi structured questionnaire which was administered to sugar cane farmers in Awendo and Uriri Districts of Migori County. The study found out that digital divide exists among sugar farmers and it is enhanced by factors such as reduced interaction with extension agents and input suppliers. Inadequate communication channels such as television, radios and mobile phones as well as low or no access to internet also increase digital divide. Solutions to the digital divide require actions from various agencies and stakeholders, and the commitments of the government as well as NGOs which can be achieved through public private partnerships.

CHAPTER 1: INTRODUCTION

1.1 Background of the study

Digital dividecan be referred to as the troubling gap between those who use computers and the internet and those who do not. The term initially referred to gaps in the ownership of, or regular access to, a computer, Mehra (2004). The global disparities in access to the Internet and other information and communication technologies have led to a digital divide between technological haves and have-nots, United Nations (2006). The digital divide results from the socio-economic differences between communities, which in turn affects their access to digital information, mainly but not exclusively through the Internet. The digital divide can be categorized as global, regional or national. At the national level, there is an urban-rural digital divide, Rao (2005). In developing countries in particular, there are clear tendencies of increased concentration of information flows to urban and central areas, Wong (2002) and Mwesige (2004). Economically disadvantaged countries and rural and peripheral districts within these nations tend to fall further behind in human resource development as well as in economic progress and political participation.

Digital divide may not be understood if it is viewed purely as a technological phenomenon. A broader interpretation of the term digital divide may be necessary. For instance, Van Dijk (2006) claims that the term cannot be understood without addressing issues such as digital skills, cultural analyses of lifestyles and daily usage patterns. On the other hand, the great merit of the sudden rise of the term digital divide is that it has put the important issue of inequality in the information society on the scholarly and political agenda.

The convergence of telecommunication and computer technology that include telephone, television, video, fax, personal computers, internet and its associated services such as

electronic mails, electronic bulletin boards and the world wide web, is generally called information and communication technology (ICT). It covers any product that will store, retrieve, manipulate, transmit or exchange information electronically in a digital form over the networks to many destinations in the world. It helps individuals, corporations and businesses to use all types of information such as data, audio and video with digital technology. Today, ICT is used extensively as a diffusion tool to reach and share information, knowledge and resources efficiently and effectively in any field, Bouman et al. (2004) and Warren (2002).

There are widespread inequalities in ICT usage which, in turn, delays the substantial amount of efficiency and productivity resulting into losses in different sub sectors of the economy. In the case of ICT, such inequalities are referred to as digital divide. Digital divide is the division of the world between those who have access to new information and communication technology and those who do not have access Quibria et al. (2002). For example, Africa with over one billion people, constituting about 15% of the world population, (United Nations, 2013) had, in 2005, about 2 Personal Computers per 100 inhabitants and an Internet penetration of less than 4%. The global average Internet penetration rate was more than 15%, ITU (2006). The situation in Sub-Saharan Africa is even worse, and in Tanzania for example ITU (2006) estimates the number of Internet users to be less than 1%.

The concept of digital divide is becoming more and more complex as access and use of computers change over time. Earlier existence of digital divide revolved around access to computers and related technologies. The high cost of computers creates a large divide between people who can afford them and who have access to all the advantages of a computer and those who cannot. As a result, the digital divide is further defined around social or political spheres to refer to socio-economic gap between communities with access to computers and internet and those without. The gap also exists between groups or individuals of a particular interest

regarding their ability to use information and communication technologies effectively, due to differing levels of information literacy and technical skills, as well as the gap between those groups with access to quality, useful digital content and those that do not. Broadly speaking, the term digital divide is not necessarily determined by the access to the internet, but includes any ICTs and media channels that different segments of the society can use, Davison (2003).

1.2 Sugar cane sub sector in Kenya

The sugar industry plays a central role in socio-economic development of the Kenyan economy. The sub sector is significant in the country's economy through its forward and backward linkages, by supporting directly or indirectly, over six million Kenyans and is a source of income to over 260, 000 small scale farmers and 12,500 permanent employees in the factories and plantations (GOK, 2011). According to the sugar industry regulator, the Kenya Sugar Board (KSB 2009), the sugar sub sector saves Kenya in excess of US$ 250 million in foreign exchange annually. Other benefits accruing from the sub sector are social amenities such as schools, roads and bridges, health facilities provided to the communities by the sugar companies and out-growers institutions.

For purposes of regional cane production, the Sugar industry is divided into four sugar belts namely; the Nyando Sugar Belt with approximately 44,500 farmers, the Mumias Sugar Belt with 180,520 farmers, the South Nyanza Sugar Belt with 28,000 farmers and the Coastal Region Sugar belt where farmers are yet to be fully registered. Out of the four (4) sugar belts, the Nyando Sugar belt is the oldest and has five Sugar factories out of which two, Chemelil and Muhoroni are state owned factories. Mumias Sugar belt is the largest with the highest number of farmers and has only one state owned sugar factory, Nzoia Sugar Factory after privatization of Mumias in the year 2004. The South Nyanza sugar belt is relatively young and has one state owned sugar factory called the South Nyanza Sugar Factory (SONY) with two private owned

sugar factories in Ndhiwa and Transmara districts. The Coastal Sugar belt has been non-operational for some time; however, with the coming of Kwale International Sugar Company, the future prospects are encouraging.

The development of the sugar industry in Kenya started with private investments at Miwani in 1922, followed by Ramisi Sugar Company at the Coastal region in 1927. After independence, six additional companies were established namely: Muhoroni (1966), Chemelil (1968), Mumias (1973), Nzoia (1978), South Nyanza (1979), West Kenya (1981) and Soin (2006). The last five years has also seen establishment of four new sugar factories namely; Kibos Sugar Factory in Kisumu County (2008), Butali Sugar Factory in Kakamega County (2010), Transmara Sugar factory in Narok County (2011) and Sukari Mills in Homa bay County (2011), (KSB, 2010). Out of the mentioned fourteen factories, seven of them were established by the Government as state owned factories (parastatals). The establishment of the parastatals was driven by a national desire to accelerate social economic development, address regional economic imbalances, increase Kenyan citizen's participation in the economy, promote indigenous entrepreneurship and foreign investments through joint ventures. This desire was expressed in the Sessional Paper No. 10 of 1965 on African Socialism and its Application to Planning in Kenya (GOK, 2012). Of the seven Government owned factories, Ramisi and Miwani Sugar Companies have collapsed, Mumias has been privatized while Muhoroni is under receivership.

Despite these investments, self-sufficiency in sugar has remained elusive over the years as consumption continues to outstrip supply. Total sugar production grew from 368,970 tonnes in 1981 to an all time high of 520,404 tonnes in 2007. Domestic sugar consumption increased even faster, rising from 324,054 tonnes in 1981 to 741,190 tonnes in 2007 (KSB, 2009). Consequently, Kenya has remained a net importer of sugar with imports rising from 4,000

tonnes in 1984 to 230,011 in 2007. The country's annual National sugar deficit on average is 200,000 tonnes of sugar.

Table 1: Kenya sugar factory production capacities in 2012

Factory	Location (County)	Rated Tonnes Cane per Day (tcd)	Actual 2012
Mumias Sugar Company	Kakamega	8,800	8,336
Nzoia Sugar Company	Bungoma	3,000	3,148
West Kenya Sugar Company	Kakamega	2,496	2,452
Butali Sugar	Kakamega	1,500	-
Chemelil Sugar	Kisumu	3,360	2,808
Muhoroni Sugar Company	Kisumu	2,400	2,120
Kibos and Allied	Kisumu	1,800	1,428
SONY Sugar Company	Migori	3,240	2,856
Sukari Sugar Company	Homa Bay	1,500	-
Transmara Sugar Company	Narok	1,500	-
Soin Sugar Company	Kericho	300	242
Total TCD	**Kenya**	**29,976**	**20,940**

Source: KESREF sugarcane and sugar database, 2012

The co-products include molasses which is used for ethanol production that can produce bio-fuels and other products such as alcoholic spirits and yeasts. Currently, molasses is processed by three distillers in Kenya; Spectre International (Kisumu), Agro-Chemical and Food Industries (Muhoroni) and London Distillers (Nairobi). Bagasse is used for providing power to the boilers and also for co-generation (loading to the national power grid). Currently, Mumias Sugar Factory is the only factory producing power through co-generation. Filter mud is another co-product generated by all the factories except Mumias due to the use of diffuser technology. For any strategy to address the whole question of poverty and food insecurity successfully especially in the sugar cane sub sector, it must embrace broad-based growth and development of agriculture and by extension, development of rural Kenya like Migori County. This must

involve activities aimed at improving agricultural production and real farm incomes, and at ensuring availability of, and access to, food. This entails transforming the way agricultural information flows, get processed and utilized for improved production.

1.3 Sugar cane production in Migori County

Migori County falls under the wider South Nyanza cane production zone. There are three Districts in the County that produces sugar namely; Awendo District within which SONY Sugar Company is located, Uriri District and Rongo District. Awendo and Rongo are fairly within the urban confines in terms of digital networks and infrastructure while Uriri District is in a rural set up.

There are three sugar factories operating in the South Nyanza zone and the biggest is South Nyanza Sugar Company which started operating in 1979. The current capacity of the company is 2,400 TCD but it has a rated capacity of 3000 TCD. The total area under cane for the company is 18,359.45Km^2 with a total of 25,000 farmers. The annual rainfall is 1780mm and the soils are mainly vertisoils and ferralsols which are suitable for cane production.

This study targeted to investigate the effects of digital divide on information accessibility among sugar cane farmers with a view of identifying and evaluating the factors that contribute to its effects and sources of information for the sugar cane farmers in these areas.

1.4 Why agriculture information accessibility

There are multiple definitions of information as advanced by several scholars. For purposes of this study, information accessibility will be considered to be a concept that includes elements of agriculture information creation, acquisition, storage, retrieval, transfer and utilization all at the right time and place to maximize the benefits. Information is said to be a resource that must

be acquired and used for the improvement of agricultural production. Agriculture information is an important resource which is required for effective mobilization and utilization of resources, policy formulation and implementation and other activities involved in agricultural development. The sharing of ideas and information forms a larger part of extension agent's job. Having adequate and well-presented information will improve the efficiency of rural development projects and programmes, Samuel (2001). According to Asres (2005), information facilitates an individual to be more rational, increase the decision making abilities and improve the standard of life. Using information is a key issue in the information age. The real challenge therefore may not be producing information, storing information but getting people to utilize information.

Despite the central role that agriculture plays in the Kenyan economy, the sector continues to experience challenges which include accessibility to agricultural information by the farmers. This is due to inadequate extension services which are key in sharing information, knowledge, technologies and linking of farmers to other sectors of the economy. Kenya has a long history of public agriculture extension service. In the past, the government was solely responsible for the provision of extension services through the Ministry of Agriculture (SRA, 2004-2014). According to the national economic blue print, the Kenya Vision 2030, the current national average is one extension officer per 1,093 farm households (GOK, 2005). Besides, the SRA (2004 -2014) states that the government budgetary allocation to extension service has steadily declined over time thus no credible extension system and methodology in place, and messages delivered to farmers under the current system lack new or useful information.

With the weakening of public extension services, a multiplicity of extension agents such as Non-Governmental Organizations (NGOs), community based organizations, private sector and individual consultancy groups have come up to fill the gap. In addition, commodity based

enterprises or organizations involved in production of crops such as sugar cane have been providing extension services specifically for the commodity they are dealing with (SRA, 2004 – 2014). Agricultural Information Resource Centre and agricultural shows have been important sources of agricultural information, knowledge and technology.

The current Government policy is to move farmers from subsistence to commercial agriculture (ASDS, 2010 – 2020). This requires use of modern technologies which can only be attained from specialized, modern and appropriate agricultural information to farmers. However, many farmers still rely on old methods of production thus unable to commercialize their production despite continuous efforts of research, extension, training and development programmes to promote the generation and use of new information in agricultural production.

According to the national economic blue print, Vision 2030 1st Medium Term Plan, (GOK, 2008) a total of 5,072 extension officers were provided with uniforms in the year 2007. In addition, 599 motor vehicles and 1,037 motorcycles were procured and distributed to the field with the aim of strengthening agricultural extension service delivery. Consequently, the number of farmers reached per year increased from 1.0 million in 2003 to 2.1 million in 2007. Extension service delivery has been improved further through establishment of 1,538 information desks in the provinces and district as avenues of sharing agricultural information with farmers and other agricultural stakeholders. Efforts have also been made to revamp the key extension institutions of Agricultural Training Centers (ATCs) and Agricultural Mechanization Stations (AMSs) through rehabilitation and upgrading of facilities and equipment.

Efforts were also made to improve on the policy framework for extension services. This culminated in formulation of the National Agricultural Sector Extension Policy (NASEP) that aims at giving extension a sector-wide dimension and representation to take over from the

National Agriculture Extension Policy (NAEP) of 2001. It is also to guide and regulate the provision of agricultural extension service in the country.

The sugar sub sector is intricately weaved into the rural economies of most areas in Kenya. The adoption of ICT in dissemination of agricultural extension information is still low amongst different sub sectors, a factor which affects development of agriculture and the national economy at large. Kenya, like in many other developing countries, has very low levels of awareness and knowledge about access and use of ICT facilities in the rural communities thus the need for expansion of means of agriculture information accessibility to farmers. Such expansion of for instance Internet access in poor areas may be facilitated by specialized arrangements for public use, such as Internet kiosks, cybercafés, or multipurpose community telecentres, Rogers and Shukla, (2001).

1.5 Statement of the research problem

Agricultural productivity in Africa has declined over the years leading to progressive increase in food imports (AU/NEPAD, 2003). The total food import bill for Least Developed Countries in 1970 was USD 1 billion and this rose to USD 122 billion in the year 2006 (FAO, 2006). Since 28 percent of the population in sub-Sahara Africa suffers chronic food insecurity, efficiency of resources used in agricultural production will continue to be a major concern for policy and initiatives targeting improved livelihoods in the region. One way of achieving this is adequate information dissemination to farmers and other key agricultural players in the region. In spite of the demand, service delivery through Information and Communication Technologies (ICT) still face several challenges worldwide amongst them unreliable supply, high costs and the variance in the rate and nature of actual use, varied and dynamism of production, high investment capital requirement and uncertain returns on investment. Such

challenges have brought about digital divide in agriculture sector especially in the developing countries such as Kenya.

Information dissemination and communication management has always remained vital in modern agriculture with farmers continuously seeking relevant information on the new technologies which they may apply to improve their production. However, accessibility to such information has sometimes been very elusive due to several factors. The adoption and use of digital devices in service delivery in the sugar sub sector in Kenya is still at a very low level and although some of the players in the sugar sector have already gone into adoption of various types of ICT to various degrees and obtained a 'first mover advantage', others have not been paying much attention to this phenomenon. For that reason, there exists a gap called digital divide with respect to the level of utilization of ICT by farmers in the sugarcane sub sector thus affecting the production.

1.6 Research objectives

The main objective of the study was to assess the effects of digital divide on accessibility of agricultural information among sugarcane farmers in Migori County. The specific objectives were:-

i. To identify the digital tools used by sugar cane farmers in Migori County to access information.
ii. To asses the extent of digital tools usage for information accesibility by sugar cane farmers in Migori County.
iii. To identify and evaluate the effects of the factors that contribute to digital divide among sugarcane farmers on accesibility of agricultire information in Migori County.

1.6.2 Research questions

i. What are the available digital tools used by sugar cane farmers in Migori County for accessing information?

ii. What is the extent of digital tools usage for information accesibility by sugar cane farmers in Migori County ?

iii. What are the factors that contribute to digital divide and how do they affect access to agriculture information by sugarcane farmers in Migori County?

1.7 Justification

Kenya faces a problem of insufficient sugar supply and in order to be self-sufficient in sugar production, maximum output from the limited resources is crucial. Efficient and effective availability and use of information would result in increased output and in turn increased availability of sugar thus the country achieving self-sufficiency. The gap created by digital divide in accessing relevant agricultural information by sugarcane farmers, if bridged, is likely to determine how they are going to invest in the crop and this would have implication on their levels of technical efficiency.

With the entry of numerous players like NGOs and private agents in the extension and advisory services, it is evident that there are multiple sources of agriculture information available to farmers. However, there are equally numerous factors that interfere with access of such information leading to digital divide among farmers. Access to agriculture information is central to production levels and as such, it should be enhanced for all the farmers. This is especially so for rural based farmers in places like Migori county where digital sources of information may be scarce, expensive or simply not available.

This study therefore sought to research on the factors that cause digital divide, effects of digital divide and to provide useful information to farmers and extension officers in the sugar sub sector by proposing ways of bridging the divide in order to increase agriculture information accessibility. It was also to provide useful information to policy makers in the ICT and Sugar cane sub- sector to develop policies to regulate information flows in Migori County and help speed up the adoption of use of ICT in the Sugar cane sub sector.

The results of this study would inform the Government, the private sector and other stakeholders at the national and county levels who are involved in management of the Kenyan sugar sub sector, of the extent of existent of digital divide in the sector. It would also indicate ICT services and adoption of such services for service delivery, capital investment requirements and customers' willingness to pay for ICT based delivered services. The study would further inform the parties on how the aforementioned factors affect performance of the sub sector and hence production. The mentioned players will therefore be able to make informed decision about the viability of instituting ICT based service delivery system and making use of it to eliminate digital divide thus enhance service delivery for better production outcome.

The study would be important for provision of reference to policy formulation in respect to development of ICT industry in Kenya. The consumers and farmers would use the findings of this study to lobby the Government to upscale investment on digital information infrastructure access in the agriculture sector. The results would further contribute to the limited body of knowledge on the digital divide in the sugar industry in Kenya.

1.8 Definition of terms:

For purposes of this study, the following terms have been defined as stated hereunder;

Agriculture Information: Information that is acquired and utilized for purposes of perpetuating agriculture service delivery

County: The second unit of governance in Kenya, headed by a Governor, after the national Government.

Contract farming: in sugarcane farming, this means agreement between sugar cane farmers and the milling company for provision of specific services that relate to sugarcane production on cost recovery when cane is delivered.

Digital Divide: As used in this study, digital divide refers to the gap between the sugarcane farmers who have access to ICT and those who do not.

Information: Refers to data that has been processed into specific, accurate, timely and organized for a purpose, and is presented within a context that gives it meaning and relevance leading to an increase in understanding and decrease in uncertainty.

Information Communication Technology (ICT): this is an overall term that includes all available digital tools which can be used by farmers to access, share and store agriculture information for purposes of improving their production.

Out growers Institutions: these are farmers'institutions that are outside the arrangements of the miller and are used to negotiate with the miller on behalf of the members.

Parastatals: These are state owned corporations that are formed by the Government to undertake specific task or tasks that cannot be performed easily under the purview of the mainstream service.

Information Management (IM): means the collection and organization of information from one or more sources and the distribution of that information to one or more audiences including those who have a stake in, or a right to that information.

1.9 Organization of the thesis

This thesis is organized into five chapters namely; chapter one that covers introduction and general background to the study. Chapter two presents the literature review while chapter three presents the methodology that outlines the research design, the method used to obtain the sample size, collection of data and the analysis techniques. Chapter four covers the presentation of results and discussion and, chapter five has conclusion and recommendations.

CHAPTER 2: LITERATURE REVIEW

2.1 Digital divide in Kenya

Information technology became popular as a source of automation for information system in the 1970s during which discussions and debates on the impact of this technology were centered on information gaps which existed between developed and developing countries. This lead to an assumption that the world populations may soon be divided into groups of inequalities between 'information elites' and 'information ignorant' (Lucky, 2012).

However, as a result of rapid developments in information and communication technology (ICT), this problem manifested in greater complexities associated with technological disparity. It came to light that technological disparity can also occur within a single country, rather than between developed and developing countries. In addition, this disparity would not necessarily be confined to the computer or the Internet use but rather may involve accessibility of information in forms of ICT tools such as mobile phone and television. This awareness led to the use of another term, the 'digital divide', which encompasses a broader and more cavernous meaning than 'information gap'.

The digital divide is essentially a geographical division, and can be categorized as global, regional or national (Rao, 2005). The global digital divide is a term often used to describe disparities in opportunity to access the Internet between wealthy and poor nations, or between developed and developing countries.

The extension of infrastructure for the use of the Internet in developing countries has generally been much slower than in economically rich parts of the world. This is mostly due to low demand and thereby low profitability of ICT businesses. The disparity in the intensity of ICT adoption among countries is wider than the disparities in their GDP per capita, indicating that

the digital divide is also increasing and likely to become even more severe in the future (Wong, 2002).

At the regional level, Africa is in a particularly bad condition. According to the UN ICT Task Force (2002), the digital divide is at its most extreme in Africa, where the use of ICT is still at a very early stage of development compared to other regions of the world. Sub-Saharan Africa remains at the bottom of the list of developing regions in Internet usage since it has only one-third of the Internet penetration compared to North Africa or one-thirtieth of the European penetration (ITU, 2006).

In developing countries, in particular, there is clear tendency of increased concentration of information flows to urban and central areas (Wong, 2002; Mwesige, 2004). Economically disadvantaged countries and rural and peripheral districts within these nations tend to fall further behind in human resource development as well as in economic progress and political participation and thus widening the intra-country or national digital divide.

In academic literature, there are many articles covering the global and regional digital divide, in particular describing the gap between more and less industrially developed nations (e.g. James, 2005; Wade, 2004; Warschauer, 2003; Lucas &Sylla, 2003; Norris, 2001). Some authors like Gyamfi, (2005), covered the regional aspect of the digital divide in Sub-Saharan Africa, but there is scarce literature on intra-country digital divide, in particular in Africa.

Even if the above presented access oriented definition is commonly used in literature and everyday discussions, the digital divide will not be understood if it is viewed purely as a technological phenomenon. A broader interpretation of the digital divide is necessary Joseph, (2001); De Haan, (2004); Rao, (2005). In line with this, Van Dijk and Hacker (2003) claim that the extent and the nature of the digital divide and information inequality depend on a

multifaceted concept of access, where they distinguish between four kinds: “mental access”, “material access”, “skills access”, and “usage access”.

While the public opinion and public policy, so far, have been strongly preoccupied with the second kind of access, lack of computers and network connections, they have observed that access problems of digital technology gradually shift from the first two kinds of access to the last two kinds.

The largest gap is between better-educated, affluent, younger, English speaking men in developed cities and less-educated, poor, older, non-English speaking women in underdeveloped rural areas. Rao (2005) highlights India in the context of digital divide by discussing its infrastructural bottleneck that includes electricity, IT penetration, teledensity, and Internet industry. Within India, some states are more digital than others and within a state, there is an urban–rural digital divide. Within urban areas, there is educated–uneducated digital divide and amongst educated there is a rich–poor digital divide. This broader interpretation of the digital divide also contains a cultural dimension. Mosse and Sahay (2003) opine that attempts to deploy ICT in Mozambique face critical problems due to a variety of constraints ranging from inadequate infrastructure to manpower shortages, to a culture that does not yet value the “efficient use of information”.

According to Lucky and Achebe (2012), ‘digital divide’ began to gain popularity when it became a mainstream political topic in the US in the 1990s and eventually, it achieved recognition as an English colloquial term in dictionaries such as ‘The Australian Concise Oxford Dictionary, 4th edition and the Penguin English Dictionary, 2nd edition. Although the term digital divide has taken on a broader and more cavernous meaning than ‘information gap’, there have been times that the latter was used synonymously with the former Michelle, (2009).

The term became popular among concerned parties such as scholars, policy makers and advocacy groups in the late 1990s. Broadly speaking, it earlier meant access to the Internet, but presently includes any ICTs and media channels that different segments of society can use, Davison (2003). Digital divide refers to the gap between people with effective access to digital and information technology and those with very limited or no access at all. It includes the imbalance both in physical access to technology and the resources and skills needed to effectively participate as a digital citizen, Rice(2002). Lucky and Achebe (2012) averts that the conclusion from the various existing definitions of the digital divide is that the nature of the divide and the question whether it is closing or widening, depends on the particular definitions chosen. Based on the theory of the diffusion of innovations through social networks, a common framework can be set up to distinguish the main approaches researchers have taken to conceptualize the digital divide. All kinds of studies and approaches to the digital divide can be classified into these four categories, Lucky (2012):**Level of analysis:** Individuals versus organizations; **Attributes of nodes and ties:** Income, education, geography, age, gender, or type of ownership, size, profitability, sector; **Digital sophistication**: Access versus usage; and **Type of technology:** Phone, Internet, computer, digital.

The above categories do not necessarily occur between different societal set ups like urban and rural, but even within the same set up like in the rural areas. For instance, attributes of nodes and ties are characteristic of settings like sugar cane farmers within a particular area like in Migori County.

2.2 Digital divide and agricultural information accessibility

The digital divide is probably one of the first concepts considered when reflecting on the theme of the social impact caused by information and communication technologies. From there on, one perceives that these technologies are going to produce differences in the development

opportunities of peoples and that a distance will be established between those with access to these technologies and those without Kemly (2005). There are several definitions of the term digital divide; Mehra (2002) defines it simply as the troubling gap between those who use computers and the internet and those who do not. The term can mean not only unequal access to computer hardware, but also inequalities between groups of people undertaking the same economic activity in terms of their ability to access and use information technology fully.

Given the range of criteria used to access the various technological disparities between groups/ nations and lack of data on some aspects of usage, the exact nature of the digital divide is both contextual and debatable. Servon (2002) argued that digital divide is a symptom of a larger and more complex problem than that of persistent poverty and inequality. Mehra (2002), identifies socio-economic status, income, educational level and race among other factors associated with technological attainment, or the potential of the internet to improve everyday life for those on the margins of society and to achieve greater social equity and empowerment.

Access to technology is further divided within farmers according to socio-economic status (SES). The upper SES farmers are able to maintain access to technology at home whereas the lower SES are limited to technology access only at cyber cafes and public providers. With the non-equitable availability of technology there will continue to be dividing among user groups, Robyn (2007). Broadly speaking, the difference is not necessarily determined by the access to the Internet, but by access to ICT (Information and Communication Technology) and to media that the different segments of society can use. With regards to the Internet, the access is only one aspect, other factors such as the quality of connection and related service should be considered.

Another issue at play with access to digital information is its availability at affordable cost. The problem is often discussed in an international context, indicating certain countries such as the

US are far more equipped than other developing countries to exploit the benefits from the rapidly expanding internet, Lucky (2012). The digital divide is not indeed a clear single gap which divides a society into two groups. Researchers report that disadvantage can take such forms as lower performance computers, lower-equality or high price connections (that is narrowband or dialup connections), difficulty of obtaining technical assistance and lower access to subscription-based contents.

In dissemination of agriculture extension information, the advent of technology and technological devices, the medium of information storage, retrieval and dissemination has greatly lead to the use of computers and Internet facilities in accessing information other than the conventional method, Lucky (2012). While this may be true, most users especially in the rural areas still find it difficult to adjust to these new technologies while others do not have access to the devices at all. Therefore, the aim of this study is to discover the split between sugar farmers in Migori County who have access to digital agriculture information and those who do not.

Researchers thought that the reason that more people were not using the internet was simply an issue of affordability which in turn hindered access. Therefore, at the beginning of digital divide research, studies focused on providing the economically disadvantaged with physical access to the internet and related technologies, Van Dijke (2006). Kemly (2005) historically reviewed the concept and, according to her, the relationship between technology and development has frequently been perceived as a lineal relationship. It is therefore evident that digital divide affects accessibility of information and hence development. This divide will be reduced with access to ICTs and with the creation of digital opportunities in the rural areas such as Migori County. This approach creates intent to express how information and communication technologies can be used as a tool for development. Further, today there is not

only discussion about the internet, but rather other information and communication technologies such as mobile phones.

2.3 Digital divide and extension education

The main question here is the relationship between digital divide and literacy. If trends of divide are considered across the globe then it can be said that developed countries have a low rate of illiteracy; therefore, the gap between the users and non-users of the internet is lower than in developing countries. On the other hand, the illiteracy rate is higher in the developing nations where some people do not know how to read or write and this limit their access to the digital technologies.

However, simply learning how to read and write does not mean that people will automatically be ready to access digital technologies, Warschauer (2002). In linking socio-economic status with the digital divide discussion, one must remember that education does not happen in a vacuum, but in a specific time/place continuum, Lucky (2012). World statistics indicate that the more education a person has, the more likely they are to use the internet. Towards Digital Inclusion report (October, 2000) indicates that "Better educated adults are more likely to use and become familiar with computers and the Internet at work or through their school experiences".

Mehra (2002) in a research carried out in India asserted that only 11.7% of households headed by someone with less than a high school education had internet access in 2000 compared to 69.9% of households headed by someone with post graduate education and 64% of Bachelor degree headed households. Further, the study showed that 49.0% of college qualification headed households and 29.9% of households headed with those with high school diploma had access to internet in the year 2000. Lucky and Achebe (2012) conclude that educational

attainment divide is a self-perpetuating one in that the more education a person has, the more likely he or she will benefit from ICT which in turn increases benefits from increased ICT use. The other factor that hinders adequate exploitation of digital information especially in the rural set up is the language in which the information is packaged.

This study seeks to investigate how the educated farmers are able to make use of the internet and other ICT tools to improve in the cane production as compared to the un-educated farmers in the same rural set up of Migori County.

2.4 Bridging the digital divide

According to UN ICT Task Force (2002), in Sub-Saharan African countries, the divide between urban and rural areas is greater than in the rest of the world. Most of the services and users are concentrated in the towns, while the majority of Africans are scattered in small communities spread-out across vast rural areas. Very limited diffusion of the telecommunications networks into rural areas (often over 75 percent of the country's telephone lines are concentrated in the capital city) and irregular or non-existent electricity supplies are a common feature and a major barrier to the use of ICT, especially outside the major towns.

Robyn (2007) argues that although education could be used as a tool to close the digital gap, closing this gap will not completely close the achievement gap between those from lower and higher Socio-Economic Status (SES) backgrounds. Written (2002) listed five specific areas where digital libraries can promote developments in the developing countries. These include the dissemination of humanitarian information; facilitating disaster relief by providing the appropriate information; the preservation and propagation of indigenous culture; building collections of locally produced information; and creating new opportunities to enter the global market place. While discussing the collection and services of the Greenstone Digital Library,

Written (2002) stated that digital libraries provide a golden opportunity to reverse the negative impact of ICT on developing countries. The main activities should include building and linking local digital libraries. This implies that building digital libraries of local and indigenous materials is an important step in bridging the digital divide.

Digital outsourcing can also be useful and it concedes that information professionals in the developing countries should spend time on outsourcing of free digital information sources and services in order to make it more available. The task of selection should include a number of activities including identification of the appropriate sources and services based on the subject, sources/authority, user requirements and evaluation of the sources in order to assess the suitability of the selected sources and services in the light of the user requirements vis-à-vis the technical requirements to access and use them and to create some sort of surrogate for each source and service to facilitate organization; organization of the digital information sources and services.

Another critical factor in bridging the digital divide is information usage. There are reasons for poor information usage despite having good access. One of the major reasons is poor information literacy. The other most important reason is the study culture and habits. In many countries, more so in the developing world, the study culture does not allow people to spend more time on the internet and the day-to-day activities are based more on the traditional approach through the use of paper documents and telephone or written communications.

Poor information and digital literacy is a major problem in the developing countries. Widharto (2002) while discussing the problems facing information services in Indonesia indicated that training remains a key to the future of the Indonesian libraries. This statement can be generalized for other developing countries too. Information or digital literacy training may be organized at different levels. Because of the limitation of resources, information professionals

may begin with a simple approach of providing training to the users at different levels that is basic and advanced to keep pace with the rapid changes in ICT and digital library systems and services. Such training should be provided on a regular basis in order to help the users keep up to date and thereby make the optimum use of the sources and services made available to them.

Even if there is an agreement in a broad definition of the digital divide concept, the first step in the direction of bridging the digital divide in a country is to provide access to the internet in rural areas. In developing countries, most Internet users gain access through public access points like internet cafés, Kristiansen et. al (2003). In China, Liang and Ning (2004) predicted that Internet adoption in smaller cities was to continue growing with the popularization of Internet cafés. Mathur and Ambani (2005) claim that private profit-making institutions, like cybercafés, can develop solutions to capture the hitherto unrecognized markets, make profits, and at the same time provide aid to the rural societies in India. From Malaysia, Alhabshi (2004) reports that in an area, which is politically marginalized and physically ignored, the digital divide is bridged by way of structurally poor and financially weak cybercafés. In a study of cybercafé industry in Africa, Mutula (2003) stated that they had become important access points for a majority of internet users.

2.5 Empirical reviews

Dasgupta et al., (2007), investigated the digital divide across African, Latin American and Asian regions especially with regard to the “internet intensity” and “telecommunication” access. The result suggests that the rapid growth of internet use in high income economies has raised the presence of digital divide. This has marginalized the developing countries because they cannot afford internet access or use effectively even when it is available.

Van Dijk (2006) claimed that the digital divide cannot be understood without addressing issues such as attitudes toward technology, the channels used in new media diffusion, educational views of digital skills, and cultural analyses of lifestyles and daily usage patterns. He has studied the digital divide research during a period of time and states that the deeper social, cultural, and psychological causes behind the inequality of access have not been addressed so far.

Kasusse (2005) investigated the strategies of bridging the digital divide in Uganda. Even as communication barriers fell, he found that new divides had emerged and Internet access, though certainly affordable to the middle class in the urban area of Kampala, is still mostly non-existent for the 90% of Ugandans who live away from Kampala. This shows that the digital divide is not only a hardware divide regarding telephone lines and computers. It is also a mental divide, defined by illiteracy, command of English, and feelings of ease and familiarity with these technologies.

Chen and Wellman (2004) studied Internet use in eight countries: United Kingdom, United States, Germany, Italy, Japan, Korea, China and Mexico. Across these eight countries, socioeconomic status, gender, life stage, and geographic location significantly affected people's access to and use of the internet. The study reveals that Internet users are more likely to be well-off and better educated than non-users and, that men are more likely than women both to access and to use the Internet regularly. In both developed and developing countries, the Internet penetration rate among younger people is substantially higher than that among older people. Students who can get online via school connections make up a big share of Internet users in developing countries, and geographic location also affects access to and use of the Internet, with more affluent regions having higher Internet penetration rates than poorer ones. Moreover, the intersection of socioeconomic status, gender, age, language and

geographic location tend to increase the digital divide in mutually reinforcing ways within and between countries.

Sticker et al., (2003), investigated the relationship in the context of agriculture sector in Germany. They used a three – stage questionnaire based survey to examine the issues such as access and usage of computers, internet and e-commerce by farm managers. The results found out that young and educated managers were more likely to use the internet than older and less educated peers and also with respect to large and small-scale farms. The outcome of analysis revealed that a clear division of technology adoption can be seen in the agriculture sector in Germany and this affects production.

Warren, (2002) examined this phenomenon in the context of agriculture sector in the United Kingdom. It showed that there exists a significant difference with regard to use of personal computers between small and large scale arable production. The differences in internet use were even more extreme. The study reveals that older farmers and those without formal education beyond the secondary school were unlikely to adopt ICT.

Kling, (1999) argued that internet use is a question of social as well as technological access. Technological access refers to infrastructure and the physical availability of computer hardware and software, while social access refers to the mix of professional knowledge, economic resources, and technical skills required for the use of ICT.

This literature review shows that there have been no studies on the effect of digital divide on accessibility of agricultural information among farmers in Kenya, thus, this specific case for Sugar cane farmers in Migori County was considered as a contribution to understanding the far reaching effects of digital divide in different sectors of the Kenyan economy. In studying the effects of digital divide on accessibility of agricultural information among sugar cane farmers

in Migori County, focus was put on infrastructural, socio-economic and demographic aspects. The study among others sought to find out sugar cane famers access to information and communication technology services and other levels of utilization. The research also investigated if financial status, users' education and proximity to urban centres with cyber cafes could act as restrictions of accessing the digital based agriculture information.

2.6 Theoretical framework

In addressing the objectives of this research, the study adopted two communication models: the Shanon - Weaver mathematical model (1949) and Rogers and Shoemakers model (1971) as later expounded by Benhanida (1989) to come up with the diffusion model. The Shannon and Weaver's theory is used more literally and is referred to as *Shannon* or information theory.

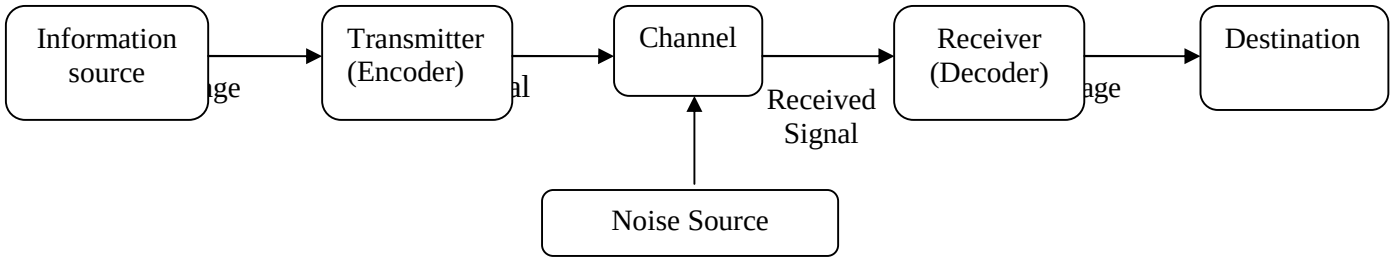

Figure 1: The Shannon and Weavers mathematical Model, 1949
(Source: Allen and Thomas, 2000)

The Shannon's formula isas follows;

$C = W \log_2 (1+ S/N)$..... equation 1

Where;

C =channel capacity measured in bits/second,

W = bandwidth in Hz,

S = signal level in watts across the bandwidth (W),

N = the noise power in watts in the bandwidth (W).

The theory embodies the concepts of information source, message, transmitter, signal, channel, noise, receiver, information destination, probability of error, coding, decoding, information

rate, channel capacity. Shannon developed information entropy as a measure for the uncertainty in a message while essentially inventing what became known as the dominant form of "information theory." According to Shannon and Weaver's model, a message begins at an information source, which is relayed through a transmitter, and then sent via a signal towards the receiver. But before it reaches the receiver, the message must go through noise (sources of interference). Finally, the receiver must convey the message to its destination.

According to this theory, for an idea in the brain (information source) to be told to someone else, it must first move from the brain to the mouth (transmitter) of the owner. Since the owner of the idea cannot actually share his or her gray matter, there must be selection of words for the transmitter to use. Once spoken, the voice (signal) is carried through air towards the listener's ear (receiver). Along the way, the signal is joined by a myriad of other sounds and distractions (noises). The receiver then takes everything it receives and tries to maximize the message and minimize the noise. Finally, the receiver conveys its message to the other person's mind (destination).

Shannon and Weaver's model clearly demonstrates why even the simplest communications can be misunderstood. Transmitting a signal across additional media only adds to the complexity of the communication and increases the chance for distortion. It is suddenly easier to understand why other people just can't grasp what others already know. It is evident that the model's separation of the communication process into discrete units has proved fruitful and has formed the basis of several other models which provide some more insightful elaboration of the human communication process. To study information accessibility and factors that affect it in Migori County, the study intends to be guided by this model while looking at the various entropies in communication and how they relate to the digital divide.

To predict the behaviour of interpreters in regard to their ability and willingness to adopt and diffuse terminological neologies, it may be fruitful to examine some concepts and findings from diffusion of innovation studies. According to Rogers and Shoemaker (1971) as quoted in Benhamida (1989), diffusion is a special type of communication in that it is the process by which innovations spread to members of a social system. Diffusion studies are concerned with messages that are new ideas, whereas communication studies encompass all types of messages. As the messages are new in the case of diffusion, a degree of risk for the receiver is present. This leads to somewhat different behaviour on this part in the case of innovations than if he were receiving messages about routine ideas, Rogers and Shoemaker (1971)

The theory describes social change as a three-stage process: 1. invention, 2. diffusion, and 3. consequences. The model as later modified by Benhamida (1989) has the following five steps: *Awareness*: where the user learns of one or more competing innovations; *Interest*: where the user learns about the source of innovations and concept or item it refers to; *Evaluation*: where the user develops an attitude toward the innovation(s) and evaluates the risks and payoffs of adoption/rejection; *Small-scale trial*: where the user determines appropriate contexts for use, especially if there are competing innovations, and; *variable adoption*, categorical adoption or rejection of terms.

One of the useful concepts from the theory is the common culture. In diffusion studies, the terms *heterophony* and *homophily*are used to identify to what degree pairs of individuals who interact are different or similar in certain attributes, such as beliefs, values, education, social status etc, Rogers and Shoemaker (1971). Lack of common culture often impedes the diffusion of innovations. The study seeks to make use of this aspect in determining how differences of individual sugar cane farmers in Migori County affect their accessibility of agricultural information.

The other useful aspect as defined in the Rogers and Shoemaker (1971) communication model is the compatibility in a social context. They assert that compatibility is the degree to which an innovation is perceived of as being consistent with the existing values, past experiences, and needs of the receivers. An idea that is not compatible with the prevalent values and norms of the social system will not be adopted as rapidly as an innovation that is compatible, Rogers and Shoemaker (1971). Further, the characteristics and principles of the language in use, Alloni-Fainberg (1977) will lead to better and quicker acceptance and dissemination.

With the understanding of the mentioned models, it is clear that several factors affect information dissemination and these lead to the digital divide thus effects on the outcome. For sugarcane farmers that may be affected by the mentioned factors, digital divide may result thus low production.

CHAPTER 3: METHODOLOGY

3.1 Conceptual framework:

Figure 2 illustrates the conceptual model as conceived in this study. The figure 2 illustrates that digital information accessibility is influenced by contextual factors such as education, age, resources, demographic and geographical factors. These are aided either positively or negatively by adequacy or otherwise of tools and approaches for dissemination and extension agents. When such factors are unfavourable, then digital divide would result. Existence of digital divide then leads to ineffective communication and extension services thus low production of sugarcane. On the other hand, when the contextual and enabling factors are favourable, then digital divide and its effect on information accessibility by farmers is eliminated. Farmers then are able to make adequate use of ICT tools; access required information for their use in the farm thus improved production.

The overall outcome of eliminating digital divide in the sugar sub sector would be improved operational performance, effective communication, cordial relationship between industry players and farmers. These factors overly contribute to improved cane productivity.

According to Nyirenda – Jere (2010), the primary propose of ICTs is to provide an enabling environment for the generation of ideas, dissemination and use. Through ICT tools, the diffusion and sharing of knowledge is enabled through open access to information and better coordination of knowledge.

Some of the ICT tools considered in this study include computers, mobile phones, televisions, radios and internet which are commonly used in the identified districts.

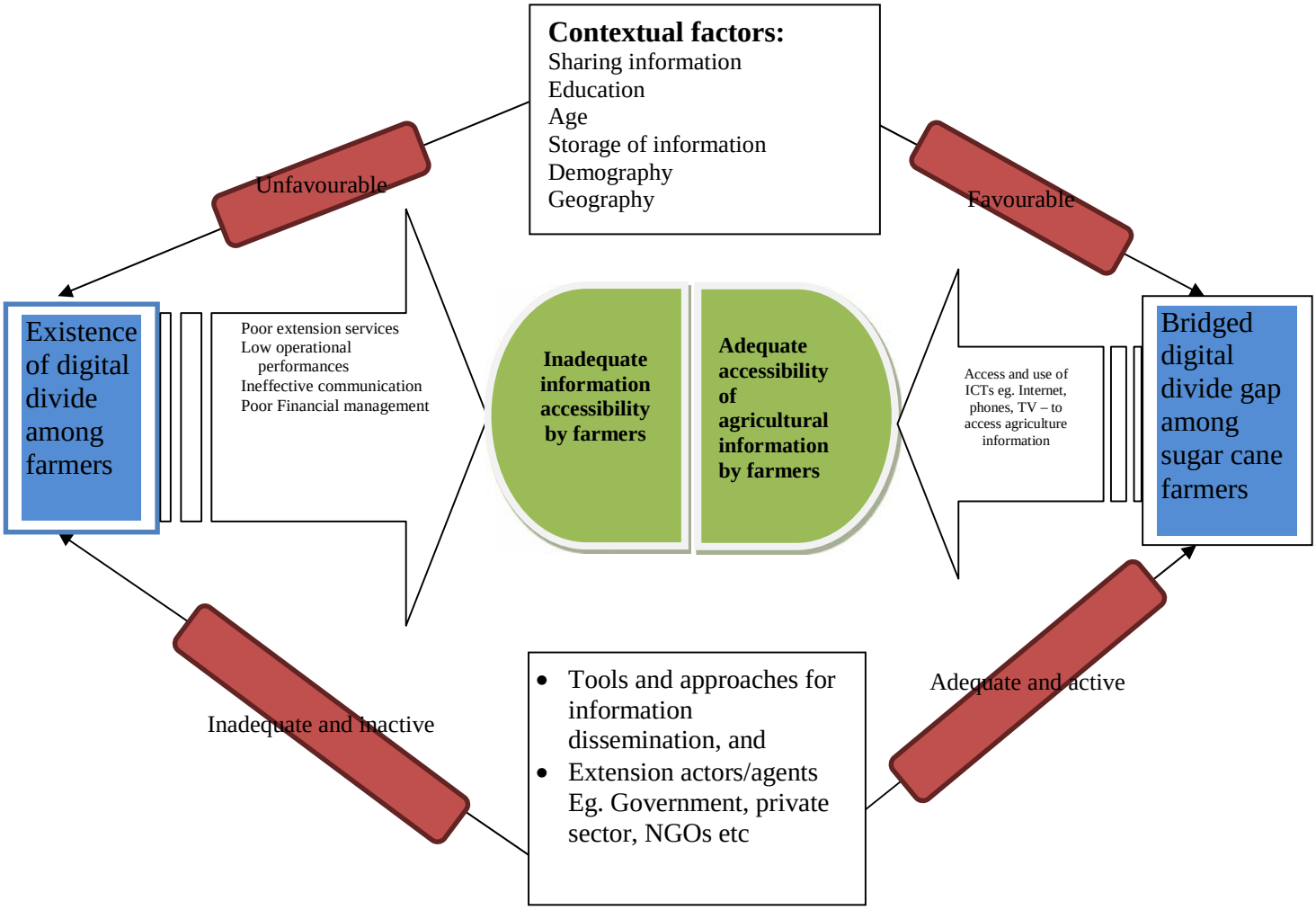

Figure 2: Conceptual Model
(Source: Author)

3.2 Empirical model

3.2.1 Digital tools

Both qualitative and quantitative research designs were used to determine digital tools used for accessing agricultural information by sugarcane farmers in Migori County and in particular, Awendo and Uriri districts. Collection of qualitative data involved administration of questionnaires (Appendix 1) to the farmers face to face by trained enumerators who made farm visits. This also applied in determining the extent of ICT tools usage for information accessibility and utilization. It was done through the use of key informant interviews with extension service providers in the two districts. A total of eight interviews were conducted,

four in each district with two representing government actors and two representing non-governmental actors.

Before final administration, a draft questionnaire was pre-tested in the two districts to establish effectiveness of the tool in achieving the stated objective. The pretesting involved ten farmers in each district to find out if the questions outlined in the questionnaire were clearly understood by the respondents. Any inconsistencies noted were adjusted accordingly. In administering the questionnaire, the literacy level was taken into account and where the farmers could not read and write, this was explained to them and written as they state during the interview. A total of 276 farmers were interviewed with 138 sugar cane farmers drawn from each district.

To give support to the quantitative data, qualitative data were collected through the use of Focused Group Discussions (FGDs). These groups were structured in terms of women farmers, youthful farmers and men. Every group was between 10 to 15 farmers selected using the snow balling technique. A total of six discussions were held; three per district. A check list was developed to guide the discussions and provide an in-depth understanding of the farmers' opportunities, challenges, levels of involvement with ICT and reasons behind their behaviours towards information accessibility and digital divide. For record purposes, the discussions were taped after getting the consent of the participants.

3.2.2 Factors that contribute to digital divide among sugarcane farmers

To identify factors that contribute to digital divide in the two districts, specific questions were introduced into the questionnaire that provided farmers with a range of options from which to choose their most preferred factors. Overall, qualitative methods including interviews and observations were preferred because they answer a wide variety of questions as indicated by

(Jenny, 1999). On the other hand, quantitative method of structured survey questionnaire was employed to collect quantitative data.

3.2.3 Effects of the digital divide factors on accessibility of agricultural information

From the above conceptual framework, access to information and communication technologies by sugar cane farmers in Migori County can be equated to Agricultural technology adoption whose models are based on farmers' utility or profit maximizing behaviors. This is based on the assumption that farmers adopt a new technology only when the perceived utility or profit from using this new technology is significantly greater than the traditional or the old method. While utility is not directly observed, the actions of economic agents such as farmers are observed through the choices they make. The influence of subjective perception on the adoption behavior for innovations and the socio-economic determinants are Categorical variables since their measurement scale consists of a set of categories. For such responses, the use of continuous data analytical methods is inappropriate. These are therefore analyzed through models such as Probit, Logit, and Tobit.

Both probit and logit approaches are probabilistic dichotomous choice qualitative models.However, the quality of their prediction depends on the nature and relationships between the independent variables. The Binary probit or logit models are employed when the number of choices available is two (whether to adopt or not).These models are statistically similar (Amemiya, 1981), but the probit model assumes a normal cumulative distribution function (thus has fatter tails) while the logit model assumes a logistic distribution of the dependent variable. Although parameter estimates may differ in the two models because the two distributions have different scales, Amemiya, (1981) and Agresti (1996), note that it would require enormous sample sizes to have significant differences in the two models. Use of either model is thus discretionary.

In this study the binary logistic model is preferred because of its popularity given that binary data such as access or no access to information and communication technologies by sugarcane farmers with the response being either a 'success' or a 'failure' in improvement of livelihood by the farmers..

Logistic regression models are used when the dependent variable is categorical. Variants of the logit model include the ordinary logit (binary logit), the ordinal logistic, nominal logistic and the multinomial logit.

The impact of an event on the probability depends on the initial probability of the event. Concerning the behavior of technology adoption at initial stages adoption occurs at a slow pace, gradually picks up momentum and then slows down as the process approaches saturation point.

The function is therefore given by:

$P_i = e^z / (1+e^z)$……Equation 2

Where

P_i – probability of binary outcome (accessibility of information and communication technologies or otherwise)

$Z = \beta X$……..Equation 3

Where

X – Represents the farmer characteristics

β – vector of coefficients or parameters to be determined

The unknown parameters can be estimated by maximum likelihood method.

The natural log of odd ratios is given by:-

$Z_i = \ln [P_i / (1-P_i)]$ ……..Equation 4

These probabilities are not directly observable, but are proxied by binary variable Y_i which takes a value of 1 if the interviewed sugarcane farmer has access to information and communication technologies and 0 if not.

Using Y_i as the dependent variable, the final empirical model for estimation is represented as;

$$\mathbf{Y_i = \beta_0+\beta_1X_1+\beta_2X_2+\beta_3X_3+\beta_4X_4+\beta_5X_5+\beta_6X_6+\beta_7X_7+\beta_8X_8+£\ i} \quad \textbf{.....Equation 5}$$

Where:

Y_i- is the use of ICT tools

β_0- Constant

X_1 -Gender (male/female)

X_2- Age (years)

X_3- Size of land (acres)

X_4-Farming experience (years)

X_5-Formal education (years)

X_6- Forum (membership to farmer group)

X_7- Share information

X_8- Keep information (storage of information)

3.3Description of the study area

Administrative set-up: Migori County is one of the fourty seven counties in the Republic of Kenya and is located in south west region of the country. The county neighbours Homa Bay County to the north, Kisii and Narok Counties to the east, Tanzania to the south and Lake Victoria to the south west as shown in figure 3.

The county has a total land area of 2,586.40 km^2 and a population of 917,170 according to the Kenya National Census report (Kenya National Bureau of Statistics, 2009). There are eight (8) districts in the County as shown in figure 4.

Map of Kenya showing Migori County;

Figure. 3: Map of Kenya showing Migori County
(Source: Google map)

Migori County map showing the two study districts:

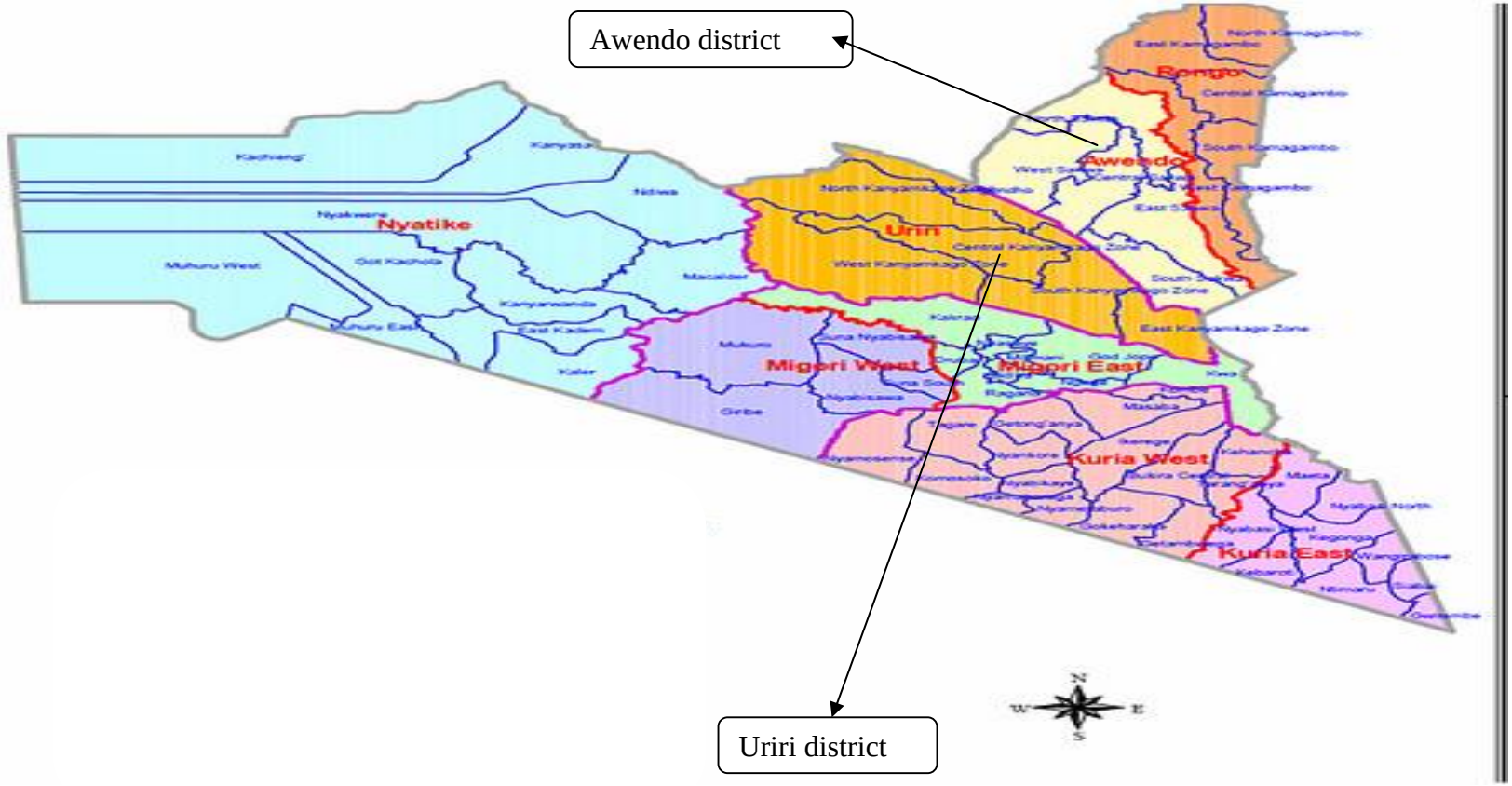

Figure 4: Map of Migori County

(Source: Google map, 2014)

Table 2: County population and area per district

No.	District	Population (2009 census)	Area in km^2
1	Rongo	100,547	208.40
2	Awendo	108,913	262.00
3	Uriri	115,751	380.70
4	Migori East	97,121	207.30
5	Migori West	94,127	282.80
6	Nyatike	144,625	677.70
7	Kuria West	162,857	332.50
8	Kuria East	93,229	235.00

(Source: IEBC, 2012)

Climate: Migori County is endowed with good rainfall of between 25-1000 mm per annum, fertile and arable land which is capable of producing various crops such as sugarcane, tobacco, bananas and horticulture. Rainfall amount and reliability decline towards the western parts of the County (Nyatike and Uriri) which reduces the potential for crop production. The County experiences two seasons of rain and the highest rainfall is between March and May. Average rainfall is approximately 1200 mm, but the rainfall patterns are unique. Temperatures in Migori County range between 21^oC to 35^oC.

The soils are well-drained and tend to be loamy. This favours the cultivation of tobacco, sugarcane, maize, beans, coffee, groundnuts and vegetables. However, agricultural production is restricted by the dry periods as if no irrigation water is available.

Economic Activities: The main economic activities arefishing and fish trade due to the presence of lake Victoria, river Migori and river Kuja, sugarcane production and sugar manufacturing, tourism in Ruma national park and artisanal mining of gold.

The relatively good weather patterns in the County have resulted into well drained soils in the making the county conducive for agriculture. Agricultural produce consists of tobacco,

sugarcane, maize, beans, coffee, groundnuts and vegetables. There is also small scale livestock production. Due to mineral resources available in the County, there is a nascent but growing mining industry particularly gold mining that many residents have taken up.

3.4 Sample size and sampling procedure

3.4.1 Study design

In undertaking this study, the sample comprised of sugar cane farmers in Awendo and Uriri districts of Migori County. The focus with extension agents in the study arose from the key role it plays in information accessibility by farmers. Christopolos (2010) defines extension as a system that facilitates access to knowledge and information by the farmers, their organizations and other market actors. Extension also facilitates farmers' interaction with researchers, educationists and other relevant institutions. According to Anderson (2007), the term agricultural extension refer to the entire set of organizations that support and facilitate people engaged in agricultural production to solve the problems and to obtain information, skills and technologies to improve their livelihoods.

The study sought to look at effects of digital divide on information accessibility with respect to digital sources of agriculture information available to farmers in Migori County. To gather information about extension services in the area, the County headquarters and the two districts headquarters were visited to obtain contacts of all the groups, individuals or organizations involved in extension activities. The South Nyanza Sugar Company offices in Awendo town centre was also visited in order to obtain the list of sugarcane farmers in the two districts of Awendo and Uriri. A purposive and snowballing field survey technique was used to obtain the sample from this target population with primary data being collected at one point in time. A simple random sampling procedure was used to identify the individual farmers to be visited. It was from the lists obtained that a sampling frame was designed. The unit of analysis in the

study was sugarcane farmers in the two districts. Both large scale and small scale farmers who grow commercial sugarcane and sell to the South Nyanza Sugar Company (SONY)[1] for profit were targeted. These farmers also benefit from extension service provided by the company.

3.3.2 Sample size determination

The population of the study comprised of sugarcane farmers of Awendo and Uriridistricts in Migori County. It was important to choose districts where the sugarcane production is undertaken in order to improve the likelihood that farmers would be motivated to access information and communication technologies for enhanced participation in research and development activities.During calculation a good representative sample size is selected from the sugar cane production and socioeconomic factors that are affecting accessibility to information and communication technologies by sugar cane farmers in Migori County. Hence, for the 95% (Z = 1.96, 2 tailed test) level of significance, within ± 5% (e = 0.05) margin of error and taking into account the proportion of sugar cane farmers in Awendo and Migori Sub-counties, the sample size n, was calculated as discussed in Fishers et al., (1991) as;

$$n_0 = \frac{z^2 pq}{d^2}$$ .....Equation 6

n_0 = Desired sample size

z = Standard deviation (1.96) which corresponds to 95% confidence interval

p = Expected prevalence of proportion

q = 1-p

d = Degree of desired accuracy set at 0.05

$$n_0 = \frac{1.96^2 \times 0.1 \times 0.9}{0.05^2}$$

$$n_0 = 138$$

Therefore the sample size was n = 138sugar cane farmers drawn from each district. The total number of farmers interviewed were 276. The limited sample of farmers interviewed were based on budgetary and time constraints.

3.5 Data analysis

The model used to evaluate the relationship between accessibility to information and communication technologies and the respective determinantsinvolved a mixed set of qualitative and quantitative analyses. Qualitative models have been used extensively in studies of this nature, although they have been criticized for their inability to account for partial decisions made by the agents(Feder*et al*., 1985). Alternative specifications of qualitative choice models include the linear probability models. The Probit and the Logit models are the two most frequently used applications in explaining the socio-economic determinants, especially for analyzing the relationship between dependent discrete variables and explanatory variables (Polson *et al*., 1992). Both models yield similar parameter estimates and it is difficult to distinguish them statistically. Of these two models, the binomial Logit model is easier to estimate and simpler to interpret (Abebaw and Belay, 2001). In this case, the binary logit regression model (BLRM) is considered appropriate (Polson *et al*., 1992). It requires far fewer assumptions than the others, and even when the assumptions required for Discriminant analysis are satisfied, it still performs well (Hosmer and Lemeshow, 1989; Kleinbaum 1994).

The relationship between the independent variable and probability is non-linear. The probability estimate will always be between 0 and 1, regardless of the value of Z in the Equation 3. The parameters of the model were estimated using the maximum-likelihood method. That is, the coefficients that make the observed results most likely are selected. Since the Logit regression model is nonlinear, an iterative algorithm is necessary for parameter estimation. The coefficients in this model are tested by the Wald statistics, which has a Chi-square distribution and t statistics.

The quantitative data were coded and subjected to both inferential and descriptive statistics using the Statistical Package for Social Sciences (SPSS) version 20.0 software. Comparison of conformation between the haves and the have not were done using logit regression for ranked scales and categorical values with statistical significance set at $p<0.05$. The qualitative data was categorized to allow for thematic and comparative analysis while qualitative analysis was run throughout the data collection stage.

CHAPTER 4: RESULTS AND DISCUSSION

4.1 Preamble

This study evaluated the effect of digital divide on accessibility of agricultural information among sugarcane farmers in Migori County. This chapter is organized under the specific objectives of the study: The first section describes characteristics of sugarcane farmers in Migori County while the second section gives the digital sources of information among farmers. The third section focuses on the digital tools used by extension agents for information dissemination, while the fourth section deals with identificationand evaluation of the effects of the factors that contribute to digital divide among the sugar cane farmers.

4.2 Characteristics of the sugarcane farmers

Majority of the farmers interviewed were males who constituted 60% of the sample whereas female respondents constituted 40%. Most sugarcane producing households were male headed and this explains why male respondents constituted a higher proportion as compared to female counterparts. This was significant p(>0.070) as a factor in determining the digital divide and meant that men participate more in primary decision making concerning sugarcane farming than female as shown in figure 5.

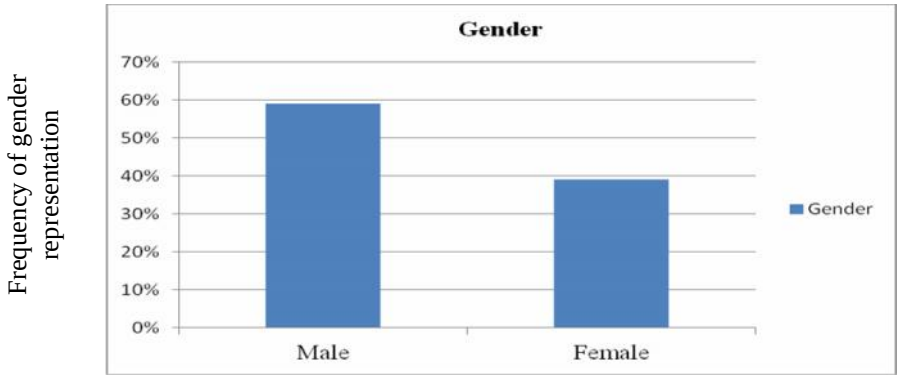

Figure 5: Gender distribution of the respondents
Source: computed from survey data 2013

The relationship between the level of education and the age of the respondent is presented in table 3. The study revealed that younger respondents had higher education level compared to the old respondents. The age between 30 and 39 registered highest number of individuals who had attained secondary, college or university education. Older respondents of age 60 years and above recorded the least number of respondents with college level of education. Age and education level were found to be significant factors that have contributed to the digital divide p>(0.067 and p>(0.000) respectively.

Table 3: Average age and education levels of sugarcane farmers

Age of respondent (in years)	**Attained education level (%)**					
	None	Lower primary	Upper primary	Secondary	College	University
18-29	7	4	21	24	19	7
30-39	0	19	26	34	34	50
40-49	0	26	26	22	16	14
50-59	21	30	15	10	22	29
60-69	57	15	10	10	6	0
70 and above	14	7	2	0	3	0

Source: computed from survey data 2013

As showed in Figure 6 above, the study indicates that majority of households own land between 1-2 acres (40%) while only 10% own land less than 1 acre. On the other hand, about 5% of the sampled households own more than 5 acres. This indicates that majority of sugarcane farmers in the study area are land constrained and technology adoption could be key in realization of growth in an already resource constrained enterprise.

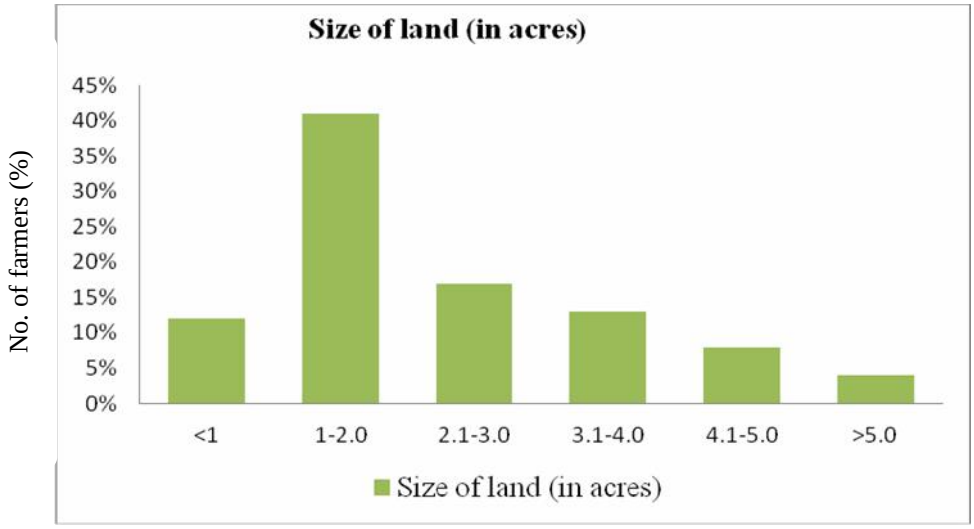

Figure 6: Land ownership
Source: computed from survey data 2013

4.3 Frequency of use of ICT tools

From Table 4, it is shown that Awendo district registered a higher percentage in use of ICT (71%) as compared to Uriri district (55%). This is the case because farmers in Awendo has a higher proximity to a town centre compared to farmers in Uriri district. In addition, the study showed that more males (76%) use ICT tools compared to female respondents (49%). These findings are in agreement with Nyamba and Mlozi (2012) who found out that age, sex, marital status and income influenced the use of ICT tools in communicating agricultural information. Samuel *et al*.(2005) found a positive correlation between mobile phones ownership and access to electricity while Aminuzzaman *et al*. (2003) argued that, though use of ICT tools have positive effect on livelihoods, lack of electric power and high costs were hindering factors. This compares with the findings and suggests that, sugarcane farmers in Awendo district have access to electricity as compared to those in Uriri District which is mostly a rural setting.

Table 4: Frequency of regional and gender use of ICT tools

District	Yes (%)	No(%)	Total(%)
1. Awendo	71	29	100
2. Uriri	55	45	100
Gender			
1. Male	76	24	100
2. Female	49	51	100

Source: computed from survey data 2013

Figure 7 shows type of information the farmers required. About 35% of the farmers were interested in getting information on sugarcane prices while 30% wanted to know about agronomic package for cane production. Very few farmers (5%) were keen on the information about sugarcane harvesting. This implies that farmers are more concerned with information about pricing of sugarcane due to perception of exploitation by millers during computation of cost recovery as a result of inputs provided on credit under contractual arrangements. Pricing being a marketing issues is a key determinant of income of the farmers hence level of profitability of the sugar cane production as an economic enterprise. Sugar cane being a specific crop with no alternative market apart from the sugar factories is also prone to price fixing unless the government intervenes by declaring set prices every year.

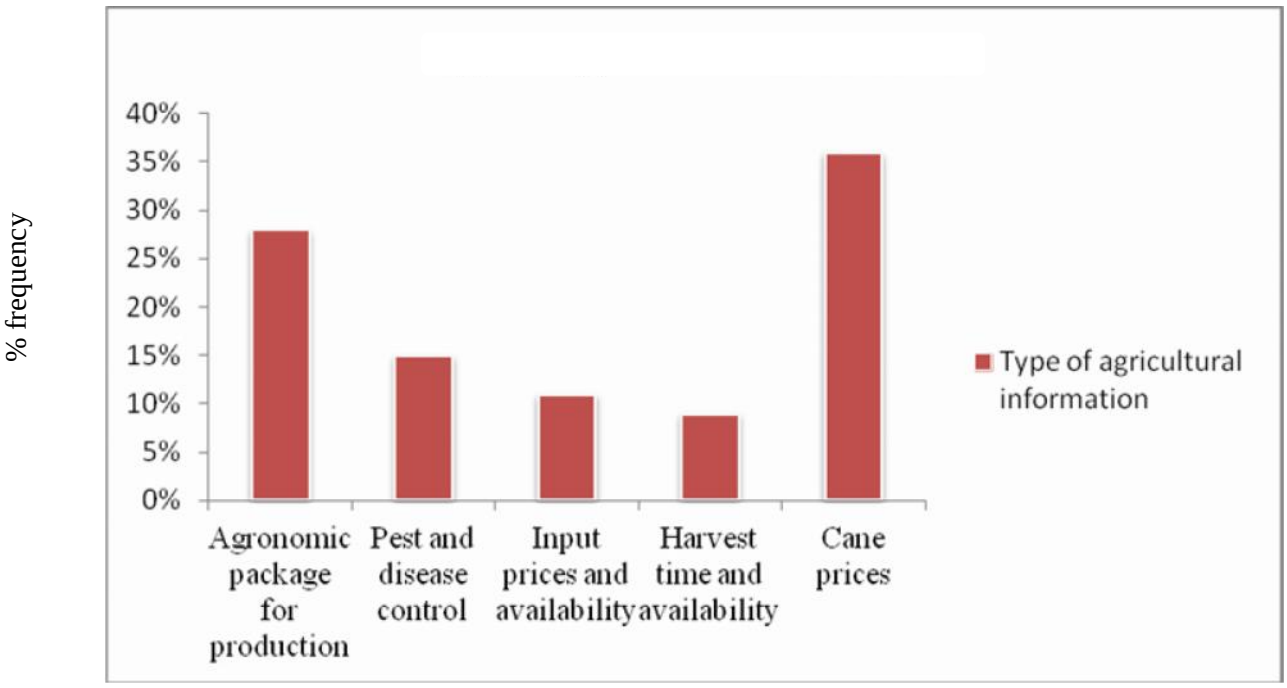

Figure 7: Type of agricultural information required
Source: computed from survey data

4.4Digital tools used for information dissemination

Table 6 shows ICT tools used by sugarcane farmers in Migori County. The study revealed that mobile phones are the most popular ICT tool of communication among small scale sugar cane farmers. Benin Adegbidi et al (2012) found out that 41% of the households interviewed used mobile phones as their preferred ICT tool while 90.4% got their information from radio programmes, these tools significantly contributed to the digital divide p>(0.000) . In addition they reported that majority of the respondents believed that information communincated through mobile phones is timely and reliable as compared to other channels of information including radio programmes, video and internet. In addition, they argued that use of mobile calls in farming activities was positively influenced by land owned and cultivated and whether the farmer was owner of the mobile phone. Participation in ICT based projects and education

level influence use of mobile phones. Participation in ICT-based project is important in enhancement of skills in mobile phone use for farming activities. Other important ICT tools included internet, television and radio.

Table 6: ICT tools used by farmers in Migori County

ICT tools	Frequency	Percent (%)
Internet	14	7 %
Mobile phones	55	26 %
Television programmes	12	6 %
Radio	21	10 %
Internet and mobile phones	25	12 %
Total		60 %

Source: computed from survey data 2013

4.5The extent of ICT tools usage for information accessibility among sugarcane farmers.

Figure 8 indicates that most (60%) sugarcane farmers in Migori use ICT tools.The use of ICT tools in transaction process can help farmers improve their skills in marketing process.This, according toKwadwo and Daniel (2012),would help improve agricultural productivity, practices, and farmer livelihoods.

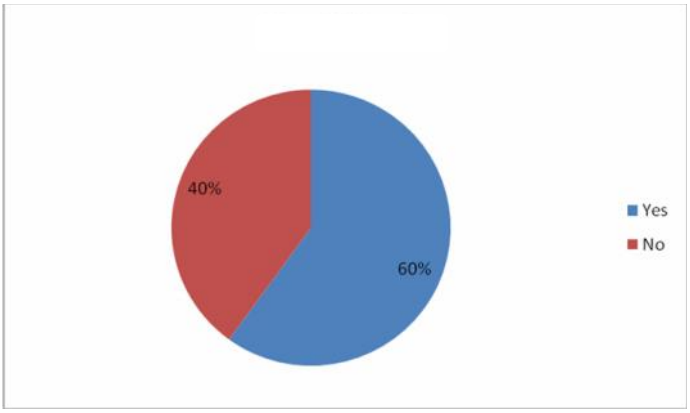

Figure 8: ICT usage in Migori County

Source: computed from survey data 2013

Younger farmers between age 18 and 59 used ICT tools more than the old farmers of 60 years and above as shown in Table 7.The study postulates that younger people are better able to assess the features of modern technology than older ones. However, it could also be that the younger people have attended computer literacy class than older people who have a lesser likelihood of adopting new technologies.

Table 7: Age and usage of ICT tools

Age of respondent (in years)	Use of ICT tools to acquire agriculture information (%)	
	Yes	No
18-29	21	12
30-39	28	29
40-49	20	21
50-59	19	18
60-69	11	15
>70	2	5

Source: computed from survey data 2013

Figure 9 shows that farmers who had sugarcane farming experience of between 3 years to 5 years reported to have used ICT tools to acquire information more than other farmers. This is in line with Adekoya (2006) who reported that the farming experience and mobile phones were determinants in ICT use. It is expected that farming experience conferred to a farmer some skills in farming.

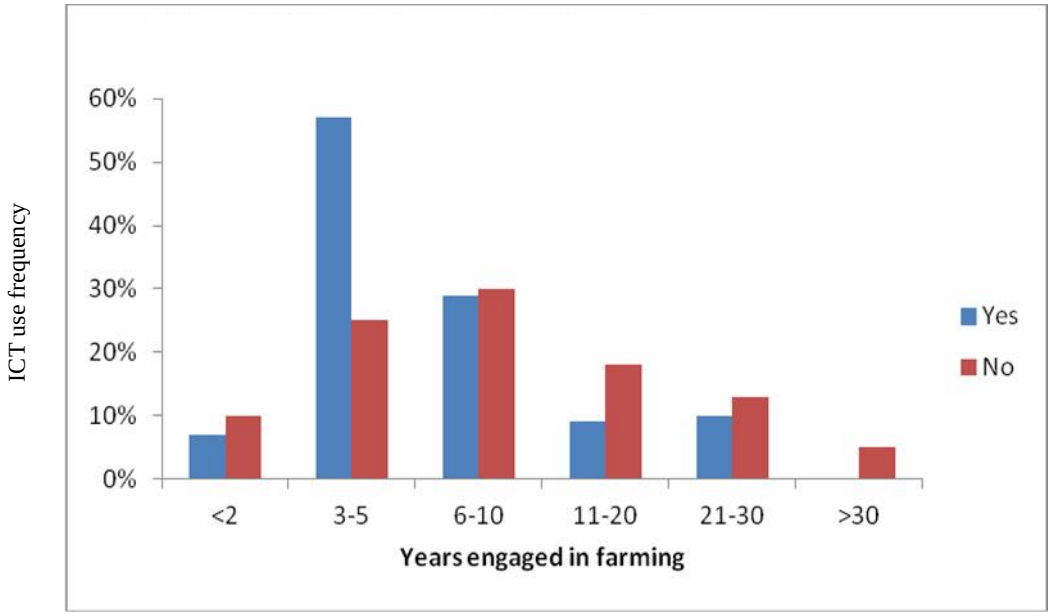

Figure 9: Experience and ICT tools used.

Source: Computed from survey data 2013

Figure 10 indicates that households where the size was between 1 person and 5 people used more ICT tools to acquire information on agriculture. This is in line with Anselme*et al* (2012) who found out that the households with large size certainly had other off farm activities. The information acquired and share among farmers were found to be significant factors p>(0.000) that determine the digital divide.

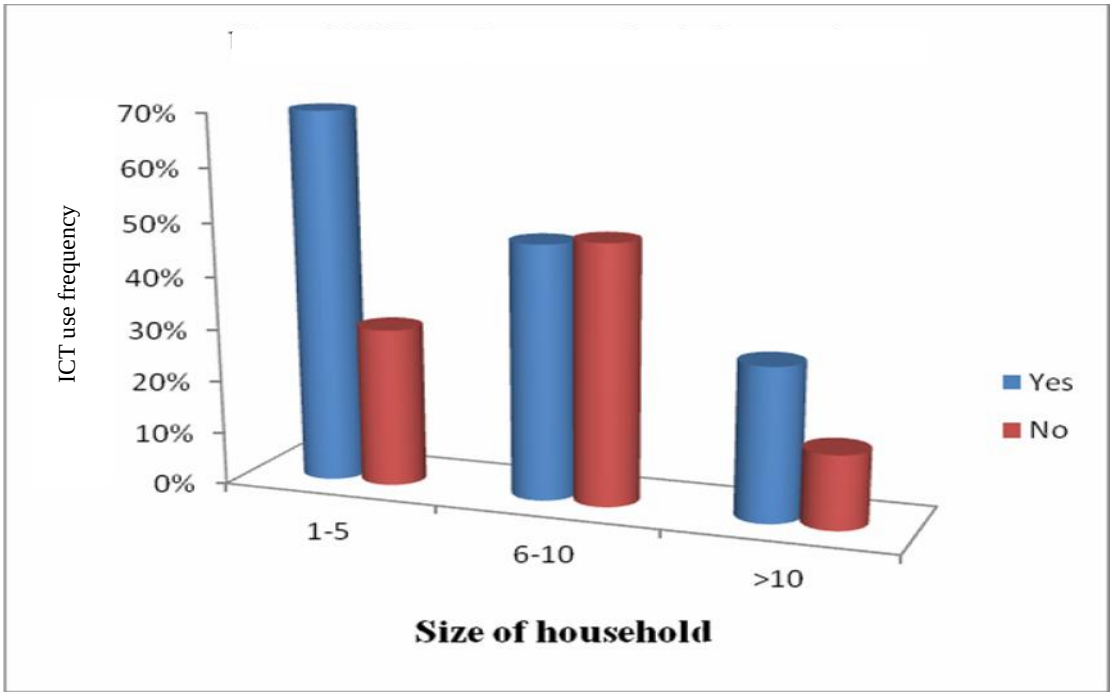

Figure 10: size of household and ICT tools used

Source: computed from survey data 2013

Anselme*et al* (2012) argued that comparative advantage was in play whenever the costs of buying ICT tools and getting information from the media were to be considered, this is in agreement with what was found when farmers were asked to give reasons as to why they do not use ICT tools to acquire information on agriculture where some believed that it was expensive and could not afford while others indicated that it was due to low level of education as shown in Table 8.

Table 8: Reasons for not using ICT tools

Reasons for not using ICT tools	Frequency	Percent (%)
Low education level	40	18.9
Affordability	29	13.7
Accessibility	14	6.6
Low education level and affordability	5	2.4
Affordability and age	1	0.5

Source: computed from survey data2013

As indicated in Table 9, different events attended by farmers and channels used to get information about the events attended were a combination of radio, extension agents and fellow farmers. This is in agreement withAnselme*et al* (2012) who found out that the proportion of farmers using ICT tools in their farming activities (69%) was greater than those of farmer members of ICT project. The four main common types of media used for farming purposes were radio programmes, mobile call-up, mobile SMS and television.

Table 9 : Channels used to get information about the events attended

	Channel (% use)						
Events attended	Radio	TVs	Internet/ cyber cafes	Extension agents	Fellow farmers	Radio, Extension agents and fellow farmers	Radio and TV
workshop	4	5	2	19	2	63	0
Field days	11	4	3	42	13	86	0
Agricultural show	17	6	3	15	3	85	1
Chief's baraza	9	3	0	29	14	66	0

Source: computed from survey data 2013

Gakuru et al, (2009) believed that sharing of information with outsiders implies that given many rural households simply cannot afford modern ICTs, shared access could be a cost-effective means of providing rural connectivity and perhaps partly a solution to the digital divide. In fact, this was evidenced in this study where farmers (61%) indicated the sharing of agricultural information with other farmers from outside the district as shown in Figure 14.

4.6Effects of the factors that determine digital divide among sugar cane farmers.

The results in Annex 2provide outcome of logistic regression using Equation 5 above and summarized in Table 10 below.

Table 10: Factors that determine digital divide

Factors	Coefficients	Z Value
Gender	0.7784804	1.81
Age	- 0.0185074	-1.18
Land	- 0.0997825	-0.52
Education	0.020503	0.05
Farming Experience	-0.071972	-2.40
Forums	0.1815233	0.40
Sharing of information	1.897364	4.40
Keeping information (storage)	1.680954	3.00

From the table 10 above, the results of the estimated model can be represented as;

Y_i = -1.613+0.778GEN-0.018AGE-0.997LAND+0.0205EDUC -

0.0719EXP+0.182FORUM+1.897SHARE+1.68 KEEP

Where:-

GEN- Gender (male or female)

AGE- Age of the farmer (in years)

LAND- Land Size in acres

EDUC- Formal education (in years)

EXP- Farming Experience (in years)

FORUM- Farmers group membership

SHARE- Information Sharing

KEEP- Keeping of information (storage of information).

The results show that the model was appropriately formulated as shown by the Goodness of fit represented by the Chi-square at 69.34%. The Pseudo R^2 value of 0.2848 lies between 0.2 and 0.4 which further confirm the suitability of the model. The significance of specific explanatory(independent)variables in the model are evaluated using the z- statistic values at 95% confidence level. The corresponding z-value for this is 1.96. In this regard, key determinants of digital divide among sugarcane farmers in Migori County are farming experience in years, sharing of information by the farmers, and keeping or storage of information by the sugar cane farmers.

Although farming experience in years is a key determinant of digital divide, it has a negative value (-0.0719). This implies negative relationship between use of ICT and the farming experience of sugar cane farmers.Since farming experience is closely associated with age of the farmer, it implies that more experienced farmers are less likely to access information and communication technologies compared to the new farmers. This means that risk aversion factor increases with increase in experience in sugarcane production. They are therefore likely to be more skeptical of the new information and are thus resistant to change hence late adopters or laggards.

On the other hand, sharing of information and storage of information by sugar cane farmers have a positive values (+1.897) and (+1.68) respectively. This implies that, sharing and keeping of information would reduce the digital divide among farmers. According to World Bank (2011), sharing of information has improved the use of ICT in agriculture and therefore, sharing knowledge and exchanging information have also created opportunities in agriculture.

These results were in agreement with (Jensen, 2007; Aker, 2008, De Silva, 2010) where they emphasized the use of ICT tools in many developing countries. Okello (2011) found out that lack of agricultural market information focused on the use of ICT-based tools, spurred by the rapid spread of some of these tools (especially the mobile phone) in developing countries. While it is expected that both men and women contribute to farming, they do so in different ways as a result of differences in their access to productive resources (World Bank, 2011). Results indicated a significant difference in gender towards ICT use and these findings are supported by Bimber (2000), who found out that women are substantially less likely to be frequent users of ICT.

On the other hand, gender, age of the farmer, land size, formal education in years and the farmers forum are less significant determinants of access to information and communication technologies among sugarcane farmers in Migori County.

Further Analysis of the results show that the coefficients of age, and land size have negative values (-0.018) and (-0.997) respectively. This implies that an increase in any of these variables impede accessibility to information and communication technologies by the farmers. On the other hand, the coefficients of gender, formal education in years, membership to farmer groups have positive values (+0.778), (+0.0205) and (+0.0182) respectively. This implies that access to information and communication technologies increase with increase in years of formal education, participation of farmers in the various for a by the sugar cane farmers. Along the same lines male sugar cane farmers have higher access to information and communication technologies compared to female farmers as shown by the coefficient of gender.

CHAPTER 5: CONCLUSIONS AND RECOMMENDATIONS

5.1 Conclusions

The study concludes that digital divide exists among sugarcane farmers in Migori Countythus affects accessibility of agricultural information. The divide can be bridged through adequate development, availability and use of ICT tools. Adequate use of ICT can make a significant contribution in increasing the efficiency, productivity and sustainability of small scale sugarcane farmers in Migori County. The specific digital tools used by sugar cane farmers in Migori County include Internet, mobile phones, Television Programmes, Radio and a combination of mobile phones and internet. The sugar cane farmers expressed their preference for use of these tools. In this regard, over a quarter of farmers interviewed (26%) use mobile phones for accessing information. This is followed by combination of mobile phones and internet at 12%, radio at 10%, internet through computers at 7% and lastly Television programmes and adverts at 6%.

The specific factors that contribute to digital divide among sugar cane farmers in Migori county are gender, age, land size, years of education, farming experience in years, farmer group membership, sharing of information by farmers, and storage of information by the farmers. The key determinants of digital divide by sugar cane farmers in Migori county are Farming experience in years, Sharing of information and storage of information by the farmers. However, age of the farmer, land size and farming experience in years have a tendency of enhancing the digital divide due to their negative relationship with the use of ICT tools. On the other hand gender, years of education, farmer group membership, sharing of information and storage of information by the farmers have a tendency of reducing the level of digital divide among the sugar cane farmers due to their positive relationship with the use of ICT tools.

5.2 Recommendations

- There is need to establish or streamline existing institutional mechanisms that are aimed at linking rural communities with knowledge centres. This would not only promote information sharing by sugarcane farmers which the study shows as a key factor, but also provide more formal avenue through farmers would access stored information thereby encouraging them to store more information either in print or electronic form in their private homes.
- Both National and County Governments should enhance implementation of policy measures aimed at empowering women to address gender parity issues that would facilitate use of ICT tools by women in sugarcane production in Migori County. Affirmative action is therefore necessary among sugarcane farmers.
- Both National and County Governments should enhance implementation of the policies that strengthen provision of continuing education to farmers on new technologies through the Agricultural Training centres and other institutions by collaborating with private sector players to enhance delivery of extension services.
- There is need to formulate policies aimed at establishing ICT infrastructure and farmers interaction to avoid rural isolation and reduce digital divide. This could include Global Positioning Systems (GPS) connected to Geographical Information Systems (GIS) made accessible to rural areas. This will help farmers in documentation, improved transparency, reduced cost and prompt communication of current situation. These could be systems that report prices and weights directly to farmers from the factory to farmers' mobile phones, alerts for new inputs among others.
- Further surveys to establish the situation in other sugarcane growing Counties in Kenya with respect to effects of digital divide on agriculture production in such areas. This would assist the Government, Government linked institutions and private sector while planning famer extension service provision in these areas.

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ANNEX 1: QUESTIONNAIRE

EFFECT OF DIGITAL DIVIDE ON AGRICULTURE INFORMATION ACCESSIBILITY AMONG SUGARCANE FARMERS IN MIGORI COUNTY

By Hamisi M. Williams (University of Nairobi)

Survey Questionnaire

A) Background Information

1. Information on respondent

Gender	**Age**	**District**	**Size of land (in acres)**	**Attained education level**	**Alternative source of income**	**Ever been formally employed**	**Years engaged in farming**
Male	18-29	Awendo	< 1	None	Self	No	<2
Female	30-39	Uriri	1 -2	Lower primary	Casual	Yes	3-5
	40-49		2.1 – 3.0	Upper Primary	Formal		6-10
	50-59		3.1 – 4.0	Secondary	None		11-20
	60-69		4.1 – 5.0	College			21-30
	70 and above		>5.0	University			>30

2. Household demographic information

Size of household	1-5	6-10	>10
Gender of household head	Male	Female	
Number of dependants	1-5	6-10	>10

B) **Agriculture information generation, acquisition and dissemination**

3. Which type of agricultural information do you consider more important in relation to sugar cane production?
   1=Agronomic package for production
   2=Pest and disease control
   3=Input prices and availability
   4=Harvest time and availability
   5=Cane prices
   6=Other (Please specify)
4. What are your main sources of agricultural information on sugar cane?
   1=Company Extension Agents
   2=Government Extension agents
   3=NGO extension agents
   4=Farmer Associations
   5=Input suppliers
   6=Neighbours
   8=Internet / Digital information
   7=Other (Please specify) _____

5. Which of the above mentioned sources in No. 4 do you use most often?
6. Do you use ICT tools to acquire agriculture information? 1=Yes 2=No
7. a) If yes for 6 above, which of the following ICT tools do you rely on as a source of agricultural information?
   1=Internet
   2= Mobile phones
   3= Television programmes
   4=Radio
   5=Other (Please specify) _____
   b) If no for No. 6 above, give reasons;
   1= Low educational level
   2= affordability
   3= age
   4 = accessibility
   5= other (specify)
8. How often do extension agents visit to disseminate information?
   1=Weekly 2=Monthly 3=Quarterly 4=Never 5=Other
9. Please rank the following sources of agriculture information according to ease of access whenever needed, according to the scale given (1=very easy, 2=moderately easy, 3=not easy, 4=impossible, 5 – not aware)

Source of knowledge	**1**	**2**	**3**	**4**	**5**
Company Extension agents					
Outgrower services					
Government extension agents					
NGO extension agents					
Farmer Associations					
Input suppliers					
Radio programmes					
Television programmes					
Mobile phone services					
Internet					
Other (please specify)					

10. Give reason for your answer in 9 above, as per the scale given (1=readily available, 2=proximity of offices, 3=long distance, 4=use of mobile phones, 5=don't know where to get them, 6=don't know about them, 7=other (please specify)

Source of knowledge	1	2	3	4	5	6	7
Government extension agents							
NGO extension agents							
Farmer Associations							
Input suppliers							
Radio programmes							
Television programmes							
Mobile phone services							

Internet							
Other (please specify)							

C) **Information sharing and dissemination**

11. Do you have a forum where you meet as farmers on your own to share agricultural information? 1=Yes 2=No
12. If yes for 11 above, how often do you meet? 1=Daily 2=Weekly 3=Monthly 4=other (please specify) _____
13. Which methods do you use to share agricultural information with others:
    1=Face to face interaction
    2=Use of mobile phones
    3=Use of internet
    4=other (please specify) _____
14. How do you meet with the extension agents?
    1=they come to our farms
    2=I go to their offices
    3=Sometimes we go to their offices; sometimes they come to our farms
    4=I use a telephone to call them
    5=I send them emails
    6= I access thier information from the internet / company website
    6=other (please specify) _____
15. Do you share agricultural information with other farmers from outside the district?
    1=Yes 2=No
16. If yes for 15 which channels do you use to communicate?
    1=Face to face interaction
    2=Internet
    3=Mobile phones
    4=other (please specify) _____
17. Please indicate whether you attend the events listed below (indicate with a tick).

Event	1=yes	2=no
Workshops		
Field days		
Agricultural shows		
Chief's baraza		

18. Please tick the channels you use to get information about the events listed in 18 above
    1=Radio
    2=TVs
    3=Internet / cuber cafes
    4=Extension agents
    5=Fellow farmers
    6=Family relations
    7=other (please specify) _____
19. If you ticked no for any even in question 17 above, please indicate why you do not attend such events.
    1=Lack of information about it
    2=Distance
    3=Lack of funds/resources to attend
    4=Lack of interest

5= Stringent rules
5=other (please specify) _____

D) **Information Storage and Retrieval**

20. Do you find it necessary to keep the agriculture information acquired in a physical form?
    1=Yes 2=No
21. The information you acquired is stored in which form?
    1=a paper file
    2=a computer
    3=a compact disc
    4= Website
    4=other (please specify) _____
22. How often do you refer to the information acquired previously?
    1=Weekly 2=Monthly 3=Never 4=When needed 5=other
23. Please indicate how easy it is to retrieve information stored in the following forms, according to scale given in the table below (1=very easy, 2=moderately easy, 3=not easy, 4=impossible)

Form of Storage	Ease of retrieval			
	1	2	3	4
Paper file				
Computer				
Website				
Compact disc				
Other (specify)				

ANNEX 2: FACTORS DETERMINING DIGITAL DIVIDE

Table 11: Logistic regression

```
                                                  Number of obs   =        183
                                                  LR chi2(8)      =      69.34
                                                  Prob > chi2     =     0.0000
Log likelihood = -87.078371                       Pseudo R2       =     0.2848

------------------------------------------------------------------------------
         ict |      Coef.   Std. Err.      z    P>|z|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
      gender |   .7784804   .4293001     1.81   0.070    -.0629323    1.619893
         age |  -.0185074   .0157068    -1.18   0.239    -.0492922    .0122774
        land |  -.0997825   .1933379    -0.52   0.606    -.4787178    .2791528
   education |    .020503   .3937697     0.05   0.958    -.7512714    .7922774
  experience |   -.071972   .0300031    -2.40   0.016    -.1307769    -.013167
       forum |   .1815233   .4574622     0.40   0.692    -.7150861    1.078133
   shareinfo |   1.897364    .431572     4.40   0.000     1.051499     2.74323
    keepinfo |   1.680954   .5612347     3.00   0.003     .5809544    2.780954
        cons |  -1.613243   1.022695    -1.58   0.115    -3.617688    .3912018
------------------------------------------------------------------------------
```

Source: computed from survey data 2013