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ASSESSMENT OF WOMEN SMALLHOLDER SORGHUM FARMERS ACCESS TO
AGRICULTURAL INFORMATION IN MWINGI CENTRAL DISTRICT, KITUI COUNTY, KENYA

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DECLARATION

I, Patrick Mutugi.K. Kirimi declare that this dissertation is my original work and has not been presented for a degree in any other University.

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DEDICATION

This work is dedicated to my wife Angelicah Wambui, children Michael Mugambi and Frank Munene, for their encouragement and support and to my parents for their parental guidance that moulded me to whom I am today.

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ABSTRACT

Agricultural information is key to improving agricultural production in any country. Information is available in agricultural research institutions and Universities but there is lack of access to such information especially by the smallholder farmers who are usually constrained by resources.

The study investigated the access of information by women, smallholder farmers who are more involved in agricultural production and more disadvantaged in accessing agricultural information.

The study was conducted in Mwingi Central District of Kenya, which is a food insecure district that experiences recurring food shortages.

The study investigated the agricultural information dissemination channels available to women farmers, the ICT sources of agricultural information accessible to them and the influence of social economic characteristics on the use of ICTs.

A survey was done using a sample of 96 households randomly selected from among the households growing sorghum.

The study identified the channels of communication available to most farmers to be meetings/barazas, the radio, the cello-phone and trainings/workshops. The ICT sources of agricultural information identified were the radio, TV, databases and CDs/DVDs/tapes.

A chi-square test showed that age, education level and income have an influence on access and use of ICTs by women farmers.

A binary logistic regression analysis showed that it is only the level of education that was significant in predicting the likelihood of use of ICTs among the sampled women farmers.

The study recommends that training on ICTs be mainstreamed into the education system in the country starting from the primary level. Moreover, the use of the radio and the mobile phone should be enhanced since they are the ICTs available to most of the smallholder women farmers. This is in addition to promoting the non-ICTs channels such as agricultural publications and CDs/DVDs whose usage to access agricultural information is low.

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ABBREVIATION AND ACRONYMS

AFRRI	Africa Farm Radio Research Initiative
ATCs	Agriculture Training Centres
CI	Confidence Interval
EABL	East African Breweries Limited
FAO	Food and Agriculture Organisation of the United Nations
FFS	Farmers Field Schools
HH	Household
GoK	Government of Kenya
ICT	Information and communication Technologies
IK	Indigenous Knowledge
KARI	Kenya Agricultural Research institute
KACE	Kenya Agricultural Commodity Exchange
KEPHIS	Kenya Plant Health Inspectorate Services
KSh	Kenya shilling (one US dollar was equivalent to Ksh.84 by the time of the study)
MOA	Ministry of Agriculture
MDG	Millennium Development Goal
OISAT	Online information service on non-chemical pest control in the tropics

CHAPTER ONE

INTRODUCTION

1.1 Background information

The agricultural sector is the backbone of many economies in the developing countries.

In Kenya, the sector contributes about 27% of the GDP through manufacturing, distribution and service related activities. The sector also contributes 57% of the country's total export earnings and with over 80% of Kenya's workforce being employed in the sector (Ministry of Agriculture, 2011).

Kenya's vision 2030 strategy also identifies agriculture as one of the six key economic sectors expected to drive the country's economy to a projected annual economic growth rate of 10% over the next two decades through promotion of innovative, commercially oriented and modern agriculture (Ministry of Agriculture, 2009).

Agricultural information is key to improving agricultural production in any country. Farmers need access to agricultural information if their efforts to improve agricultural production are to be realised (Adom et al., 2003). Information for agricultural and rural communities is a crucial tool in the battle to achieve food security and fight against poverty. Information helps to open up and provide opportunities for the poor to shape up their lives and reduce vulnerability (Ballantyne, 2005).

An improved information and knowledge flow to, from and within the agricultural sector is a key component in improving small-scale agricultural production and linking increased production to remunerative markets (Lwoga et al., 2011). Knowledge and information are basic ingredients to food security. Rural communities require information inter alia on supply of farm inputs, new technologies, early warning systems, credit and market prices. The success of the Green Revolution in Asia and the Near East indicate that giving communities access to knowledge, information and technology can contribute to expanding and energizing agriculture (Munyua, 2000).

It is estimated that 80% of Kenyans live in the rural areas where the main economic activity is agriculture. It is also estimated that over 85% of farmers in Kenya are smallholder farmers who

contribute significantly to the agricultural output (Republic of Kenya, 2006). Kenya's vision 2030 stipulates the need to transform smallholder agriculture from subsistence to an innovative, commercially oriented sector. Key to this transformation is the availability of agriculture information in the areas of crop and livestock production, access to market information and value addition to agricultural products so as to reach the regional and international markets (Republic of Kenya, 2010).

Kenya and Africa in general have many of institutions undertaking research in agriculture including the Universities. These have a huge body of Agricultural information and technologies, which when put into practice, can lead to significant increase in productivity.

However, credible as this information may be, only a small proportion of the smallholder farmers adopt the available technologies (Kayoda, 2002). Indeed, only a small amount of agricultural information is accessible to rural farmers despite the large body of knowledge that exists in Research Institutions, Universities, Public Offices and Libraries (Lwoga, et al., 2011). This has spurred the introduction of various approaches to agricultural extension and dissemination of agricultural information to smallholder farmers, notable among them is the Training & Visit promoted by the World Bank from 1975 to 1998 in Africa and Asia. But the approach did not achieve much due to the cost of reaching large, geographically dispersed, remote smallholder farmers and the high illiteracy levels and limited access to mass media (Anderson et al., 2006). Information is a necessary component of agricultural extension and extension organizations employ agents that hasten communication of information needs of farmers. The information needs have been delivered through various media such as television, radio, newspaper, pamphlet but incorporation of computers and other electronic equipments can improve the efficiency of communicating agricultural information (Adesope et al., 2006). The advancement in the information and communication technologies (ICTs) provides an opportunity for developing countries to harness and utilize information and knowledge to improve productivity (Lwoga et al., 2011).

There is growing recognition both internationally and locally that gender considerations is important for economic growth and essential for poverty reduction. The UN decade for the advancement of women,

proclaimed in 1975, set in motion a process that led to increased awareness of women's contribution not only to sustenance but also to the development process.

The agricultural sector is becoming more technologically sophisticated, commercial oriented and globally integrated (Republic of Kenya, 2010). This poses challenges and presents opportunities for all agricultural producers but women face additional legal and social barriers that limit their ability to adopt and benefit from such changes. Majority have no control to productive assets and specifically, women in rural economies have no access and control to land .This limits their access to financial assets including credit and savings (FAO, 2009). Women also lack access to social networks and association and this limits their participation in the decision making processes. Furthermore, women are disadvantaged in terms of access to education where only 66% of women can read and write compared to 73% of the male counters in the developing countries and 99% in the developed countries.

Women make essential contributions to agriculture and rural economic development activities in all the developing countries. Their roles vary from region to region but they are basically involved in managing complex and multi-strategy rural livelihoods that include producing crops, tending animals, processing, preparing food, collecting water and marketing. In Kenya, it is estimated that women perform 70% of food production work, 80% of hoeing and weeding and 80% of food storage (Ministry of Agriculture, 2009).

However, women farmers are also involved in reproductive activities and other household chores and may not have time to attend to agricultural extension services especially when they are at conflict with these other household activities. Indeed, the agricultural sector in many developing countries is underperforming in part, because of women, who represent a crucial resource in agriculture through their role as farmers, labourers and entrepreneurs, almost everywhere face more challenges than men in access to information (FAO, 2011).

In order to maximize agricultural production, it becomes important to equip smallholder women farmers with the necessary information and skills. It is critical to consider the gender aspects in disseminating

agricultural information since different interventions affect women and men differently (Republic of Kenya, 2008).

Identifying the information delivery channels available to smallholder women farmers and the ICT sources from which they get the information therefore becomes crucial. Understanding the channels through which the information can be delivered is important as it could help the extension service providers develop more relevant information delivery plans. These include the use of mobile phones which had overtaken the use landline in communication by the year 2002; indeed, mobile telephony has increased communication in trade, health and agriculture and the personalized traits of mobile phone are changing social interactions. Contributions from China, India and Armenia illustrate how information and knowledge is being brought to rural areas using the radio, television and the internet and the main challenge is to support the local efforts to ensure the local information and communication capacities are built and strengthened. Indeed, in China, the use of ICTs has increased tremendously with the number of internet users having reached 100 million and the number of mobile phone users having reached 130 million by end of 2004. Efforts have also been made to deliver information through multiple media including printed, digital and audio-visual including DVD/VCD players (Ballantyne, 2005).

1.2 Problem Statement

Information plays a critical role in the factors of production like land, labour and capital and can have a huge multiplier effect on the efficiency and effectiveness with which other resources are utilized. Information is a resource that must be acquired and used to make informed decisions (Sumberg, 2004). Those who possess appropriate and timely information make informed and rational decisions than those without (Adesope et al., 2007). Aina et al. (1995) observed that agricultural information is available but lack of access to such information is the problem.

One way of addressing the dissemination of Agricultural information is the provision of Agricultural Extension Services to farmers. However, Agricultural Extension Services in the country face the challenge of inadequate extension staff. Indeed, the staff to farmer ratio currently stands at 1:949 (G.O.K, 2011) against the international recommendation of 1:400.

The agricultural extension system has been in place but farmers have not been receiving adequate agricultural information. It is critical to provide relevant and timely information to farmers particularly women farmers who are key players in agricultural production.

Lack of relevant agricultural information to women farmers due to poor communication channels and limited use of ICTs is a big hindrance to agricultural productivity in Mwingi Central district.

The use of ICTs in the dissemination of agricultural information is low compared to the other sectors of the economy. With the advent of ICTs, there is great opportunity to harness and utilize information to improve agricultural productivity (Lwoga et al., 2011). Computers, internet, portable digital cameras and recorders make it possible for multiple sources of information to cater for distinct type of listeners, viewers and readers (Melkote, 2002)

The study therefore sought to identify the relevant information communication channels that can be used to more effectively disseminate agricultural information so as to improve agricultural production, reduce poverty and increase food at the household level since the district experiences recurring food shortages. It also sought to identify the ICT sources of agricultural information available to women farmers and

whose use can address the information gap brought about by inadequate extension delivery system. The social-economic factors and their influence on the use of ICTs were also be analysed.

1.3 Objectives of the study

The purpose of the study was to assess how smallholder women farmers in Mwingi Central district access the agricultural information they need in their crop management. The respondents for the study were women farmers involved in sorghum production.

1.3.1 Specific objectives:

- (i) To identify the types of agricultural information channels available to small holder women sorghum farmers in the study area.
- (ii) To determine the main ICT sources of agricultural information accessible by smallholder women sorghum farmers in the study area.
- (iii) To examine the extent of access and use of ICTs by smallholder women sorghum farmers.
- (iv) To examine the influence of selected socio-economic characteristics of smallholder women sorghum farmers on use of ICTs.

1.3.2 Research Questions

The study sought to assess how small holder women farmers in Mwingi Central district access the agricultural information they need by answering the following questions:

- (a) What types of information channels are available to the smallholder women sorghum in farmers in the study area?
- (b) From what ICT sources do smallholder women sorghum farmers obtain the agricultural information they need?
- (c) What is the extent of access and use of various ICTs by smallholder women sorghum farmers?
- (d) How do social-economic characteristics of smallholder women farmers affect their use of ICTs?

1.4 Justification of the study

The study was of great importance to small scale farming amongst women in Kenya in general and in Mwingi Central district in particular.

Women play a critical role in agricultural production in the country. However, they are disadvantaged in relation to access to agricultural information due historical and social cultural settings. The findings of the study will help agricultural experts (especially extension officers) to identify and understand the channels of communication available to smallholder women farmers. This is important in determining the choice of channels to use in disseminating agricultural information to women farmers. The results of the study will also determine the most useful channels of communication to women farmers. This will enable good flow of information that is critical in making production decisions by the women farmers.

Choice of production technologies that will be disseminated through the right channels is very important in improving agricultural productivity and output.

Mwingi District is basically a food insecure district that experiences recurring food shortages. Improved access to information is important in addressing the problem in the district. The study will assist in identifying ways to improve the access to agricultural information, particularly through the use of ICTs. This will go a long way in addressing food insecurity, which is a major development challenge in the country and more so in the study area. The findings will also be useful as a reference in other studies aimed at addressing food insecurity in Mwingi District where a number of NGOs are involved in food security improvement initiatives.

Sorghum is an important crop in the district. It serves as a subsistence crop to many households and hence an important food security crop. In the recent past, the crop is being promoted as a cash crop by KARI in collaboration with East African breweries (EABL). This is very significant since EABL has in the recent past embraced the use of sorghum in malting. Therefore, income levels of farmers will be improved with increased sorghum production. The crop can be a high income earner to farmers due to the rise in its demand and this will go a long way in improving the livelihood of the smallholder farmers.

Though some studies have been conducted on access to agricultural information, none focussed on the gender factor in crop farmers' access to agricultural information in the rural areas of the nation. It is essential to understand the main ICT sources from which women farmers derive their information needs and the channels of communication available to them. The women farmers' perception on the usefulness of the different types of channels used to disseminate the information is also important to consider as this will give an indication of the preferred channels.

1.5 Limitations of the study.

Due to financial constraint, the study used only a sample of 96 women farmers.

Again, the yield estimate was based on the October 2011- February 2012 season and not the March-April season which was the prevailing season by the time of the study and the respondents may not have recalled the sorghum yields very accurately.

The study was carried out in Mwingi Central District which is only one among the sorghum growing districts of Kenya and no comparative study was done in another district.

Thus the findings of this study should be interpreted with these constraints in mind.

1.6 Organization of the dissertation

This dissertation report is organized into **five** Chapters.

Chapter 1 covers the background and introduction to the study. It also gives the problem statement and summarizes the objectives of the study and the research questions addressed by the study.

Chapter 2 reviews the different literatures related to the access of agricultural information. This review is done with a focus on the objectives the study was investigating. The review is aligned to match the objectives.

Chapter 3 outlines the research methodology used in conducting this study. It looks at the theoretical background of the study and the conceptual framework and how they relate to the study. It also provides an overview of the research design process, target population, sampling design, data collection, data analysis and presentation.

Chapter 4 presents the findings of the study, analyses these findings and discusses them in relation to the literature reviewed in chapter two. The chapter is organized according to the objectives of the study. The presentation of the findings begins with the presentation of the general findings and background information before analysis per objective.

Chapter 5 presents the summary of the findings of the study and from these findings, conclusions and recommendations are drawn in that order. The chapter also proposes areas for further study.

1.7 Operational Descriptions

Agricultural information

'Information' is an idea conveyed for a useful purpose. It may be facts, data or knowledge revealed through a written or a spoken statement. It is an essential commodity that is indispensable to people who want to grow intellectually (Iriwieri, 2007).

Agriculture information refers to any information that can be used can be used to improve both crop and livestock production such as production techniques, farm management, marketing and processing.

Agricultural information can be defined as general information when it is designed to improve existing production practices, farm management, marketing and processing activities by means of traditional extension approaches. It can also be defined as specialised information if it is situation-specific such as the result of a soil test or the identification of a new market (Zezza, 2002).

Baraza- This is a Kiswahili word meaning a public space or gathering of people for the purpose of a meeting. The meetings may be a simple, informal gathering of people or a formal public or communal gathering.

Communication channel

An electrical transmission path between two or more stations. Channels may be furnished by wire, radio, fiber or a combination of all three (World bank ICT glossary guide). However, for the purposes of this study, it includes even non electrical means of information dissemination including inter-personal communication.

ICTs- The term Information and Communication Technologies (ICTs) is used to refer to hardware, software, networks and media for collection, storage, processing, transmission and presentation of information in the formats of voice, data, text and images (World Bank ICT glossary guide). Thus, the nature of ICTs is diverse, ranging from telephones, radios and TVs to more complex technologies such as Internet technologies, mobile telephony, computers and databases. With this diversity, it means that

they can be used by people with varying degrees of skills, although the current trends towards sophisticated applications are more and more demanding on the end user.

HouseHold(HH) refers to a person or group of related persons who live together in the same dwelling unit(s), who acknowledge one adult male or female as the head of household and who share the same housekeeping arrangement and are considered as one unit.

Merry go rounds- are an innovative arrangement between farmers' group members who come together for strength. The members contribute money regularly to build a reservoir of funds for investment (a revolving bank) and the money is loaned to members on a rotating basis. The merry go rounds have provided easy access to credit.

Smallholder

Smallholder is a relative term used to mean a small scale farmer who is rural based. They mainly produce for subsistence. They constitute 85% of Kenya's rural population and contribute 90% of the country's total agricultural output. They operate on holdings less than 11 acres (Shibanda et al, 2002)

CHAPTER TWO

LITERATURE REVIEW

2.1 Introduction

The agricultural sector is the backbone of many economies in the developing countries.

In Kenya, 80% of the population live in the rural areas and derive their livelihood from agriculture. The sector therefore is critical in employment and wealth creation, contributing 24% of the GDP and 65% of the total export earnings (Republic of Kenya, 2008).

Women play a critical role in agricultural production. It is estimated that they provide 60-80% of the agricultural labour force in most developing countries (FAO, 2011). Kenyan women play a key role in agricultural production as they do over 70% of agricultural activities.

Key to improving agricultural productivity is information. There is indeed a general consensus among agricultural experts that information plays a critical role in improving the agricultural productivity of any nation. For this reason, farmers need to have access to agricultural information if their efforts are to succeed (Adomi et al., 2003).

Different extension providers use different methods and channels to reach farmers. In most cases, they tend to replicate a particular methodology/channel across different gender groups without understanding that interventions affect men and women differently (GOK, 2010). For instance having an agricultural radio programme when women are involved in other household responsibilities may deny them the opportunity to attend to such a programme.

2.2. The Role of Information in Agriculture.

There is a general consensus among experts in the agricultural sector that information plays an important role in improving agricultural production in any nation (Aina et al., 1995), thus farmers need to have access to agricultural information if their agricultural efforts are to succeed (Adomi et al., 2003). In Kenya 80% of the population live in the rural areas and derive their livelihoods from agriculture. The agricultural sector plays a critical role in wealth creation and employment, and accounts for 25% of

gross domestic product (Republic of Kenya, 2008). Agriculture provides raw materials to manufacturing sector and stimulates indirect growth. 85% of farmers in Kenya are small holders, who produce mainly for subsistence. These farmers face many barriers to attaining full agricultural production including poor access to agricultural information (Republic of Kenya, 2006).

Information for agricultural and rural communities is therefore a crucial tool in the fight against poverty and the battle to achieve food security. Information is a powerful tool in addressing other agricultural needs and if it is used appropriately, it can radically change a nation's economy (Tshabalala, 2001). Information helps to open up and provide opportunities for poor people; it helps them to actually make use of opportunities and to shape their own lives, while also assisting them reduce their vulnerability to sickness and misfortune, (Ballantyne, 2005). Munyua (2000) regards information as the least expensive input for rural development, and it can also be viewed as a basic, necessary ingredient for bringing about social and economic change in rural areas (Morris, 2000). Rural areas in developing countries are generally perceived to be an information deserts that are becoming increasingly marginalized as the technology and information gap between rural and urban areas widens. Rural communities, where agriculture is commonly the main activity, require information on the supply of agricultural inputs (seed, fertilizer), new technologies and innovations, early warning mechanisms (for pests, drought, and disease) and credit facilities, markets, and such-like (Munyua, 2000).

Further, Adom et al. (2003) notes that agricultural information is available but there is a problem of access to such information due to inadequacy of extension staff, literacy levels of farmers and the general lack of infrastructure. Lwoga et al. (2011) also notes that only a small proportion of agricultural information is accessible to rural farmers despite the large body of knowledge that exists in Research Institutions, Universities, Public Offices and Libraries.

Shibanda et al. (2002), further highlights women as the power behind most of the farming activities but have no background or training in agriculture. Due to illiteracy and social cultural factors, women

participation in decision making process is limited or seems not to be very appropriate for increased and sustainable agricultural production.

2.3. Women and their Participation in Agriculture.

The international development community has recognised that agriculture is the engine of growth and poverty reduction in many developing countries where it is the main occupation of many. Women make essential contributions to agricultural and rural economies in all developing countries.

Rural women often manage complex households and pursue multiple livelihood strategies. Their activities typically include producing agricultural crops, tending animals, processing and preparing food, working for wages in agricultural or other rural enterprises, collecting fuel and water, engaging in trade and marketing, caring for family members and maintaining their homes (FAO, 2011). Many of these activities are not defined as “economically active employment” in national accounts but they are essential to the well-being of rural households.

It is estimated that women provide 60-80% of the agricultural labour force in many of the developing countries especially in Africa. Kenyan women play a key role in agricultural production as they do over 70% of agricultural activities.

The agricultural sector in many developing countries is underperforming in part, because of women, who represent a crucial resource in agriculture and rural economy through their role as farmers, labourers and entrepreneurs, almost everywhere face severe challenges than men in access to information (FAO, 2011). Illiteracy and other social cultural factors, limit women participation in decision making process for increased and sustainable agricultural production (Shibanda et al., 2002).

2.4 Findings of others Studies on Access to Agricultural Information

Aina, et al. (1995) observed that agricultural information is available but there is a problem in access to such information. A number of factors contribute to this such as inadequate extension staff, the literacy level of farmers and the general lack of infrastructure in rural communities in Africa, including Kenya. Though a wealth of research findings exist in the national research systems, poor information and documentation services hamper the preservation and dissemination of these research results to farmers and other end users. Only a small amount of agricultural information is accessible to rural farmers despite the large pool of knowledge that exists in Research Institutions, Universities, Public Offices and Libraries.

Thapisa (1997) in his study “A Quest for Agricultural Information Program in Southern Africa” argues that in order to develop an appropriate agricultural information program in the Southern African Development Community (SADC), there is need to establish in each SADC country an agricultural information policy, which supports both the generation of agricultural information and training of agricultural information specialists.

Adomi et al. in (2003) in their study “Gender Factor in Crop Farmers’ Access to Agricultural Information in Rural Areas of Delta State in Nigeria”, found out that farmers of both gender experienced obstacles in information use. However, the findings revealed that there were differences between male and female farmers in respect to their information needs and sources of agricultural information. Female farmers experienced greater problems in accessing agricultural information. However, major information problems suffered by farmers were not gender specific problems.

Ballantyne (2005), further notes that despite increasing urbanization, many people still live in the rural areas in developing countries and they depend on agriculture and other rural activities for their livelihoods. Information for agriculture is therefore a crucial tool in the fight against poverty and battle

to achieve food security. Information helps to open up and provide opportunities for poor people; it helps them to actually make use of opportunities and reduce their vulnerability.

Munyua and Stilwell (2009) in their study, “Agricultural Knowledge and Information Systems for smallholder farmers in Kirinyaga District”, identified key agricultural actors in the district, farmers’ information needs, how they accessed, shared and exchanged agricultural knowledge and information. They identified 100 active information and knowledge providers, with extension emerging as the most important source of information. However, linkages with various farmers and actors are weak. They also found out that agricultural knowledge and information systems for small-scale farmers are location specific and varies with enterprise produced.

Lwoga et al. (2011), noted that an improved information flow and knowledge to, from and within the agricultural sector are key components in improving small scale agricultural production and linking increased production to remunerative markets. This leads to improved rural livelihoods, improved yields, food security and national economies.

The literature review shows that there are few farm level studies that have been done regarding farmers’ access to agricultural information and especially regarding women farmers in Mwingi Central District.

2.5 The Sorghum Subsector in Kenya.

In Kenya, sorghum is mainly grown by smallholder farmers. Eastern province is the leading province in sorghum production in Kenya. The province produced 726,140 bags out of the 1,822,950 produced in the country in the year 2010. However, the yield per hectare was only 6.0 bags compared to a national average of 8.0 bags per hectare. There has been an increase in production of the crop by smallholder farmers in the recent past. This could be attributed to its promotion as a drought tolerant crop in the ASAL areas and further due to the improved prices from increased demand for malting. This saw a total of 225,782 Hectares put under the crop in 2010. Indeed, KARI in collaboration with a Kenyan leading brewer is promoting Gadam sorghum variety to supplement barley in beer production (Ministry of Agriculture, Economic review 2011).

In Kenya, sorghum varieties grow in diverse soils and varying rainfall regime and able to survive drought conditions where maize crop fail to reach physiological maturity. The crop also has limited pests and diseases and excellent storability.

2.5.1 Sorghum Production in Mwingi Central District.

Mwingi Central district is one of the districts in Eastern province where sorghum is commonly grown. The crop is grown both as a food crop and a cash crop. In the year 2011, 11600 hectare of land was put under the crop. A total of 59,200 bags of the crop were produced in the district during the year. Currently, there are approximately 2,000 households growing the crop in the district.

The average yield realised was 4 bags per hectare. The district has a high potential for increased crop production and yield per unit area. The two main sorghum varieties grown in the district are Gadam and Seredo (DAO Mwingi, 2011).

CHAPTER THREE

METHODOLOGY

3.1 Theoretical Framework

The study adopted the uses and gratification theory that stipulates that the audience is not passive. The theory was developed in the 1940's to counter the perspective that the mass media had a direct effect on the audience and the way they perceived a certain phenomenon. The theory was first developed in research on the effectiveness of radio communication. Psychologist Herta Herzog (1944) coined the term gratifications to depict the specific dimensions of usage satisfaction of radio audiences.

Following this, mass communication theorists applied the uses and gratification theory perspective in the context of various mass media such as television and electronic bulletins. The theory has been quite fruitful in understanding consumers' motivations and concerns for using various media such as radio, TV, and electronic bulletins.

The theory focuses on explaining the audience motivations and associated behaviour. Rubin in 1994, for example found that certain kinds of television programs have been shown to be related to various human needs, including information acquisition, escape, emotional release, companionship, reality exploration and value reinforcement.

The basic assumption of the uses and gratification theory is that users are actively involved in media usage and interact highly with the communication media. This is also true for agricultural extension service provision; it requires high farmer involvement in the information need identification so that the relevant and useful information is acquired by the farmer. It also becomes important to understand the sources from which farmers acquire their information in order to enrich those sources and develop appropriate policies towards various information sources. The theory is also important in improving our understanding of the farmers behaviour towards the various channels used to disseminate information and technologies to them. Farmers are increasingly looking for frequent interactions with various information sources and channels not only to carry out their farming and marketing tasks efficiently but

also to ensure delivery of safe and quality agricultural products to consumers (Adhiguru et al., 2009). This will enable the extension service providers to choose the most effective and useful channels that are preferred by farmers.

Furthermore, the uses and gratification theory explores the interpersonal aspects of communication. This is an important aspect when it comes to farmer to farmer extension service provision. A key source of information for farmers is other farmers, because it is readily available and its utilisation does not impose high transaction costs. The effectiveness of this diffusion process is of great importance since it affects the cost effectiveness and sustainability of public funded extension system. If information diffuses extensively from farmer to farmer through informal communication, then a relatively small effort, focused on a nucleus of farmers trained could achieve a large impact at a reasonable cost. It is for this reason that the Farmer Field Schools (FFS) approach is gaining prominence as a more effective approach to extend science-based knowledge and practices to farmers. The approach utilises participatory methods to help farmers develop their analytical skills, critical thinking, and creativity, and help them learn to make better decisions (Feder, et al 2004).

3.2 Conceptual Framework

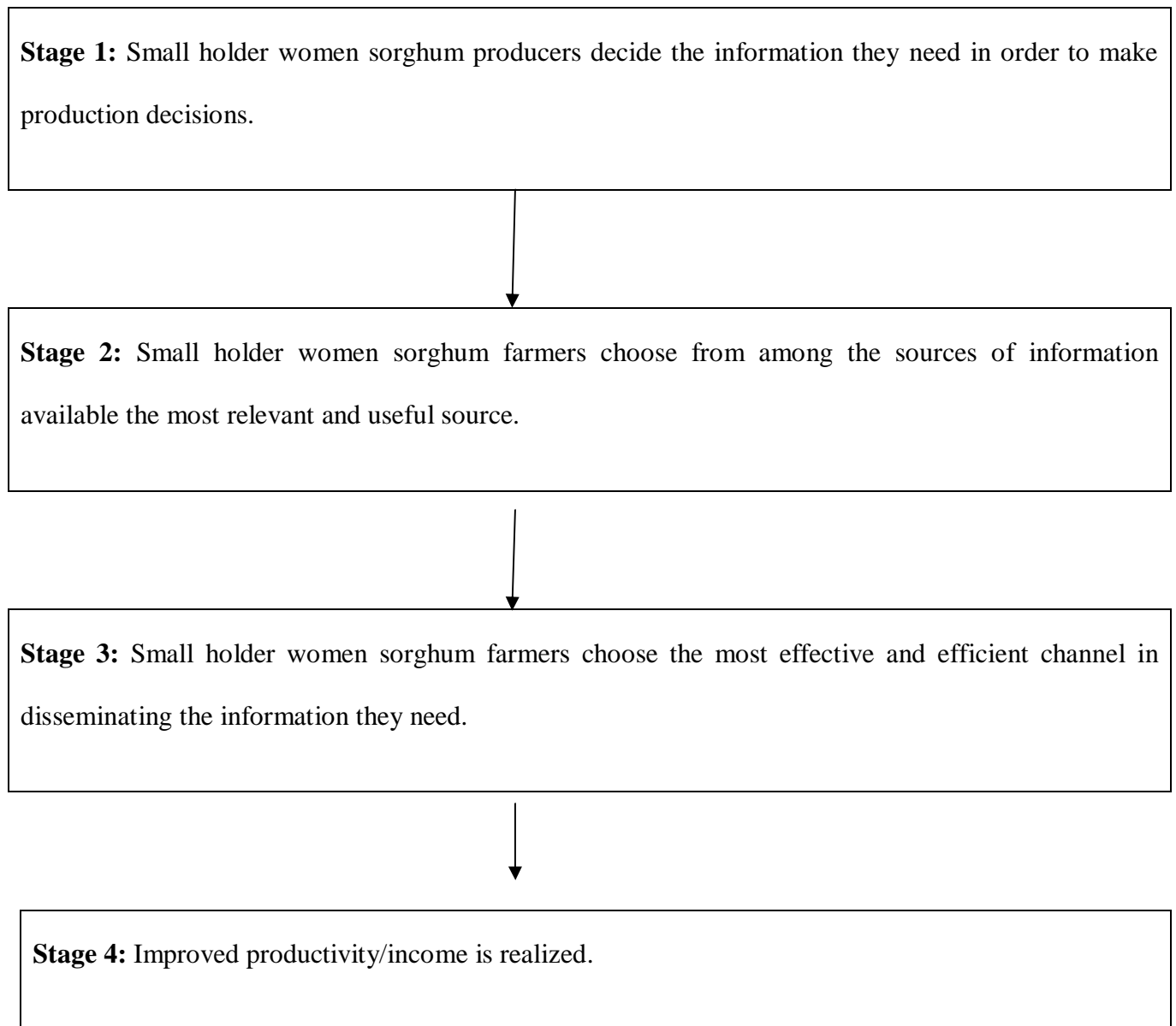
Small-scale women farmers face uncertainty when making production decisions. They may not have the right and adequate information. Information about field production practices, weather, new technologies, and prices helps reduce producer's uncertainty (Swinton, 2002). Farmers' production decisions, incorporating selection of information sources, can be modelled in three stages as described by Just et al. (2002). In the first stage, the producer decides how much information is needed to manage production system subject to an availability constraint. In this first stage, producers face uncertainty associated with unobserved information benefits that are realized in the second stage when deciding whether to invest in a given farming enterprise. In the second stage, producers use information acquired in the first stage to make decisions about inputs. Profits are realized in the third stage.

In the study, Just et al.'s (2002) three-stage approach was modified to fit the study. It was hypothesized that before farmers decide on what to produce and how to produce it, they need information on how to manage the production system they will use. Depending on the amount of information needed, they then must decide which source or combination of sources they will use from a suite of available information sources. They then have to choose the most appropriate information dissemination channel that delivers the information in a timely and effective manner.

With the antecedent stage, the decision making process can be described as:

- 1) Farmers decide on the amount of information they need and choose among sources of information available,
- 2) Farmers decide the amount of information to be used from the sources depending on their perceptions of the usefulness of the sources chosen in stage 1,
- 3) Farmers choose the most effective channels in the dissemination of the information they require,
- 4) Information gathered is used to make production decisions and profits are realized.

Fig 3.1 The conceptual framework



Conceptual model modified from Just et al. (2002)

3.3 The Study Area

The larger Mwingi district is one of the 13 larger districts in Eastern Province. It borders Kitui District to the south, Machakos District to the west, Mbeere and Meru South District to the north and Tana River District to the east. Mwingi lies between Latitude 0°03' and 1°12' and Longitudes 37°47' Degrees 38°57'. The district covered an area of 10,030.30 km (Fig 3.2.).

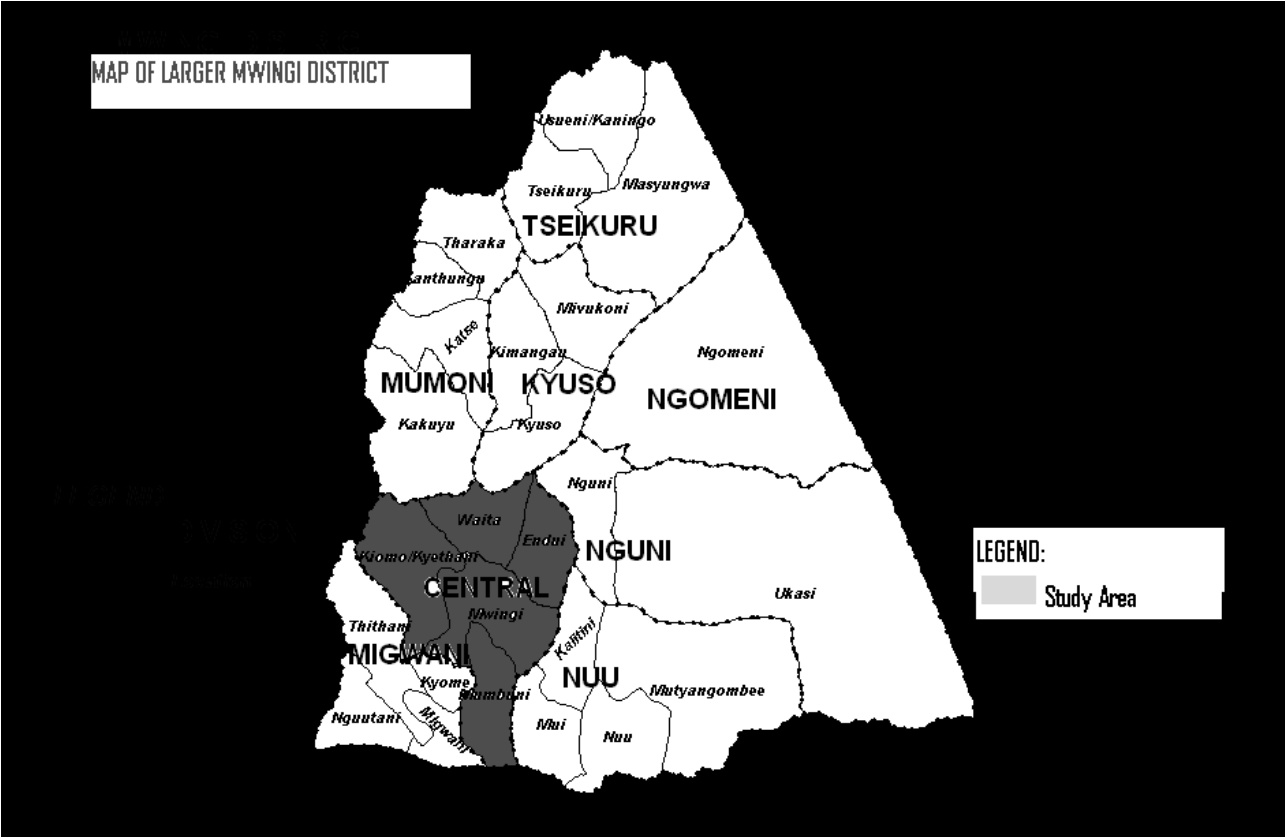
The district has now been subdivided into 6 new districts. These are Mwingi Central, Mwingi East , Mwingi West, Kyuso, Mumoni, and Tseikuru(Fig 3.3). Mwingi Central district has the highest population density of 87 persons per km while Tseikuru has the lowest population density of 8 persons per km.

Mwingi Central District is one of the districts forming the Kitui county of Lower Eastern region, Kenya. It covers an area of 1200.4 square kilometres. The district receives a bimodal type of rainfall with an annual average of 300mm. Temperatures range between 26 and 34 degrees centigrade. The soil type is mainly sandy with pockets of black cotton soil.

The district has a population of 104,826 (50,263 males and the 64,563 females). Thus women account for 61% of the population according to the population census of 2009. However, despite the females being dominant in terms of population, the male control the means of production (GOK, 2005). The inhabitants of Mwingi Central District are predominantly farmers and cultivate various arable crops such as millet, sorghum, green grams, cowpeas, cassava, maize, beans, sunflower and cotton. The main livestock enterprises are cattle, goats, and poultry.

Sorghum is one of the important crops grown in the district. It serves as a subsistence crop to many households and hence an important food security crop. In the recent past, the crop is being promoted as a cash crop. This is being done by KARI in collaboration with EABL, a leading brewer in Kenya that is promoting sorghum to supplement barley hence it is a potential source of cash for farmers in the area.

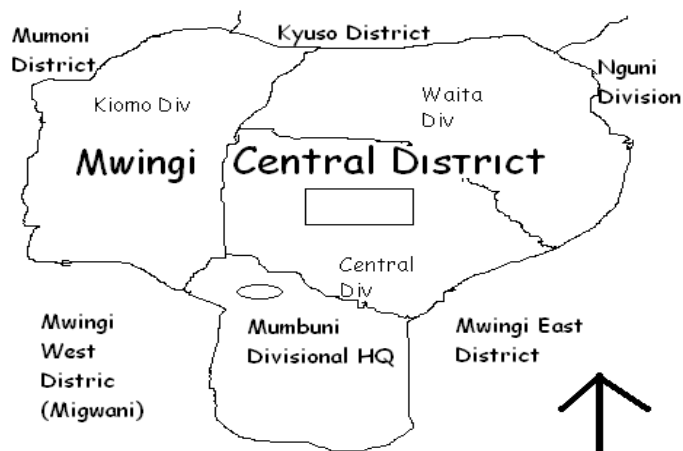
Fig 3.2 A map of the larger Mwingi district



The district was purposively selected since it's a food deficit area that experiences recurring food shortages. Sorghum is a crop that can address this deficit and also improve the farmer's income through sale to East African brewing companies for malting, since the crop has been accepted as a supplement to barley.

The respondents of the study were smallholder women farmers who are growing sorghum.

Fig 3.3 A map of Mwingi Central district



Not drawn to scale

3.4 Sources of Data and Data Collection

The study was descriptive and analytical in nature. The data collected was used to correlate selected socio-economic characteristics with the access and use of ICTs.

The study population consisted households that are growing sorghum. The women farmers from these households were interviewed.

3.4.1 Sampling procedure

A multistage sampling model was employed. Mwingi Central District was purposively selected because it experiences recurring food shortages and sorghum is a drought tolerant crop that can address this shortage. The crop is also being promoted in the district by KARI in collaboration with EABL.

The divisions of the district were treated as the clusters.

Two divisions of the district were randomly selected for the study (Kiomo & Waita).

Two locations from each of the selected divisions then randomly selected for the study (Kyethani, Kairungu, Endui & Mwambui) .

From each location, two sub-locations were randomly selected.

The sampling frame consisted of the list of farmers/households in the sub-locations that were allocated with Gadam sorghum seed.

Simple random sampling was again used to select 12 women farmers from each of the sub-locations from among the sorghum growing households. This was done using pre-determined sampling interval.

The sampling interval was obtained by dividing the total number of households in each area by the number of households to be sampled per sub-location.

This gave a sample size of 96 women farmers.

The formula $n = \frac{z^2 \cdot p \cdot q \cdot N}{e^2 (N-1) + z^2 \cdot p \cdot q}$ had been applied to give a sample size of 93.

$$e^2 (N-1) + z^2 \cdot p \cdot q$$

where

n = the desired population sample size

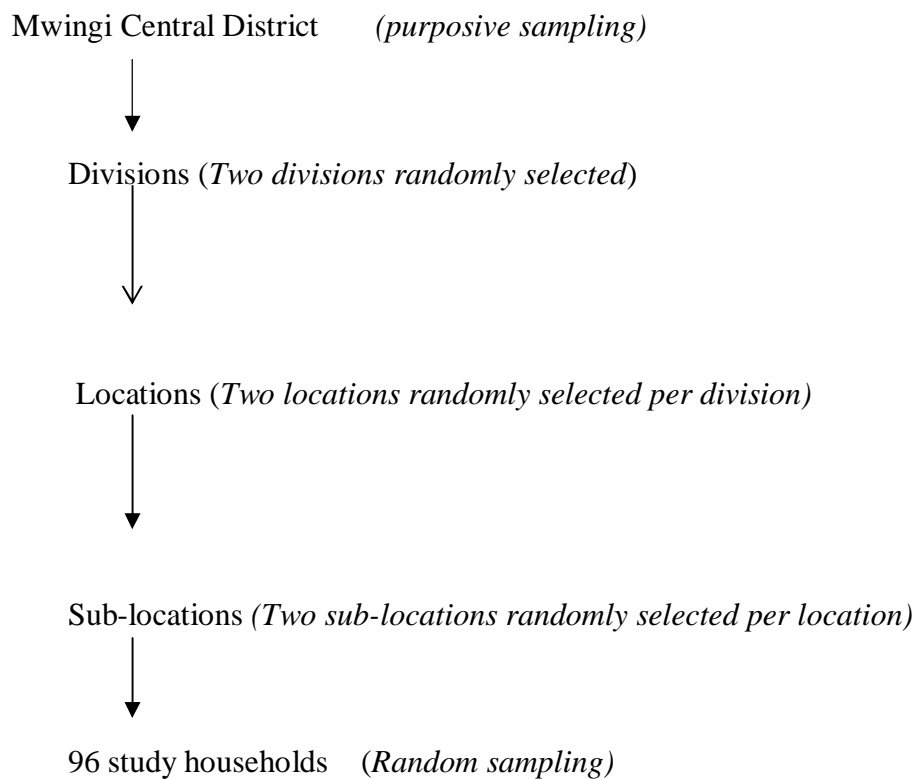
N= 2,000(the estimated women farmers growing sorghum)

e = 0.02(since the estimate is within 2% true value)

z = 2.005 (standard deviation at 95.5% confidence interval)

p = 0.02 i.e proportion of defectives based on past data

Figure 3.4 Schematic presentation of sampling procedure



Selection criteria: Growing sorghum

3.4.2 Data collection

The research assistants for data collection were trained for one day on interviewing techniques, the completion of the questionnaire and methods of estimating cultivated area and crop yields.

3.4.2.1 Pre-testing of the questionnaire

The questionnaire was pre- tested to ensure understanding and clarity. The investigator and the three research assistants carried out the pre-testing which involved 8 purposively selected households. Based on observations in the field, revisions were made accordingly.

3.4.2.2 Data collection

Primary data was collected using a structured questionnaire. The questionnaire, among other issues addressed the socio-economic characteristics of the respondents, the acreage under sorghum and yield, household incomes, agricultural information dissemination channels and the sources of agricultural information.

The area under sorghum and the yield was the October 2011- February 2012 season since it is the main season in the study area and the rains are more reliable compared to the March-April rains. Again, the March-April 2012 crop had not been harvested at the time of the study.

The respondents were asked to recall the amount of sorghum harvested either in terms of tins/debes or kilograms. The yields were then converted into bags using a pre-determined conversion rate (Appendix 1).

To confirm the area under sorghum, respondents were requested to show in the farm the portion that had been planted with the crop. The research assistants then confirmed the acreage by counting the number of footsteps made. Each footstep was estimated at 0.9 Metres (90cm). The actual area in acres was then calculated using the standard conversion ratio of 1 acre is approximately 43,560 square feet (Appendix 2).

The income of the respondent was estimated based on the farm produce sold in the year 2011. The crop produce sold were mainly green grams, sorghum, dolichos lab lab and cowpeas. The livestock sold was

mainly chicken, goats and cows. The respondents then converted this into a monthly income by dividing by 12.

At the end of every day, questionnaires were screened to check for recording errors and completeness.

3.5 Data Analysis

The data was analysed using the statistical package for social scientists (SPSS) version 20.0

Both descriptive and inferential statistics were derived. These were used to describe the study sample in terms of mean, median, mode and frequencies and also make conclusions about the sample population.

A chi-square test was done to test the significance of the factors age, level of education and income in determining the use of ICTs by the women farmers.

Binary logistic regression was then used to perform an analysis to determine the likelihood of use of ICTs by the sampled women farmers from the independent variables of age, level of education and income.

CHAPTER FOUR

RESULTS AND DISCUSSIONS

4.1 Social-Economic Characteristics of the respondents

4.1.1 Age

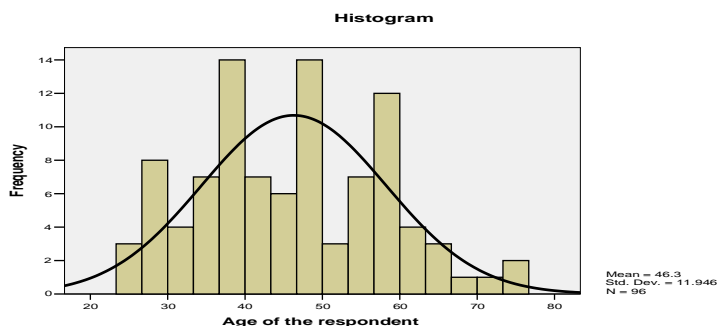
The age of the respondents ranged from 25 years to 74 years with a mean of 46.3 years. The age of the respondents was categorized at intervals of 10 years and it was found out that the category with the highest number of respondents was age bracket 35-44 year at 27.1%. Majority of the other respondents were of age bracket 45-54 years (25%) and 55-64years (22.9%). This means that over 75% of the respondents are of the age 35-64 (Table 4.1).

The age of the population of the study area is normally distributed as shown in fig 4.1

Table 4.1: Socio-Economic Characteristics the smallholder women sorghum farmers (n=96)

Socio-Economic Characteristics	Freq.	Percent
Age of the respondent		
25 – 34	18	18.8
35 – 44	26	27.1
45 – 54	24	25.0
55 – 64	22	22.9
65+	6	6.3
Level of education		
None	27	28.1
Adult Education	1	1.0
Completed primary level	55	57.3
Completed secondary level (O-level)	13	13.5
Marital Status		
Single	6	6.3
Married	85	88.5
Widowed	5	5.2
Training on crop/livestock production		
No	33	34.4
Yes	63	65.6
Occupation		
Farmer	89	92.7
Business person	7	7.3

Figure 4.1 Age distribution



4.1.2 Level of education

Data on levels of education indicate that the majority of the respondents have a primary school level of education (57.3%) and a also 28.1% of the respondents have no formal education. Another 13.5% of the respondents have a secondary level of education and none of the respondents had a post secondary training (Table 4.1).

This generally means that the levels of education in the study area are low. It also means that there is not a lot of disparity in the levels of education for the farmers who have gone to school. However, a significant number of women farmers have no formal education at 28.1%.

However, 63 respondents (65.5%) have had some training on crop and livestock production.

4.1.3 Household size and marital status

The study also showed that most of the respondents in the sample were married (88.5%) and a few were either widowed or single (table 4.1). None of the respondents was either divorced or separated.

The commonest family size is the category of 7-10 family members at 49% of the households followed by the category of 4-6 members at 39.6% of the households.

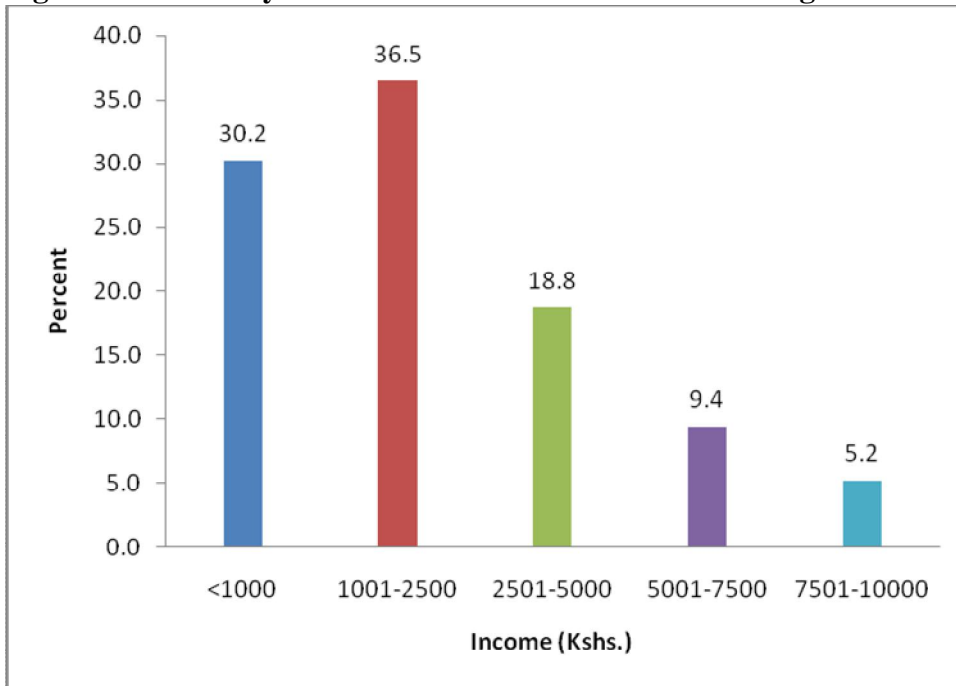
4.1.4 Income

In terms of income, majority of the respondents (36.5%) earn between ksh1000-2500 per month but a good proportion (30.2%) earns less than Ksh 1000 per month. Indeed, majority of the respondents earn less than Ksh 5000 per month (58.5%) and only 14.5% earn between Ksh 5000-10,000 per month (Figure 4.2).

This means that the levels of income are generally low in the study area.

Furthermore, 92.7% of the respondents are involved in farming as the main occupation. Apart from farming, the respondents are involved in small scale businesses such as operating kiosks, trading in poultry and sale of firewood but this was only 7.3% of the respondents (Table 4.1).

Figure 4.2: Monthly Income of the smallholder women sorghum farmers(n = 96)



4.2 Farming characteristics

On land availability, the size of cultivated land ranged from 1.5 acres to 20 acres with a mean of 5.2 acres (Table 4.2). It is important to note that these are the sizes of the cropped area and excludes land set aside for grazing purposes. Majority of the respondents cultivate 2-5 acres of land.

On average, most of the respondents cultivate 1-2 acres of sorghum with a mean of 1.6 acres (Table 4.2).

However, there is a wide range of between 0.25 acres to 10 acres.

The majority of the farmers harvest 1 to 5 bags (90kg) of sorghum per acre with a mean of 3.5bags.

Most of the farmers in the study area have a farming experience of over 20 years with the mean being 22.4 years. The most experienced farmer has 50 years of farming experience and the least experienced having farmed for only one year (Table 4.2).

Table 4.2: Farming Characteristics of smallholder women sorghum farmers in Mwingi Central district(n = 96)

Farm Characteristics	Freq.	Percent
Family size		
1-3	5	5.2
4-6	38	39.6
7-10	47	49.0
>10	6	6.3
Farm size (acres)		
<2	3	3.1
2 – 5	62	64.6
6 – 9	21	21.9
10+	10	10.4
Farming experience (yrs)		
< 5	5	5.2
5 – 10	22	22.9
11 – 15	11	11.5
16 – 20	16	16.7
20+	42	43.8
Sorghum acreage		
< 1	17	17.7
1 – 2	62	64.6
3 – 4	15	15.6
5 +	2	2.1
Sorghum harvested (90 kg bags)		
< 1	13	13.5
1 – 5	66	68.8
6 – 10	13	13.5
10 +	4	4.2

4.3 The Role of women and men in sorghum production

In terms of the work done by both gender in sorghum production, both women and men contribute to the production and marketing of the crop but women do more when it comes to winnowing, harvesting and transportation (table 4.3). Men feature more prominently when it comes to marketing of sorghum. This means that men would want to be in control of resources.

The other activities identified by the respondents were construction of storage facilities, an activity mainly done by men.

Table 4.3: Role of Women and Men in Sorghum Production in the study area

Activity in Sorghum Production	Women		Men	
	Freq.	Percent	Freq.	Percent
Land preparation	96	100.0	90	93.8
Soil conservation	93	96.9	89	92.7
Planting	96	100.0	88	91.7
Weeding	96	100.0	79	82.3
Harvesting	96	100.0	55	57.3
Threshing/winnowing	95	99.0	1	1.0
Transportation	94	97.9	32	33.7
Storage	87	90.6	42	43.8
Marketing	68	70.8	85	88.5
Other	14	14.6	20	20.8

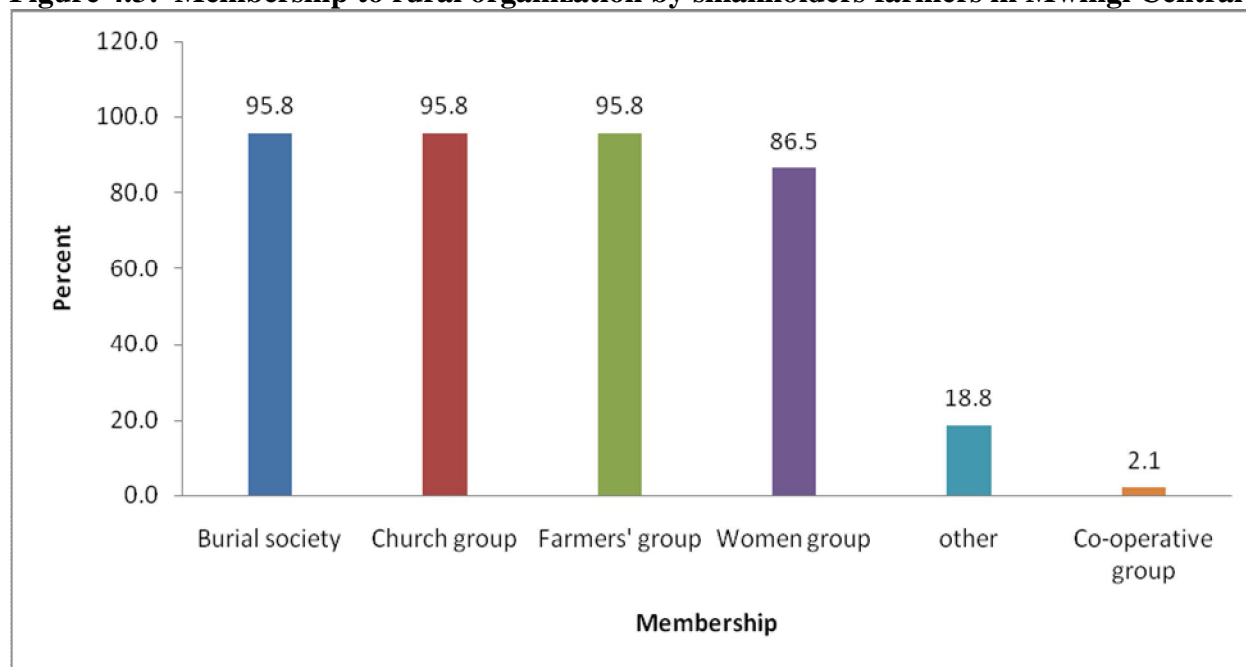
4.4 Membership to rural organizations

A majority of the respondents belong to some form of rural organization with 95% belonging to burial, church and farmers' groups and 86% to women groups (Figure 4.3)

There are very few agro-based co-operative societies in the study area hence the low membership under this category. The other organizations mentioned during the survey included financial organizations such KWFT, Faulu Kenya and Jamii Bora.

This is very significant in terms of information dissemination since these organizations can be good avenues of information dissemination. Indeed, the group approach to extension service provision is the preferred extension methodology by both public and private extension service providers. One is able to reach many farmers at a time through the method. Indeed, the approach was used to issue sorghum seed to the sorghum farmers that formed the sampling frame for this study.

Figure 4.3: Membership to rural organization by smallholders farmers in Mwingi Central district



These findings are similar to findings on a study on knowledge management approaches in managing agricultural indigenous and exogenous knowledge in Tanzania where 85% of the farmers were involved in agricultural related associations. The existence of informal and self-managed farmer groups in local communities shows the existence of communities of practices since the groups were voluntary, often non routine, and members shared a common interest. These Communities of practices can also be used to bridge the information and knowledge divide between farmers.

4.5 Information dissemination channels

The channel available to most farmers is meetings and barazas which was available to 99% of the farmers followed by radio which was available to 78%. The use of cell phone is also quite popular and available to 65% of the respondents and 61% of the respondents also access agricultural information through attending trainings/workshops (Table 4.4)

None of the respondents has used the internet as a channel of accessing agricultural information and only 2.1% of the respondents have watched CDs/DVDs/Videos on agriculture.

The usefulness of the channels was determined by assigning values on a likert scale to the usefulness as follows:

Extremely useful- 1

Very useful- 2

Useful -3

Somewhat useful -4

Not useful - 5

A mean was then determined and the smaller the value, the more useful is the channel .

Thus meetings and barazas were rated the most useful channels with a mean score of 1.5, followed by radio at 3.1, trainings/workshops at 3.3, cell phone at 3.4 and progressive farmer at 3.9. The other channels of print media, TV, electronic mode and internet scored poorly with a mean score of 5.8, meaning that they are not useful (Table 4.5)

The preferred print media is the book at 41% although 38% of the respondents were not interested in printed materials.

Most of the respondents would prefer the CDs in terms of electronic material but again 47% of the farmers are not interested in the use of electronic material in delivering agricultural information (Table 4.6).

The most important consideration in choosing the channel of communication is the accessibility of the channel (95%) followed by cost at 84% (Figure 4.5).

Table 4.4 Information dissemination channels available to smallholder women sorghum farmers

Channel availability	Freq.	Percent
Radio	75	78.1
TV	10	10.4
Cell phone	63	65.6
Print media(agricultural publications, pamphlets, books)	29	30.2
Electronic mode(videos/CDs/DVDs)	2	2.1
Internet	0	0.0
Meetings and barazas	95	99.0
Progressive/innovative/contact farmer	52	54.2
Trainings and workshops	59	61.5

Table 4.5 Usefulness of the Channels

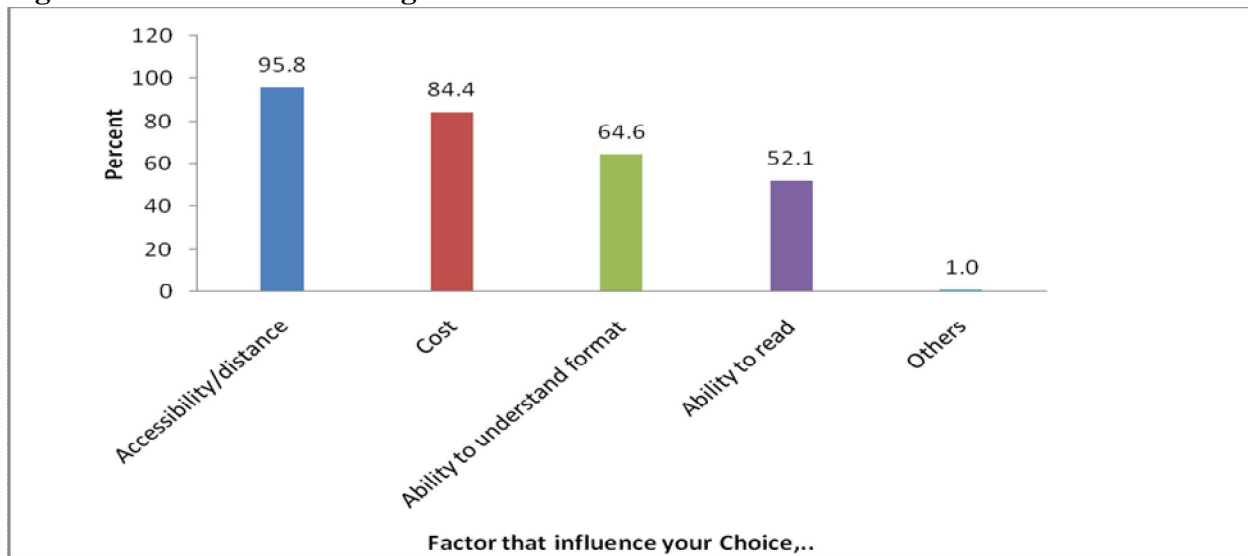
Rated usefulness of the channel	Freq.	Percent	Mean score
Radio			
extremely useful	17	17.7	
very useful	29	30.2	
Useful	24	25.0	3.1
somewhat useful	5	5.2	
not useful	0	0.0	
N/A	21	21.9	
TV			
extremely useful	0	0.0	
very useful	2	2.1	
Useful	4	4.2	5.8
somewhat useful	2	2.1	
not useful	0	0.0	
N/A	88	91.7	
Cellophone			
extremely useful	12	12.5	
very useful	38	39.6	
Useful	12	12.5	3.4
somewhat useful	0	0.0	
not useful	1	1.0	
N/A	33	34.4	
Print media			
extremely useful	3	3.1	
very useful	10	10.4	
Useful	12	12.5	5.0
somewhat useful	3	3.1	
not useful	0	0.0	
N/A	68	70.8	
Electronic mode			
Extremely useful	0	0.0	
very useful	0	0.0	
Useful	1	1.0	6.0
somewhat useful	0	0.0	
not useful	0	0.0	
N/A	95	99.0	
Internet			
extremely useful	0	0.0	
very useful	0	0.0	
Useful	0	0.0	6.0
somewhat useful	0	0.0	
not useful	0	0.0	
N/A	96	100.0	

Rated usefulness of the channel	Freq.	Percent	Mean score
Meetings and barazas			
extremely useful	48	50.0	
very useful	47	49.0	
Useful	0	0.0	1.5
somewhat useful	0	0.0	
not useful	0	0.0	
N/A	1	1.0	
Progressive/innovative/contact farmer			
extremely useful	17	17.7	
very useful	20	20.8	
Useful	13	13.5	3.9
somewhat useful	0	0.0	
not useful	0	0.0	
N/A	46	47.9	
Trainings and workshops			
extremely useful	27	28.1	
very useful	27	28.1	
Useful	5	5.2	3.3
somewhat useful	0	0.0	
not useful	0	0.0	
N/A	37	38.5	

Table 4.6 Preferred print media

Preferred print media	Freq.	Percent
Printed material		
Pamphlets	19	19.8
Books	40	41.7
Newsletters	0	0.0
Journals	0	0.0
Newspapers	0	0.0
N/A	37	38.5
Electronic media		
Videos	5	5.2
Tapes	0	0.0
CDs	29	30.2
DVDs	16	16.7
N/A	46	47.9

Figure 4.5 Factors influencing the choice of channel



4.6 Sources of agricultural information

The most important source of agricultural information in the study area was cited to be informal contact in form of neighbours, friends, relatives and family members which is available to 99% of the women farmers (table 4.7). These are the people the respondents interact with on a daily basis. It is expected that they share any information and knowledge they have among themselves before they reach out to other sources.

This source is closely followed by agricultural extension workers at 95% (table 4.7). Indeed, it was established that the agriculture extension staff have in the recent past intensified campaigns to promote sorghum production in the area. This is after the EABL started to use sorghum to supplement barley in beer making. It is also a drought tolerant crop that can do very well in the district. The effort to promote the crop is also being supported by other non-governmental organization in the district e.g Action Aid in Kakongo sub-location of Kairungu location. Most of the farmers interviewed have at least attended a meeting/baraza organized by the Agricultural extension officers to promote sorghum growing.

Radio is another important source of agricultural information at 77%, followed by trainings & workshops at 67% and innovate farmers at 55% (table 4.7). The innovative farmer as a source of information is more prevalent in Kiomo division where there had been a programme supported by UNDP in the 1990,s that promoted farmer to farmer extension.

The usefulness of the sources of information were similarly rated as the usefulness of the channels of communication above using the following values on a likert:

Extremely useful- 1

Very useful- 2

Useful -3

Somewhat useful -4

Not useful - 5

A mean was then determined and the smaller the value, the more useful is the source of information.

Agricultural extension workers scored best with a mean of 1.8 meaning they were rated as being extremely useful to very useful. These were followed by informal contacts that scored 2.3 and radio seminars/workshops that scored 3.1, meaning that they are at least useful sources on information (Table 4.8). Again, the internet, databases, TV, agricultural publication and CDs/DVDs are not very important sources of agricultural information in the study area.

The results on ranking of the sources of agricultural information followed a similar trend where agricultural extension was ranked as the most important source followed by informal contacts, seminars/workshops, radio programmes and innovative farmers (Table 4.9)

Table 4.7 Sources of Agricultural Information accessible to women farmers

Sources of Agricultural Information	Freq.	Percent
Agricultural publications(pamphlets, books, newsletters)	34	35.4
Agricultural extension workers	91	94.8
Trainings/workshops/seminars	65	67.7
Informal contacts(friends, neighbours, relatives, family)	95	99.0
Progressive/innovative/contact farmers	53	55.2
Radio programmes	74	77.1
TV programmes	8	8.3
CDs/DVDs/Videos/Tapes	2	2.1
Internet	0	0.0
Databases	1	1.0
Nothing/own knowledge	7	7.3
Others	1	1.0

Table 4.8 Rating of the usefulness of the Sources of agricultural information

Usefulness of the Sources	Frequency	Percent	Mean Score
Agricultural publications (pamphlets, books, newsletters)			
Extremely useful	4	4.2	
Very useful	14	14.6	
Useful	14	14.6	4.8
Somewhat useful	1	1.0	
Not useful	0	0.0	
N/A	63	65.6	
Agricultural extension workers			
Extremely useful	48	50.0	
Very useful	39	40.6	
Useful	4	4.2	1.8
Somewhat useful	0	0.0	
Not useful	0	0.0	
N/A	5	5.2	
Trainings/workshops/seminars			
Extremely useful	22	22.9	
Very useful	38	39.6	
Useful	5	5.2	3.1
Somewhat useful	0	0.0	
Not useful	0	0.0	
N/A	31	32.3	
Informal contacts (friends, neighbours, relatives, family)			
Extremely useful	17	18.1	
Very useful	34	36.2	
Useful	41	43.6	2.3
Somewhat useful	2	2.1	
Not useful	0	0.0	
N/A	0	0.0	
Progressive/innovative/contact farmers			
Extremely useful	12	12.5	
Very useful	27	28.1	
Useful	14	14.6	3.8
Somewhat useful	0	0.0	
Not useful	0	0.0	
N/A	43	44.8	
Radio programmes			
Extremely useful	10	10.4	
Very useful	26	27.1	
Useful	31	32.3	3.3
Somewhat useful	6	6.3	
Not useful	0	0.0	

Usefulness of the Sources	Frequency	Percent	Mean Score
N/A	23	24.0	
TV programmes			
Extremely useful	1	1.0	
Very useful	1	1.0	
Useful	2	2.1	5.8
Somewhat useful	4	4.2	
Not useful	0	0.0	
N/A	88	91.7	
CDs/DVDs/Videos/Tapes			
Extremely useful	0	0.0	
Very useful	1	1.0	
Useful	2	2.1	5.9
Somewhat useful	0	0.0	
Not useful	0	0.0	
N/A	93	96.9	
Internet			
Extremely useful	0	0.0	
Very useful	0	0.0	
Useful	0	0.0	6.0
Somewhat useful	0	0.0	
Not useful	0	0.0	
N/A	96	100.0	
Databases			
Extremely useful	0	0.0	
Very useful	0	0.0	
Useful	0	0.0	6.0
Somewhat useful	0	0.0	
Not useful	0	0.0	
N/A	96	100.0	
Nothing/own knowledge			
Extremely useful	0	0.0	
Very useful	4	4.2	
Useful	3	3.1	5.7
Somewhat useful	0	0.0	
Not useful	0	0.0	
N/A	89	92.7	
Others			
Extremely useful	0	0.0	
Very useful	0	0.0	
Useful	0	0.0	6.0
Somewhat useful	0	0.0	
Not useful	0	0.0	
N/A	96	100.0	

Table 4.9 Ranking of the Sources of Agricultural Information

Rank of Information	Mean	Median
Agricultural extension workers	2	1
Trainings/workshops/seminars	6	3
Informal contacts(friends, neighbours, relatives, family)	3	3
Radio programmes	6	4
Progressive/innovative farmers	8	5
Agricultural publications(pamphlets, books, newsletters)	10	13
TV programmers	12	13
CDs/DVDs/Videos/Tapes	13	13
Internet	13	13
Databases	13	13
Nothing/own knowledge	12	13
Others	13	13

4.7 Use of ICTs in agriculture

A majority of the respondents have ever used ICTs in agriculture at 71% (figure 4.6).

However the usage of ICTs is mainly confined to radio and cell phone.

The main advantages identified in using ICTs in agriculture were that they are easy to use, convenient to use, fast in accessing information and are relatively cheaper (Figure 4.7)

In terms of sorghum production, ICTs are used to mainly access information on marketing at 70.8%, pest and disease control at 47.9%, post harvest management at 41.7% and finance/credit at 28%. A few respondents also use ICTs to get information on suitable varieties, soil fertility and utilization (table 4.10)

The main challenges faced by the respondents in accessing agriculture information are cost at 88.5%, ICT illiteracy at 85.4% and unavailability of channels/sources at 79.2%. Moreover, lack of time, illiteracy, language barrier, and poor infrastructure were rated as challenges by at least 40% of the respondents (Table 4.11).

Figure 4.5 Use of ICTs to access agricultural information

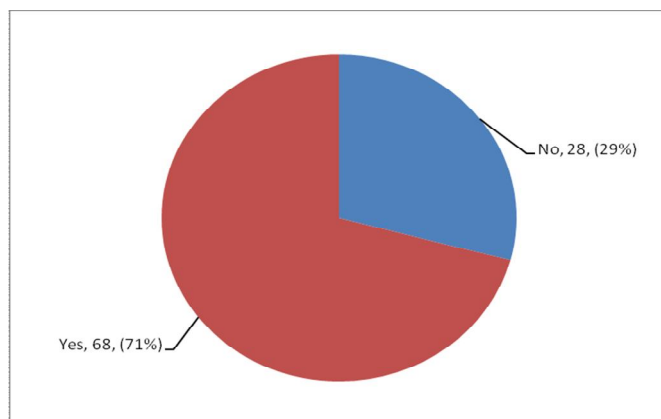


Figure 4.6 Advantages of ICTs

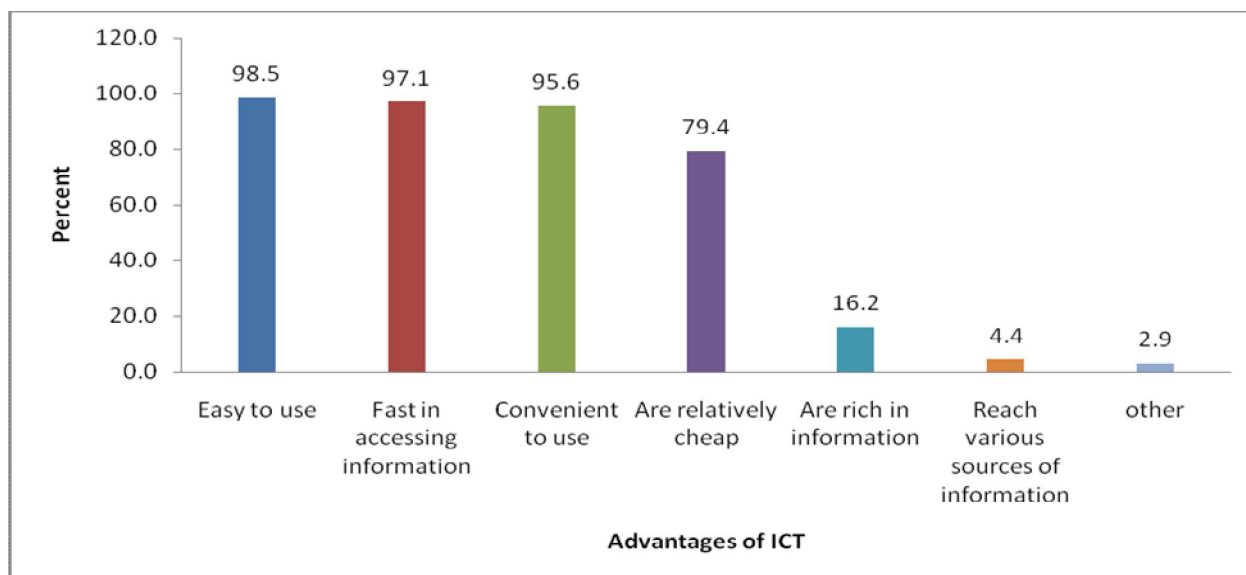


Table 4.10 Information on Sorghum accessed using ICTs

Access using ICT	Freq.	Percent
Land preparation	0	0.0
Suitable varieties	12	12.5
Pest and disease control	46	47.9
Soil fertility management	16	16.7
Finance and credit	27	28.1
Marketing	68	70.8
Post harvest management	40	41.7
Utilization	10	10.4
Others	0	0.0

Table 4.11 Challenges in Accessing Agric.Information

Challenges	Freq	Percent
Illiteracy	43	44.8
ICT illiteracy	82	85.4
Language in which information is presented	48	50.0
Cost	85	88.5
Lack of time	63	65.6
Unavailability of sources/channels	76	79.2
Social-cultural (tradition, religion)	0	0.0
Poor infrastructure	46	47.9
Format of information presentation	38	39.6
Ignorance	15	15.6
Other	0	0.0

4.8 THE RESULTS OF THE OBJECTIVES UNDER STUDY

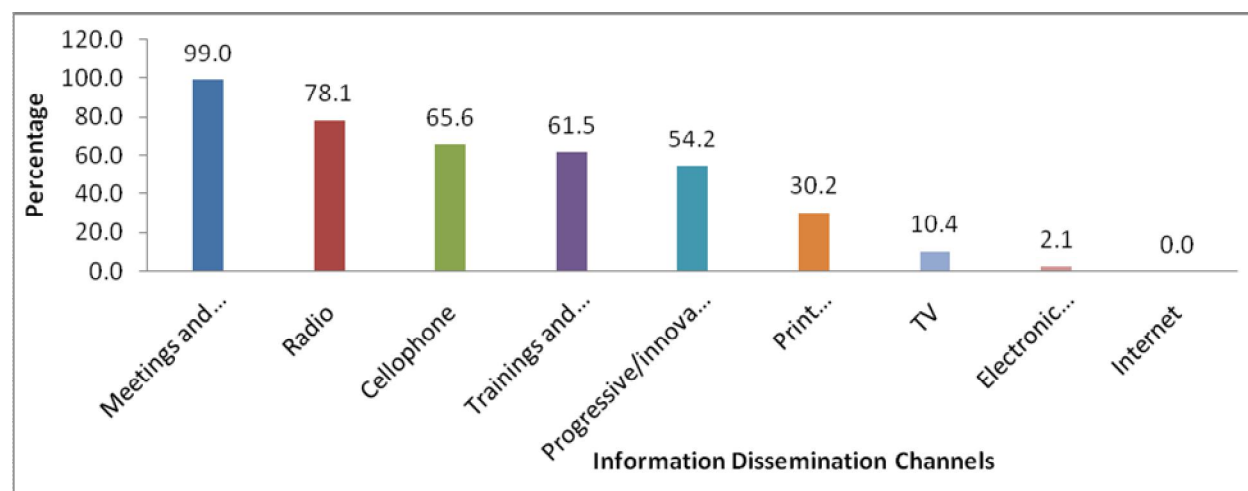
Objective 1- To identify the types of agricultural information channels available to small holder women sorghum farmers - What type of information channels are available to the smallholder women sorghum in farmers in the study area?

The study identified both modern ICT related channels and non-ICT related channels.

The results show that meetings/barazas and radio are the communication channels available to most farmers since over 70% of the women farmers have access to these channels (figure 4.4). Indeed meetings/barazas are available to 99% of the respondents.

The availability of cell phone, trainings/workshops and progressive/innovative farmers is also high. These channels are available to over 50% of the women farmers (figure 4.4). The availability of agricultural publication, the electronic materials in form of CDs/DVDs and the internet is low. Indeed, none of the respondents has ever used the internet as a channel of information dissemination (figure 4.4).

Figure 4.4 Information dissemination channels



Communication channels are very critical in the dissemination of agricultural information. The availability of the channels is key to information dissemination.

Meetings/barazas are agricultural related meetings that may take a few hours or a day. It is a commonly employed channel of face to face communication between the agricultural extension staff and farmers.

The method is quite popular due to the direct two-way communication between the experts and the

farmers. It is an interactive two way communication where the smallholder farmers have an opportunity to ask questions and get answers.

In terms of investment, the channel does not require any form of investment except setting aside time to attend the meeting. It is thus affordable to most farmers since the meetings/barazas are provided at no cost to the clients.

The Radio is an important channel which is available to 78% of the women farmers in the study area (figure 4.4). This is a modern mass media channel of communication that has evolved over the year and generated a lot interest in the early studies of mass communication.

Radio is the most widely used modern channel for disseminating information to rural audiences across Africa. The radio can reach communities at the end of the development road; people who live in areas without even phones or electricity. The radio is also used to reach people who cannot even read or write. In Kenya, the advent of vernacular radio station has enhanced information delivery even to the illiterate. Even in the very poor communities, radio penetration is vast due to its affordability compared to the other channels of mass media. It is also very portable in addition to the advantage of not having to depend on the availability of electricity. Furthermore, there has been integration of modern ICTs that have enabled radio to provide better two-way communication between radio stations and their farmer listeners.

The use of cell phone is also quite popular in the study area. This channel is available to 65% of the respondents (Figure 4.4). With the emergence of mobile telephony technology and the development of the necessary infrastructure, the use of cell phones has gained popularity as a tool of communication. It is a portable gadget that can be carried anywhere. It also offers a personalized means of communication unlike the fixed lines which were installed in offices or public booths. Again, with increased competition in the production of mobile phones, the cost of the gadget has gone down considerable and it is thus affordable to many. The mobile phone has thus become the “other” key technology to many farmers.

The use cell phone has experienced phenomenal growth in the recent past in Africa in what has been referred to as the 'mobile boom'. Africa has in the recent past recorded the largest increase in mobile cellular subscribers and mobile telephony has become the most useful ICT tool on the continent (ITU 2009). By the end of 2008, there were 246 million mobile cellular subscriptions in Africa. According to the ITU, two thirds of the world's mobile phone subscriptions are in developing countries, and a quarter of that population is in Africa.

Trainings and workshops on agriculture are also important channel of communicating agricultural information and this channel is available to 61% of the respondents. The workshops are usually organized by the Ministry of agriculture and other stakeholder to disseminate agricultural information. The availability of this channel is high since the Ministry of Agriculture and other stakeholders are deliberately training the sorghum farmers in order to promote the production of the crop in Mwingi Central district as a cash crop. This is being done from the time the crop started to be used for malting to supplement the use of barley in East Africa. NGOs such as Action Aid are complementing the government efforts in the training of sorghum farmers. May be the figures may not be as high if another crop was considered for this study.

The use of other farmers to disseminate agriculture information is also an important channel in the study area and this channel is available to 54% of the women farmers. This channel involves farmers visiting other farmers who have done relatively better in certain agricultural technologies to learn from them. This channel is more common in Kiomo division where a UNDP supported programme in the 1990's promoted farmer to farmer extension.

The use of agricultural publication such as books and pamphlets to disseminate agricultural information is low in the study area at 30%. This could be explained by the low literacy levels in the study area where 28% of the respondents have not attained formal education.

The use of TV and electronic materials such as CDs/DVDs/Video to access agricultural information is also very low. This could be explained in terms of affordability. The income levels in the study area are

low with the majority earning less than Ksh 5,000 per month. The TV and the CD/DVD drives also require electricity which is not available in the most of rural areas where the study was done.

None of the respondents has used the internet as a channel of accessing agricultural information. Again the question of affordability comes to play in terms of accompanying gadgets such as computers and smart phones. There are also limited skills on the use of computers and related technology due to the low levels of education in the study area. Another factor contributing to this may be the limited internet penetration in most countries in Africa due to limited international Internet connectivity. In 2008, Africa as a whole had around 12 Gbps of international bandwidth, while countries such as India had more than 3 times this amount.

In his study on the information needs of illiterate female farmers in Ethiopia East local government area of Delta State of Nigeria in 2007, Iriwieri classifies channels available to female farmers as both modern mass media and traditional media. He concluded that the traditional channels provide face to face exchange of ideas between two people. They also play an important role in facilitating information flow, persuading and mobilizing the rural dwellers and the illiterate to participate in decision making. This agrees with the findings of this study where meetings/ barazas are form of traditional channels that are very important and are used by 99% of the respondents in the study area.

Rogers and Showmaker also described traditional media as two-way exchange of ideas where the receiver may secure clarification or additional information from the source individual and this may persuade the receiving individual to form or change strongly held attitudes. This is indeed very applicable to the study area where this channel has played a key role persuading and promoting the growing of Gadam sorghum.

A survey conducted in 5 African countries (Ghana, Malawi, Mali, Tanzania & Uganda) under the African Farm Radio Research Initiative (AFRRI) in 2011 that is supported by Bill & Melinda Gates foundation on access to radio sets by gender showed that 76% of the rural households own a radio. The

ownership by men is as high as 90% in Mali and 79% by women in the same country. This is consistent with the findings of this study where the access to radio by women farmers is 78%.

The survey further found out that 86% of women listened to the radio at least once per week about marketing information and only at specific times in the day. Radio programs aimed at women must therefore consider the timing of the programs.

Again, a household survey by African Farm Radio Research Initiative in the 5 African countries (Ghana, Malawi, Mali Tanzania & Uganda) in 2010 found that as many as 65% of male farmers in some communities own mobile phones. The figures were less for female farmers and for some countries.

Thus, there is similarity with the findings of this study. The study established that the mobile phones are available to 65% of the women farmers interviewed. The mobile phone has become the “other” key technology for farmers. With a phone, a farmer can inquire about market prices, coordinate buying inputs and selling produce, as well as maintain contact with other farmers around the country.

Moreover, most radio stations in Africa have taken advantage of the spread of mobile phones by hosting call-in shows, in which listeners are invited to call the station and make comments or ask questions.

By using the phone, agricultural experts and extension agents could participate in radio programs without needing to travel to the radio station. In a survey with 41 extension agents in the AFRRI countries again found out that 61% believed that the reach and impact of their extension work was substantially improved because they could be heard on radio programs through call-out programs.

Munyua et al (2009) also studied agricultural knowledge and information system (AKIS) of small-scale farmers in Kirinyaga district and found out that information on enterprises collected by individual farmers was shared through meetings (88.2%), training (24.7%), demonstrations (22.4%), one on one oral discussions (15.3%), cellular phone, print materials, field days and churches. This further highlights the importance of meetings and trainings as channels of information delivery.

Objective 2- To determine the main ICT sources of agricultural information accessible by smallholder women sorghum farmers in the study area- From what ICT sources do smallholder women sorghum farmers obtain the agricultural information they need?

The study looked at the both the ICT and the non-ICT sources of agricultural information available to women farmers in the study area. It was found out that farmers receive agricultural information from a multitude of sources, such as agricultural extension agencies, mass media (Radio, TV) and fellow farmers (Table 4.7).

The ICT sources of agricultural information identified were the radio, TV, databases and CDs/DVDs/tapes. None of the women farmers interviewed has ever used the internet to access agricultural information. The radio is the main ICT source and is used by 77% of the women farmers. The use of the TV, databases and CDs/DVDs/Tapes is low where less than 10% of the women farmers have used these sources to access agricultural information (table 4.7)

Table 4.7 Sources of Agricultural Information accessible to women farmers

Sources of Agricultural Information	Freq.	Percent
Agricultural publications (pamphlets, books, newsletters)	34	35.4
Agricultural extension workers	91	94.8
Trainings/workshops/seminars	65	67.7
Informal contacts(friends, neighbours, relatives, family)	95	99.0
Progressive/innovative/contact farmers	53	55.2
Radio programmes	74	77.1
TV programmes	8	8.3
CDs/DVDs/Videos/Tapes	2	2.1
Internet	0	0.0
Databases	1	1.0
Nothing/own knowledge	7	7.3
Others	1	1.0

As mentioned under the operational descriptions, the term ICTs is used to refer to hardware, software, networks and media for collection, storage, processing, transmission and presentation of information in the formats of voice, data, text and images. Hence the nature of ICTs is diverse, ranging from telephones, radios and TVs to more complex technologies such as Internet technologies, mobile telephony, computers and databases. This diversity implies that ICTs can be used by people with

varying degrees of skills and knowledge, although the current trends are geared towards more sophisticated applications.

The ICT sources of agricultural information considered in this study were the Radio, the TV, the internet, the databases and the associated technology of the use of electronic devices such as CDs/DVDs/Tapes/Videos that are combined with the use TV and which can be very useful in the storage of information.

The focus on ICTs sources of agricultural information was due to the fact that ICTs can facilitate the creation of networks locally, regionally and globally, leading to collaborative and interdisciplinary approaches to problem-solving through shared knowledge-bases and even on online forums.

The advancements in ICTs provide an opportunity for developing countries to harness and utilize information and knowledge to improve productivity in various sectors including agriculture (Lwoga, 2010).

The role of ICTs is recognized in Millennium Development Goal No. 8 (MDG 8), which emphasizes the benefits of new technologies, especially in sourcing and delivery information delivery in the fight against poverty. Achieving food security requires new levels of innovation and ICTs can play a crucial role by enabling and facilitating agricultural innovation systems. ICTs can provide rapid and efficient means of accessing and sharing information across the entire agriculture value chain. The use of ICTs becomes even more critical because of the inadequacy of extension staff in the Ministry of agriculture, which is the main supplier of public funded extension service, where the staff to farmer ratio currently stands at 1: 947 (GOK 2011).

With the emergence of low-cost ICTs (such as radio, cell phones) the digital divide between the poor and the rich may be bridged (Lwoga and Ngulube, 2008).

The results, as already mentioned indicated very low usage of ICTs to source for agricultural information except the except for the radio. The use of radio is high due to the high availability as established in table 4.4 at 78%. The radio is affordable to many and does not critically depend on other

infrastructure such as the availability of electricity. This is unlike the TV whose initial cost is high and is mainly powered by electricity which has not reached most parts of the study area. The radio is also an ICT source that does not require any specialized skills and knowledge to operate considering that most of the respondents in the area have only a primary level of education which stands at 57% of the respondents with a good proportion having not attended any formal schooling at 28% (Table 4.1). The use of other ICT sources of agricultural information such as the internet and databases would require at least a secondary level of education accompanied by other forms of training in the area of computer technology. This probably explains why even among the 13% of the respondents who have attained a secondary level of education, none of them uses the internet as a source of information. Another probable explanation is the rural setting in which the study was undertaken where access to electricity to power a gadget like a computer is not available. Affordability could also be an issue since majority of the respondents earned less than Ksh 5000 per month at 85% (Figure 4.2)

The use of CDs/DVDs/Video tapes to source agricultural information is very low. Indeed, it is only two respondents that have ever watched a CD on agricultural production and technologies. The awareness on this potential source is very low. A number of respondents have watched CDs/DVDs on music but are not aware that the same is available as a source of agricultural information.

In terms of the use of database, only one respondent has ever used this source to access to access agricultural information. Further probing revealed that the respondent had actually accessed the information on organic methods of pest & disease control being promoted by OISAT. This was by watching a CD-ROM that had been issued to a group in neighbouring Kyuso district where the UNDP was promoting access to agricultural information through the use of the CD-ROM, the group having been provided with the CD-ROM and a computer.

These findings are similar to the study done in Tanzania on knowledge management approaches in managing agricultural indigenous and exogenous knowledge (Lwoga 2010) where it was established that farmers mainly used radio (89%) to acquire indigenous knowledge in the surveyed communities.

Other major ICTs were cell phones (47.6%) and television (36.6%). Audiocassettes (8.5%), e-mail (7.3%), internet (6.1%), video cassettes (3.7%) and film shows (3.7%) were less used to acquire IK in the communities. The trend was similar for exogenous knowledge although there was some slight improvement; most farmers (96.3 %) used radio to access exogenous knowledge on farming systems.

Other major ICTs were cell phones (44.1 %) and television (39.8%), while e-mail (7.5%) and internet (5.6%) still had very low use.

It is clear from this study that the use of internet and associated technology to acquire indigenous knowledge was low in spite of the availability of telecentres in the surveyed communities.

The possible explanation again given was probably due to poor ICT infrastructure, lack of electricity, language barrier, financial constraints limiting the purchase ICTs, and lack of awareness, culture and skills on how to use advanced ICTs such as the internet.

It is also important to mention the non-ICT sources of agricultural information since their use to access agricultural information is very high compared to the ICT sources.

The results of the study show that the informal contact of friends, neighbours relatives and family as the main source of information to the respondents at 99% (table 4.7).

These are the people the respondents interact with on a daily basis. It is expected that they share any information and knowledge they have among themselves before they reach out to other sources.

Another important source of agricultural information is agricultural extension at 94%. This source comprises mainly of the public extension system of agricultural officers in the Ministry of Agriculture.

But also some NGOs such as Action Aid are supplementing the Government effort to reach out sorghum farmers. As already mentioned, concerted effort is being put by the government in the study area to promote the growing of Gadam sorghum. This is after the EABL started to use the crop to supplement barley in beer making. It is also a drought tolerant crop that can do very well in the district. The effort to promote the crop is also being supported by other non-governmental organization in the district e.g

Action Aid in Kakongo sub-location. Most of the farmers interviewed have at least attended a meeting/baraza organized by the Agricultural Extension Officers to promote sorghum growing.

Thus, there is high interaction between extension and farmers in terms of barazas and seminars in an effort to campaign for more acreage to be put under the crop. May be the figure may not be as high if the respondents were women farmers growing another crop rather than sorghum.

It is also important to mention innovative/progressive farmers as another important source of agricultural information at 55%. This source involves farmers visiting other farmers who have adopted and excelled in certain farming technologies to learn from them. The source was more prominent in Kiomo division where a programme by UNDP promoted farmer to farmer extension in the study area in the 1990's.

The results on non-ICT sources of agricultural information are similar to the findings of a study by Lwoga in 2010 on the knowledge management approaches in managing agricultural indigenous and exogenous knowledge in Tanzania where it was found out that 93% of indigenous knowledge is acquired from family/relatives and 86% from neighbours/friends.

A study in Kirinyaga district by Munyua et al (2009) also indicated that about 89.9% shared the information they accessed with other members of the community including other farmers, neighbours and friends, other groups, leaders and visitors. This further confirms the importance of the informal contact of friends and neighbours as a source of agricultural information. The study also rated extension as the most important source of agricultural information. Extension services from the Ministry of Agriculture and information from model farmers were perceived to be closer and more accessible to farmers than other sources (Munyua et al 2009).

In another study done in India in 2009 on strengthening pluralistic agricultural information delivery system, Adhuguru et al looked at the various sources of information in the awareness-trial-adoption process. It was found that 65% of the famers reached the extension workers at the trail stage as the

source of information. In terms of sources of information at the various stages of the crop production cycle, extension again featured prominently at 55% as the main source of information on seed.

This is an indicator of the way extension is regarded as a source of information in other countries although these figures are not as high as 94% in the study area.

This study also identified informal contact in providing information on animal health care (54%). Again, it featured prominently at 85% in terms of promoting adoption in the awareness-trial –adoption continuum. It means that it is a very important source when it comes to the promotion of a new technology/idea since farmers are more convinced about a technology that other farmers have already adopted as found out by Rogers and Showmaker when it comes to the diffusion of innovations.

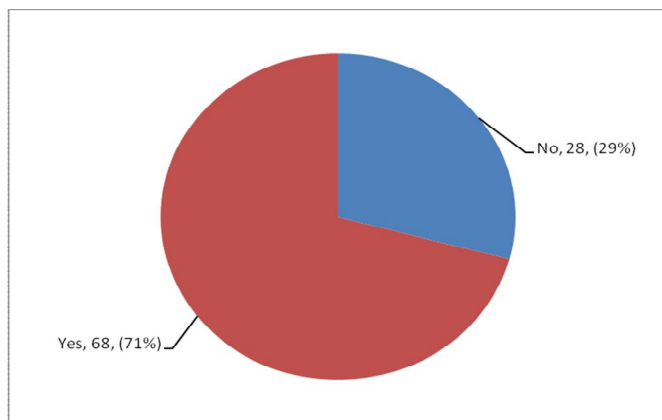
Objective 3 - To examine the accessibility and use of ICTs by smallholder women sorghum farmers- What is the extent of access and use of various ICTs by smallholder women sorghum farmers.

A primary purpose of ICTs is to provide an enabling environment for the generation of ideas, their dissemination and use. ICTs facilitate the creation of networks for sharing information and knowledge. ICT provide a rapid and efficient means of sharing and accessing information across the entire agriculture value chain.

It is widely accepted that the use of all sort of ICTs is critical for bringing progressive development in rural area and even some developed countries have recognized ICT and particularly internet access as a basic human necessity (Nungu et al 2011).

The findings from the study indicate that a majority of the women sorghum farmers have ever used ICTs to access information in agriculture at 71% (Figure 4.6)

Figure 4.6 Use of ICTs to access agricultural information



However, this usage mainly involves the use of radio that is available to 78% of the respondents and cell phone which is available to 65% of the respondents (table 4.4 & 4.7).

The usage of the other ICTs is very low with TV at 8 %, databases at 1% and none of the respondents has used the internet to access agricultural information (table 4.4 & 4.7).

This could be attributed to the low levels of education in the study area with the majority having a primary level of education and a good proportion having not gone to school at all. The use of more sophisticated ICTs requires a high level of formal education. In addition, the levels of income in the area

are low hence investing in the required ICT infrastructure in terms of computers, modems and source of power is a challenge.

The findings are similar with the findings of a study in Tanzania on access and use of agricultural in Tanzania where 89% of the respondents used ICTs to access agricultural information (Lwoga 2010). Of the ICTs available, the radio was the most used at 96.3% and the cello phone at 44.1%.

Similar results were obtained in another study carried out in Tanzania on building sustainable broadband networks in rural area (Nungu et al 2011) where it was found out that even though many rural areas enjoy access to mobile phone networks, local broadband communication services are almost non-existence.

The ITU 2009 report also points out ‘a dramatic broadband divide’ where the internet use in Africa on average is just 9.6% of the total population compared to 23% worldwide. Furthermore, of the 48 Africa’s sub-Saharan countries, 29 countries (60%) have a total internet usage of less than 3% and 15 countries (31%) have an internet usage of less than 1% (Summer 2011).

The low usage ICTs apart from radio and cello phone to access agricultural information is further confirmed by the low usage of ICT in accessing the different information types in sorghum production. It is only in marketing that the usage of ICTs is prevalent at 70% (table 4.10). Compare this with the high usage of non-ICTs sources of information to access information on sorghum (Table 4.12)

Table 4.10 Use of ICTs to access information on sorghum

Information on Sorghum that is accessed using ICTs

Access using ICT	Freq.	Percent
Land preparation	0	0.0
Suitable varieties	12	12.5
Pest and disease control	46	47.9
Soil fertility management	16	16.7
Finance and credit	27	28.1
Marketing	68	70.8
Post harvest management	40	41.7
Utilization	10	10.4
Others	0	0.0

Table 4.12 Information on sorghum accessed without using ICTs

Access of sorghum Information without ICT	Freq.	Percentage
Land preparation	68	70.8
Suitable varieties	65	67.7
Pest and disease control	45	46.9
Soil fertility management	55	57.3
Finance and credit	47	49.0
Marketing	5	5.2
Post harvest management	33	34.4
Utilization	59	61.5
Others	2	2.1

Another interesting finding is the low usage of mobile phone to send SMSs as a way of sourcing agricultural information (Table 4.14)

Table 4.13 Methods of accessing agricultural information

Access of the Agricultural Information	Freq.	Percent
Consult agricultural extension workers	89	92.7
Read agricultural publications	33	34.4
Attend seminars/workshops/conferences	61	63.5
Ask fellow friends, neighbours, relatives, family	94	98.9
Ask progressive/innovative farmers	53	55.2
Listen to radio programmes	70	72.9
Watch the TV	9	9.4
SMS from phone	1	1.0
Browse from internet	0	0.0
Other	0	0.0

This is despite the high ownership of mobile phones by the respondents which stood at 65% (Table 4.4). This is an area that can be enhanced to improved usage of ICTs to access information in the study area.

Objective 4- To examine the influence of selected socio-economic characteristics of smallholder women sorghum farmers on use of ICTs - How do social-economic characteristics of smallholder women farmers affect their use of ICTs?

The socio-economic and demographic factors of age, level of education, income and marital were considered for their effect on the use of ICTs by women farmers.

Four sub-hypothesis were generated to answer the above research question:-

Ho1: The age of the small holder women sorghum farmers does not affect the use of ICTs

Ho2: The level of education of the small holder women sorghum farmers does not affect the use of ICTs

Ho3: The level of income of the small holder women sorghum farmers does not affect the use of ICTs.

Ho4: The marital status of the small holder women farmers does not affect the use of ICTs

A chi-square test was done to test the hypothesis.

Table 4.14: The results of a chi-square test on the use of ICTs to access agricultural information

		Use of ICT as a source of agricultural information				Chi-square	P-value
		No		Yes			
		Frequency	%	Frequency	%		
age grouped	<30	0	0.0%	6	8.8%	42.2	<0.001
	30-39	2	7.1%	24	35.3%		
	40-49	1	3.6%	27	39.7%		
	50+	25	89.3%	11	16.2%		
Level of education	None	25	89.3%	3	4.4%	69.2	<0.001
	primary level	2	7.1%	53	77.9%		
	Secondary level	1	3.6%	12	17.6%		
	Tertiary and above	0	0.0%	0	0.0%		
income bracket	<1000	16	57.1%	13	19.1%	20.5	<0.001
	1001-2500	11	39.3%	24	35.3%		
	2501-5000	0	0.0%	18	26.5%		
	5001-7500	1	3.6%	8	11.8%		
	7501-10000	0	0.0%	5	7.4%		
Marital Status	Single	2	2.0%	4	4.0%	6.9	0.34
	Married	22	23.0%	63	65%		
	Widowed	4	4.0%	1	1%		

The results of the Chi-square test showed that there was a significant association between the use of ICT and age of the respondent, level of education and income at p-values of <0.001. However there was no significant association between the marital status and use of ICTs.

Older women farmers were less likely to use ICTs to source for agricultural information or use channels that are based on ICTs. This is different from the younger women farmers whose use of ICTs is high. Indeed, the age category of less than 30 years showed 100% use of ICTs to access agriculture information.

Again, the women farmers with no formal education are less likely to use ICTs to access agricultural information. Majority of farmers who have had formal education are using ICTs to access agricultural information.

Furthermore, the lesser the income, the less likely the women farmers were using ICTs.

The majority of the women farmers using ICTs were generally in the higher income bracket (>2500)

The use of ICTs is a recent technology which is used more by the younger generation. The World Bank glossary on the definition of ICTs indicates there is a trend towards more sophisticated ICT sources and channels.

Indeed, there exists a digital divide in terms of age when it comes to the use of ICTs especially those involving the use of more complex ICT technologies such as the computers. Such technologies favour the younger generation in terms of their design. Hence the use of ICTs is more common with the younger women farmers. To promote the use of ICT, less complex ICTs such as the radio and TV should be promoted unlike the use of internet and associated technology.

The level of education is also important in determining the use of ICTs. Some ICT technologies are complex to handle and require education and exposure. They require specific trainings on ICTs and skills development. Again, the promotion of less complex ICTs will positively influence their use by the women farmers who have little formal education.

Income determines the ability to purchase the communication equipment to use. Thus income is critical in determining the communication channel available to a farmer. It also determines the kind of information source accessible to the women farmers. ICT sources such the use of computers and associated technologies such as the internet and databases are more expensive compared contacting an extension agent. Thus, to improve the use of ICTs by women farmers would need a deliberate effort to improve on the farm income through improved farm productivity. There should also be a focus on increasing on improving the affordability of ICT equipment through reduces prices.

The factors that were univariately significant were taken to logistic regression to generate a model to assess the impact of these factors on the likelihood of the respondents using ICTs.

Table 4.15 below presents a summary of the raw score binary regression coefficients, Wald statistics, odd ratios along with a 95% CI.

Table 4.15: Logistic regression predicting the likelihood of the use of ICTs to access agricultural information

Main Factor	factor levels	beta (B)	SE	Wald	df	p value	Odds ratio	95% C.I for EXP(B)	
								Lower	Upper
Age	<30	-18.379	14867.930	.000	1	.999	.000	0.000	
	30-39	-17.186	14867.930	.000	1	.999	.000	0.000	
	40-49	-20.092	14867.930	.000	1	.999	.000	0.000	
Education	None	3.989	1.117	12.765	1	.000	54.023	6.055	482.001
	Primary level	2.465	1.777	1.924	1	.165	11.766	.361	383.017
Income	<1000	-.025	1.048	.001	1	.981	.975	.125	7.603
	1001-2500	18.406	8735.694	.000	1	.998	98584980.23	0.000	
	2501-5000	-1.146	1.785	.413	1	.521	.318	.010	10.506
	5001-7500	19.378	15453.527	.000	1	.999	260345447.5	0.000	
	Constant	17.652	14867.930	.000	1	.999	46343972.405		

The results show that at 95% confidence interval, it is only the level of education that significantly (p value = 0.001) predicts the likelihood of the use of ICT among the women sorghum farmers sampled. The model as a whole explained between 56.7 % (Cox and Snell R square) and 80.9% (Nagelkerke R squared) of the variance in the use of ICTs and correctly classified 94.8 % cases.

The increase of the level of education from none to the next level increases the use of ICT by 54% among the sampled sorghum farmers.

4.9. Summary of results

- The income levels in the study area are generally low.

- The levels of education in the area are also low.

- The use of ICTs in accessing agricultural information is low except for radio and cello-phone.

- Income, level of education and age have an influence on use of ICTs.

- In building a model, it only the level of education of the respondents that predicts the likelihood of the use of ICT among the sampled women farmers.

CHAPTER FIVE

SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

5.1 Summary of findings

This study investigated the access to agricultural information by smallholder women sorghum farmers. The study found that the information dissemination channel available to most women farmers is meetings/barazas that is available to 99% of the respondents. This is followed by the radio at 78%, cello-phone is available to 65% of the respondents, trainings/workshops to 61% and progressive farmers to 54% of the respondents. The use of the TV and CDs to disseminate agricultural information is low and available to less than 10% of the women farmers. The use of agricultural publications to disseminate agricultural information stands at 30% and none of the respondents uses the internet to access agricultural information. Therefore, the most useful channels in disseminating agricultural information to the women farmers is meetings/barazas and the radio. Most of the women farmers do not use ICTs to access agricultural information. The majority of the women farmers do not use agricultural publications to access agricultural information.

In terms of the ICT sources of agricultural information accessible by smallholder women farmers, the study found that majority of the women farmers do not use ICTs to source for agricultural information with an exception of the radio whose usage is 77% of the respondents. The TV is used by only 8% of the women farmers, the CDs/DVDs by 2% of the women farmers, the data bases by 1% and none of the women farmers used the internet to source for agricultural information. The radio is thus the main ICT source of agricultural information. Most of the women farmers use the non-ICT sources to access agricultural information with the informal contact of friends/neighbours/relatives being the most useful at 99%, followed by extension agents at 94%, trainings/workshops at 67% and progressive farmers at 55%.

On the extent the extent of use and accessibility of ICTs by smallholder women farmers, the findings of the study showed that majority of the women farmers have ever used ICTs to access agricultural

information at 71% of the respondents. However the usage of ICTs is limited to mainly the radio and the cello-phone at 78% and 65% respectively. The cello-phone is used to make mainly calls to extension agents and other farmers and rarely used to source for agricultural information through the SMSs system. Indeed, it is only 1% of the respondents who have ever sent SMSs to get agricultural information. Again, when it comes to access of information on sorghum, the ICTs are mainly used to access information on marketing at 70% of the respondents. Few women farmers are using ICTs to access other information on sorghum such as land preparation, suitable varieties, soil fertility management, finance/credit, post harvest management and utilization at less than 50% of the respondents.

The study also found out that social- demographic characteristics of women farmers affect their use of ICTs. The results of a Chi-square test showed that there was a significant association between the use of ICT and age of the respondent, level of education and income at p-values of <0.001 . Hence interventions that improve affordability, level of education and the ability to use ICTs among the women farmers are critical. The results also show that at 95% confidence interval, it is only the level of education that significantly (p value = 0.001) predicts the likelihood of the use of ICTs among the women sorghum farmers sampled.

5.2 Conclusion

It can be concluded that access to relevant information and knowledge is very important for improvement of the agricultural performance and improve livelihoods in the rural areas Africa. Various studies have revealed that there is a positive relationship between the increased flow of knowledge and information and agricultural development. The advancements in ICTs provide an opportunity for developing countries to harness and utilize information to improve productivity in the agriculture.

The findings of the study show that the use of ICTs as a source of agricultural information is low.

It is only the radio and cell phones that are used as important sources and channels of information dissemination in the surveyed communities, while internet and associated technology has low use.

The women farmers continue to source most of their information from informal contacts (neighbours, friends and family) followed by public extension services.

The traditional channels of information dissemination such as meetings/barazas and progressive farmers are still very important. Indeed, they are critical in persuading and convincing farmers about new technologies. Currently, they are the channels that are available to most women farmers.

The use of ICTs is very important in facilitating rapid, efficient and cost-effective learning and information sharing. Its impact is greatest in urban areas of industrialized countries, yet, ICT is just as important for sustainable rural and agricultural development. Successful application of ICT requires improved awareness among all development actors. In order to realize these benefits, access to ICTs in Africa must be affordable and within the ability of the majority of the farmers to and use. The use of ICTs in agriculture can lead to poverty reduction through increased and improved productivity and access to markets.

Further, there is need for coordination of all stakeholders in ICT and other sectors such as health, education, science and technology and agriculture to ensure that synergy is created in the efforts to promote the use of ICT with the common aim of reducing poverty in Africa.

5.3 Policy Recommendations

In order to promote rapid and efficient access to agricultural information, the use of a multiple source and channels of information is recommended. Researchers, extension agents and agricultural support services should use multiple sources of information (face-to-face, print and ICTs) to deliver relevant information to women farmers. Print formats (such as leaflets, newsletters, books) and ICTs such as radio, TV, cello phone, internet and e-mails should also be used to share and distribute knowledge among farming communities in order to build on the gains made so far.

However, since the use of ICTs is gaining prominence globally and in all sectors of the economy in most countries, a special focus should be given to their use in agriculture. The findings of the study indicate

that the realization of the full benefits of ICTs use in agriculture is linked to affordability, the ability to use and relevant ICT skills development.

In order to achieve the diffusion in the use ICTs and their contribution to the transformation of agriculture, the following recommendations are also proposed:

1. In the long run, encourage mainstreaming of ICTs in the education systems starting from the primary schools. The study has revealed that there is a positive correlation between the level of education and the use of ICTs. A change of the level of education from none to primary level increases the use of ICTs by 54%. Education enables the development of skills in the use of ICTS. Training programmes that focus on use and application of ICTs in the agriculture sector should be promoted.

However, in the short run, the use of less sophisticated ICTs such as radio, TV and cell-phones should be promoted in the study area since the levels of education in the area are low. This is as opposed to the promotion more sophisticated ICTs such as the use of internet and databases.

2. The use of ICTs such as the internet requires access to computers or high end mobile phones. But due to low income and poverty in the rural areas, the initial focus should be group users that involve sharing rather than individual users. This will improve affordability since the income levels of the women farmers in the study area are low. The study established that over 85% of the smallholder women farmers in the study area belong to rural organizations such as women groups, church groups, burial societies and merry-go-round groups. The ICT access centres could be established through these organized groups. It can also involve establishing the centres of access in the village polytechnics and agricultural institutions such as the ATCs that can respond to the specialized needs of the agriculture. A starting point could be enhancing the use of CD/DVDs/CD-ROM on agriculture by providing groups accessing electricity with computers and those without electricity with solar powered laptops.

3. Promoting initiatives that seek to promote the use of the radio and cell phones which are more available in the study area compared to the other ICTs. Such⁶⁷ initiatives should the use mobile phones to access

agricultural information via the SMS in addition to making calls. Some agricultural organizations such as KEPHIS, KACE and I-Cow have developed systems to access information using SMS but the women farmers are not aware of such systems.

The use of the radio can be enhanced by supporting radio stations to air more agricultural programmes. The public and private organizations should promote the use radio that combines vernacular languages and other languages to disseminate relevant knowledge to farmers. This is in addition to incorporating interactive segments with the farmers such as the call-in/SMS systems. The same should be done for TV stations.

This way, information and knowledge flow to smallholder women farmers, who play a critical role in agricultural production, will be enhanced for timely decisions for enhanced food security and poverty alleviation.

Finally, further research should be done to assess the access of agricultural information by women farmers in other sorghum growing areas of the country. Furthermore, a different crop other than sorghum can be used as the basis of selecting the study sample.

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Appendices

Appendix 1 Equivalent Weights of Commonly Used Containers

Container	Weight in Kilograms
2 kg Kimbo tin	2
1 debe	20
1 bag	90

Appendix 2 Equivalent measures for area used

1 Hectare = 10,000M²

1 acre = 4,000 M²

1 m² = 10.7691 square ft

1 acre = 43,000 square ft

APPENDIX 3: Questionnaire for farmers

ASSESSMENT OF WOMEN SMALLHOLDER SORGHUM FARMERS ACCESS TO AGRICULTURAL INFORMATION IN MWINGI CENTRAL DISTRICT, KENYA

PREAMBLE

Dear Sir/Madam

My name is Patrick Mutugi Kirimi and I am studying for a master’s degree at the University of Nairobi.

I would appreciate your contribution to this study on women farmers’ access to agricultural information in Mwingi Central District. The objective of the study is to determine the channels preferred by women farmers in accessing agricultural information. The information you provide will be confidential according to the research regulations of the University of Nairobi. Thank you for your co-operation.

Instructions: *Please tick in the appropriate box or write in the provided space.*

Name of the interviewer

Questionnaire No..... Date Time Mobile No.

Name of the respondent.

Surname:	Other names:	Mobile no.	
Division:	Location:	Sub-location:	Village:

a) Social economic characteristics of the respondent

Age(Year s)	Level of Education	Marital status	Training on crop and livestock production
	<input type="checkbox"/> None <input type="checkbox"/> Adult Education <input type="checkbox"/> Completed Primary level <input type="checkbox"/> Completed Secondary(O-level) <input type="checkbox"/> Completed High school level(A-level) <input type="checkbox"/> Some additional training e.g Diploma <input type="checkbox"/> Undergraduate <input type="checkbox"/> Post Graduate] <input type="checkbox"/> Other(specify).....	<input type="checkbox"/> Single <input type="checkbox"/> Married <input type="checkbox"/> Separated <input type="checkbox"/> Windowed <input type="checkbox"/> Divorced	<input type="checkbox"/> Yes <input type="checkbox"/> No

1. Occupation
 - Farmer
 - Salaried employment(Teacher, Public servant)
 - Business person
 - Casual worker
 - Other (Specify)

2. Monthly income (in Ksh).....

3. Family size
 - 1-3
 - 4-6
 - 7-10
 - >10

4. What is the size of your farm (acres)

5. Length of farming experience (years).

6. Do you grow sorghum?
 - Yes
 - No

7. What acreage do you grow

8. How much sorghum did you harvest last season?

9. What work do women do in sorghum production?
 - Land preparation
 - Soil conservation
 - Planting
 - Weeding
 - Harvesting
 - Threshing & Winnowing
 - Transportation
 - Storage
 - Marketing
 - Other tasks by women (Specify)

10. What work do men do in sorghum production?
 - Land preparation
 - Soil conservation
 - Planting
 - Weeding
 - Harvesting
 - Threshing & Winnowing
 - Transportation
 - Storage
 - Marketing
 - Other tasks by men (Specify)75.....

b) Information dissemination channels

11. Participation and membership in rural organizations

- Burial society
- Church group
- Farmer’s group
- Women group
- Co-operative group
- Other (specify)

12. Indicate which of the following information dissemination channels are available to you/used to deliver agricultural information to you?

- Radio
- TV
- Cello phone
- Print media (Agricultural publications e,g pamphlets, books, Journals, newsletters)
- Electronic mode-Videos/tapes/CDs/DVDs
- Internet
- Meetings and barazas
- Progressive/Contact/Innovative farmers
- Trainings and workshops
- Others (specify)

13. How do you rate the usefulness of the channels used to you?

Channel	Extremely Useful	Very useful	Useful	Somewhat useful	Not useful
Radio					
TV					
Cello phone					
Print media (Agricultural publications e.g pamphlets, books, journals, newsletters)					
Electronic media(Videos/tapes/CDs/DVDs)					
Internet					
Meetings and barazas					
Progressive/Innovative/Contact farmers					
Trainings and Workshops					
Others(specify)					

14. Indicate the preferred Channels on a scale of 1-10 (1= the most preferred, 10= the least preferred)

Channel	Rating									
	1	2	3	4	5	6	7	8	9	10
Radio										
TV										
Cell phone										
Print media(Agricultural publications e.g pamphlets, books, journals, newsletters)										
Electronic media(Videos, tapes, CDs, DVDs)										
Internet										
Meetings and barazas										
Progressive/Innovative/Contact farmers										
Trainings and workshops										
Other (specify)										

15. For the Print media (Agricultural publications), please indicate the type of printed material that you mostly prefer.

Pamphlets	
Books	
Newsletters	
Journals	
Newspapers	

16. For the electronic media, please indicate the type of electronic material you mostly prefer.

Video	
Tapes	
CDs	
DVDs	

17. Indicate the factors that influence your choice of channels of communication

- Ability to understand the format
- Ability to read
- Accessibility/distance
- Cost
- Others (specify)

18. Rate the importance of the factors identified above in your choice of the channel

Factor	Extremely important	Very important	Important	Not important
Ability to understand the format				
Ability to read				
Accessibility/distance				
Cost				
Other (specify)				

d) Sources of agricultural information

19. What are the main sources of agricultural information that you use?

- Agricultural publications(pamphlets, books, journals, newsletters, newspapers)
- Agricultural Extension workers
- Trainings/workshops/seminars
- Informal contact(Friends, neighbours, relatives, family)
- Progressive/Contact/Innovative famers
- Radio programmes
- TV programmes
- CDs/DVDs/Videos/Tapes
- Internet
- Databases
- Nothing/own knowledge
- Others (specify)

20. For the sources identified above, rate their usefulness/effectiveness as sources of information?

Source	Extremely Useful	Very useful	Useful	Somewhat useful	Not useful
Agricultural publications (pamphlets, books, journals, newsletters, newspapers)					
Agricultural Extension workers					
Trainings/workshops/seminars					
Informal contacts(Friends, neighbours, relatives, family)					
Progressive/Contact/Innovative farmers					
Radio programmes					
TV programmes					
CDs/DVDs/Videos/Tapes					
Internet					
Databases					
Nothing/own knowledge					
Others(Specify).....					

21. Rank the sources of information you need on a scale of 1-12 in terms of importance (1= most important, 12= least Important)

Source of information	Rank											
	1	2	3	4	5	6	7	8	9	10	11	12
Agricultural publications (pamphlets, books, journals, newsletters, newspapers)												
Agricultural Extension workers												
Trainings/workshops/seminars												
Informal contacts(Friends, neighbours, relatives, family)												
Progressive/Contact/Innovative farmers												
Radio programmes												
TV programmes												
CDs/DVDs/Videos/Tapes												
Internet												
Databases												
Nothing/own knowledge												
Others (Specify).....												

22. How do access the agricultural information you need?

- Consult extension workers
- Read agricultural publications
- Attend seminars/workshops/Conferences
- Ask fellow friends, neighbours, relatives or family
- Ask progressive/contact/innovative farmers
- Listen to radio programmes
- Watch the TV
- SMS from phone
- Browse from internet
- Other (specify)

23. Have you ever used ICTs as a source of agricultural information?

- Yes
- No(Skip to question 28)

24. What advantages do ICTs have to you as sources on agricultural information?

- Easy to use
- Convenient to use
- Fast in accessing information
- Are relatively cheap
- Are very rich in information
- Reach various sources of information
- Others(Specify)

.....

25. What information on sorghum are you able to access without using ICTs?

- Land preparation
- Suitable varieties
- Pest and disease control
- Soil fertility management
- Finance and credit
- Marketing
- Post harvest management
- Utilization
- Others (Specify)

26. What information on sorghum are you able to access using ICTs?

- Land preparation
- Suitable varieties
- Pest and disease control
- Soil fertility management
- Finance and credit
- Marketing
- Post harvest management
- Utilization
- Others (Specify)

27. Please indicate what other information you are able to access using ICTs and for what crop

Crop	Information sourced using ICTs

28. What barriers/challenges do you face in accessing agricultural information?

- Illiteracy
- ICT Illiteracy
- Language in which information is usually presented
- Cost
- Lack of time
- Unavailability of the sources/channels
- Social-cultural (Tradition, religion)
- Poor infrastructure
- Formats of information presentation
- Ignorance
- Other (specify)

29. Please explain the social- cultural challenges identified in question 28 above, if any.

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30. Please explain the infrastructure challenges identified in question 28 above, if any.

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Appendix 4: Questions for Field Extension staff in the district

ASSESSMENT OF WOMEN SMALLHOLDER SORGHUM FARMERS ACCESS TO AGRICULTURAL INFORMATION IN MWINGI CENTRAL DISTRICT, KENYA

PREAMBLE

Dear Sir/Madam

Hello. I am Patrick Mutugi Kirimi and I am studying for a master’s degree at the University of Nairobi.

I would appreciate your contribution to this study on Women sorghum farmers access to agricultural information in Mwingi Central District. The information you provide will be confidential according to the research regulations of the University of Nairobi. Thank you for your co-operation.

Instructions: *Write in the provided space.*

Questionnaire No.....Date Time Mobile No

Name of the respondent.

Surname:	Other names:	Mobile no.
Sex:	Position:	

- 1. For how long have you operated in this area?
.....
- 2. As an extension worker what activities are you involved in?
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.....
.....
.....
- 3. How do you meet your role as an agriculture information support system?
.....
.....
.....
- 4. May you please comment on participation in extension programmes by small holder farmers particularly women?
.....
.....
.....

5. Do you think information and abilities to access that information also have a role in agriculture productivity?

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.....
.....

6. How do you ensure that there is access to agricultural information particularly for women?

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.....
.....

7. From what sources do farmers in your area get the agricultural information they need

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8. What have been the challenges that you faced in trying to enhance agricultural information availability?

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9. What channels do you use to deliver the information the farmers require

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10. What are the sorghum varieties that farmers grow in your area

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.....

11. What could be the reason for low sorghum yields in your area

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12. Are there any other comments that you would want to make that are not covered in this questionnaire?

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Appendix 5: Questions to the District Agricultural Officer/District SMS

ASSESSMENT OF WOMEN SMALLHOLDER SORGHUM FARMERS ACCESS TO AGRICULTURAL INFORMATION IN MWINGI CENTRAL DISTRICT, KENYA

PREAMBLE

Dear Sir/Madam

Hello. I am Patrick Mutugi Kirimi and I am studying for a master's degree at the University of Nairobi.

I would appreciate your contribution to this study on Women sorghum farmers access to agricultural information in Mwingi Central District. The information you provide will be confidential according to the research regulations of the University of Nairobi. Thank you for your co-operation.

Instructions: Write in the provided space.

Name of the respondent.

Surname:	Other names:	Mobile no.
Sex:	Position:	

Background information about Mwingi Central district

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2. What is the government's position on access to agricultural information?

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3. Is there available blue print for reference?.....

4. What is the gender and age distribution of extension officers in Mwingi Central district?

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.....

5. How are female and young extension officers received?

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.....

6. How accessible are extension officers?

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7. Do you think information and abilities to access agricultural information also have a role in agriculture and food security?

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.....
.....

8. What challenges do farmers face in access to agricultural information

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.....

7. How do you ensure that there is adequate access to agricultural information particularly for female farmers?

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8.What are the main sources of agricultural information for farmers in your district ?

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9. What are the main channels and methodologies that you use to deliver agricultural information to your farmers

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.....
.....

10. What are the sorghum varieties that farmers grow in your district?

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.....
.....

11. What is the acreage of the crop in the district.....

12. What are the yields of sorghum per hectare and why are they low compared to the national average of 8 bags

.....

13. Are there any other comments that you would want to make that are not covered in this questionnaire?

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