ASSESSMENT OF INFORMATION AND COMMUNICATION TOOLS (ICTs) USED IN THE DIFFUSION OF AGRICULTURAL INNOVATIONS: A CASE STUDY OF CASSAVA PRODUCTION IN MSAMBWENI, KWALE COUNTY, KENYA

By

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DECLARATION

I, Timothy Gitau Gacheha, hereby declare that, this project report is my own work and has not been presented for award of degree in any other university.

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Signed

SUPERVISORS' APPROVAL

This project report has been submitted with our approval as University of Nairobi supervisors.

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DEDICATION

I dedicate this work to my wife Nduta and our children Kabura, Gacheha and Wambui for their support and encouragement during the study.

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God Bless You All.

ABSTRACT

In the coastal lowlands of Kenya, cassava is the second most important staple crop after maize. However, its productivity in the region is low due to various reasons which include the use of traditional low yielding varieties by farmers. The high perishability of the roots also limits the duration of handling the unprocessed root. To mitigate against the low productivity of the crop, there has been increased promotion of cassava production by the Ministry of Agriculture, Livestock and Fisheries through the introduction of improved high yielding and disease resistant varieties in the country. However, despite these interventions, there is lack of adequate extension services to offer timely information to farmers using information and communication tools (ICTs) available to them. Since information dissemination is crucial in enhancing and developing the adaptive capacities of all economies especially in rural areas to adopt new agricultural concepts for improved productivity, the use of ICTs can enhance the provision of extension services to farmers. This study was carried out to assess the Information and Communication Tools (ICTs) used in the diffusion of agricultural innovations and focused on cassava production in Msambweni sub-county of Kwale county. It was guided by four research objectives; to identify information sources available; to determine the ICTs available to the farmers; to establish the influence of farmers' socio-economic characteristics on the choice of ICTs and to evaluate the influence of ICTs on adoption of cassava farming. The study targeted a population of 3800 farmers in the sub-county involved in cassava production. Multistage sampling technique was applied to select 133 respondents from three sub-locations in three wards namely Kikoneni in Pogwe ward, Lungalunga in Vanga ward and Malambe in Nzombo ward. Semi-structured pre-tested questionnaires were administered to the respondents through face-to-face interviews. Data collected was entered into MS Excel sheet and analysed using Statistical Package for Social Sciences program and was presented using frequencies and percentage tables; and pie charts. Chi-square tests and correlation analysis were used to test the hypotheses and the association of the variables. The tests revealed that, significant relationships exist between the socio-economic characteristics of the farmers and ICTs use with a strong correlation; ($r = 0.863$, p-value = 0.011, $r^2 = 0.745$). Sources of information and use of ICTs had a strong correlation; ($r = 0.771$, p-value = 0.021, $r^2 = 0.594$). Availability of information and ICTs use among the farmers in the study had a strong correlation; ($r = 0.926$, p-value = 0.003, $r^2 = 0.857$). Other results indicated that, radio was the most widely used ICT by the farmers studied (69.9%) followed by mobile phones (33.1%) and television (26.3%). However, internet was found to be used by a negligent number of farmers (2.3%). Radio was mainly used due to its availability to the farmers as every farmer had a radio. Internet was rarely used due to inadequate electricity connectivity and limited number of computers in the study area. In conclusion, it is clear that there is significant influence of the ICTs used in information dissemination and the adoption of innovative methods of cassava farming. It is recommended that to enhance agricultural information transmission to the farmers, there should be effective use and application of the already available channels which are the radio, mobile phones and television. There is also need for the extension agents to be equipped with skills and internet facilities to enable them source and transfer agricultural information to farmers in the appropriate form and at the right time.

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ABBREVIATIONS AND ACRONYMS

ALRMP	Arid Lands Resource Management Project
ASAL	Arid and Semi-arid Lands
ASDSP	Agricultural Sector Development Support Program
EAAPP	East Africa Agricultural Productivity Project
FAO	Food and Agricultural Organization
ICTs	Information and Communication Tools
KALRO	Kenya Agricultural and Livestock Research Organization
KENFAP	Kenya National Federation of Agricultural Producers
KISCOL	Kwale Sugar Company Limited
NASEP	National Agricultural Sector Extension Policy
NGO	Non-Governmental Organization
SPSS	Statistical Package for Social Sciences
THVFCs	Traditional High Value Food Crops

CHAPTER ONE

INTRODUCTION

1.1 Background of the Study

Cassava *(Manihot esculenta, Crantz)*, is a staple food to about 500 million people in 80 countries worldwide, 39 of which are in Africa (FAO, 2004). The remaining countries are located in South and Central America, Asia and Oceania. It is an important famine reserve crop as it can grow in poor soils and withstand drought (FAO, 2004). Cassava is a native crop of Brazil but during the sixteenth and seventeenth centuries it was dispersed widely by the Portuguese in tropical and sub-tropical areas of Africa, Asia and the Caribbean. It soon became a staple food in many of these places because of its tolerance to drought, poor soil conditions and generally difficult crop environments.

Echebiri and Edba, (2008) indicate that, cassava provides a greater proportion of energy for low-income households than any other crop item in the tropical regions of Africa. Overall, it is the third most important source of calories in the tropics after maize and rice, (Food Safety Network, 2005). FAO, (2004) reports that, though the cassava tubers are rich in carbohydrates, mainly starch that is a major source of energy in these countries; they are of less nutritional value compared to cereals, legumes and other root crops such as yams. This is because the roots are deficient in proteins, fat, some minerals and vitamins. Further, the report adds that, the tubers and leaves are used as food sources. The starch portion of cassava tuber can also be extracted to make starch that is used as a non toxic thickening agent in the production of different food items like jellies, baby foods, glucose and confectioneries.

Cassava is an important crop that can offer food security to people in the developing countries that face persistence hunger and malnutrition. The Agricultural Sector Development Support Program (GoK, 2011) notes that, about ten million people in Kenya suffer from chronic food insecurity and nutrition. Out of this number, between two and four million people require emergency food assistance at any given time. Majority of these people are found in the arid and semi-arid lands (ASAL) of the country which are suitable for cassava production. This status has been partly brought about by weak research-extension-farmers linkages which have failed to disseminate suitable agricultural technologies to farmers, (GoK, 2012).

In the coastal lowlands of Kenya, cassava is the second most important staple crop after maize. However, its productivity in the region is low, at 10 tons/ha compared to the potential yield of 50-70 tons/Ha fresh root, (Gethi *et al*., 2008). One of the reasons for low productivity is the use of low yielding varieties. The high perishability of the roots also limits the duration of handling the unprocessed root. As a result of the poor productivity and the need to extend the root shelf life, there has been increased promotion of cassava production by the Ministry of Agriculture through the introduction of improved high yielding and disease resistant varieties (Gethi *et al*., 2008).

Another challenge that faces cassava farming is lack of adequate extension services to offer information to farmers at the right time using information and communication tools (ICTs) available to them. Okumu & Obora, (2013) observe that, information dissemination is crucial in enhancing and developing the adaptive capacities of all economies especially in rural areas to adopt new agricultural concepts for improved productivity. According to the United Nations

Development Programme (2012), ICTs include mobile telephones, community radios, television, video shows, information kiosks, farmer call-centers, Internet, web portals and video-conference. The use of ICT based agricultural extension can enhance the provision of extension services to farmers since information can be easily relayed to many farmers at the appropriate time and places enabling them make informed decisions about their farming business.

With an ICT system, there is increased efficiency in extension services since databases can be kept on relevant information and new research findings can be relayed to farmers as soon as they are released. ICTs also provide real time updates on market information giving farmers more bargaining power on product prices and adjustments of production plans according to market needs, (Adetumbi et al, 2013).

Information and communication tools (ICTs) can enhance communication, cooperation and ultimately adoption of innovations among the growing array of actors in agriculture, (Rao, 2004). Further, they can strengthen participatory communication from the traditional research-extension-farmer processes and be used to transfer and exchange information and knowledge among all stakeholders in the agricultural sector (Rao, 2004). Nikbakhsh, (2011) oberves that, ICTs increase interaction among the actors in agriculture as they facilitate collaboration and knowledge exchange nationally, regionally and globally. At the local level, they connect rural people to sources of information. In this way, they empower individuals, groups and communities to effectively access, share and use agricultural knowledge.

1.2 Problem Statement

Cassava production in Kenya is low as most cultivars grown by farmers are susceptible to endemic pests and diseases that attack the crop leading to substantial yield losses. Agricultural research has developed varieties that are tolerant to some diseases like cassava mosaic and cassava brown streak diseases. However, adoption of these new varieties is still low due to lack of information and low multiplication rates of planting materials, (GoK, 2007).

Kenya agricultural extension services still relies heavily on the use of interpersonal channels of communication, for example, farm visits, demonstrations, tours, field days, mobile training units and printed materials (GoK, 2012).

However, not much research has been done on the use of information and communication tools (ICTs) in the diffusion of agricultural technologies. Adoption of agricultural technologies depends primarily on access to information and the willingness and ability of farmers to use information channels available to them, (Murage, 2011). The use Information and Communication Tools improves communication and facilitates information flow.

1.3.1 Main Objective

The main objective of the study was to assess the information and communication tools (ICTs) used in diffusion of cassava information to farmers in Msambweni, Kwale County.

1.3.2 Specific Objectives

1) Identify the information sources available to the farmers in Msambweni Sub County.

2) To determine the ICTs available to the farmers in Msambweni Sub County.

3) Establish the influence of farmers' socio-economic characteristics on the choice of ICTs in Msambweni Sub-county.

4) Evaluate the influence of ICTs on adoption of cassava farming in Msambweni Sub County.

1.4 Hypotheses

1) The farmers' socio-economic characteristics do not influence the choice of ICTs they use in cassava farming

2) The use of ICTs influences the adoption of cassava technologies by farmers.

1.5 Operational Definition of Terms

Agriculture: A purposive activity of producing products from controlled use of characteristic plants, animals and other life forms. It is an economic activity that uses inputs or resources and for it to be meaningful, it should produce more value than that of the resources used.

Communication: Process of imparting, conveying or exchanging ideas, information and knowledge to create shared understanding.

Communication Channel: Medium through which a message is transmitted to the intended audience. Examples in this study are the radio, television and mobile phones

Diffusion: The process by which an innovation is communicated through certain channels over time among members of a social system.

Farmers: People that produce agricultural products from controlled use of characteristic plants and animals through use of resources like land, labour, physical and human capital

Information: Externalized and accessible knowledge that is channelled to farmers to enable them make decisions on their farming businesses.

Information Communication Tools: Any electronic device that is capable of accessing, storing, manipulating, retrieving and transferring information in a digital format. In agriculture, the commonly used ICTs are radios, televisions, computers, mobile phones and the internet.

Innovation: A practice that is perceived as new by members of a social system. In agriculture, innovations include new cultivation methods like minimum tillage, new crop varieties that have improved characteristics and new value addition initiatives.

Knowledge Management: The processes that make the right knowledge available to the right people, at the right time at the right place to create a conducive environment for acquisition, manipulation, storage, retrieval, transfer and sharing of the knowledge to enable individuals perform tasks to the best of their abilities.

Outcome: Likely or achieved change in the short term and medium term of an intervention

Population: Set of individuals, cases or objects with some common observable characteristics that the investigator wants to generalize the results of the study.

Sample: Set of respondents that is selected from a population for the purpose of the study.

System: Different components that are interrelated and work in harmony to achieve a common goal.

Variable: Measurable characteristic that assumes different values among the subjects of the study.

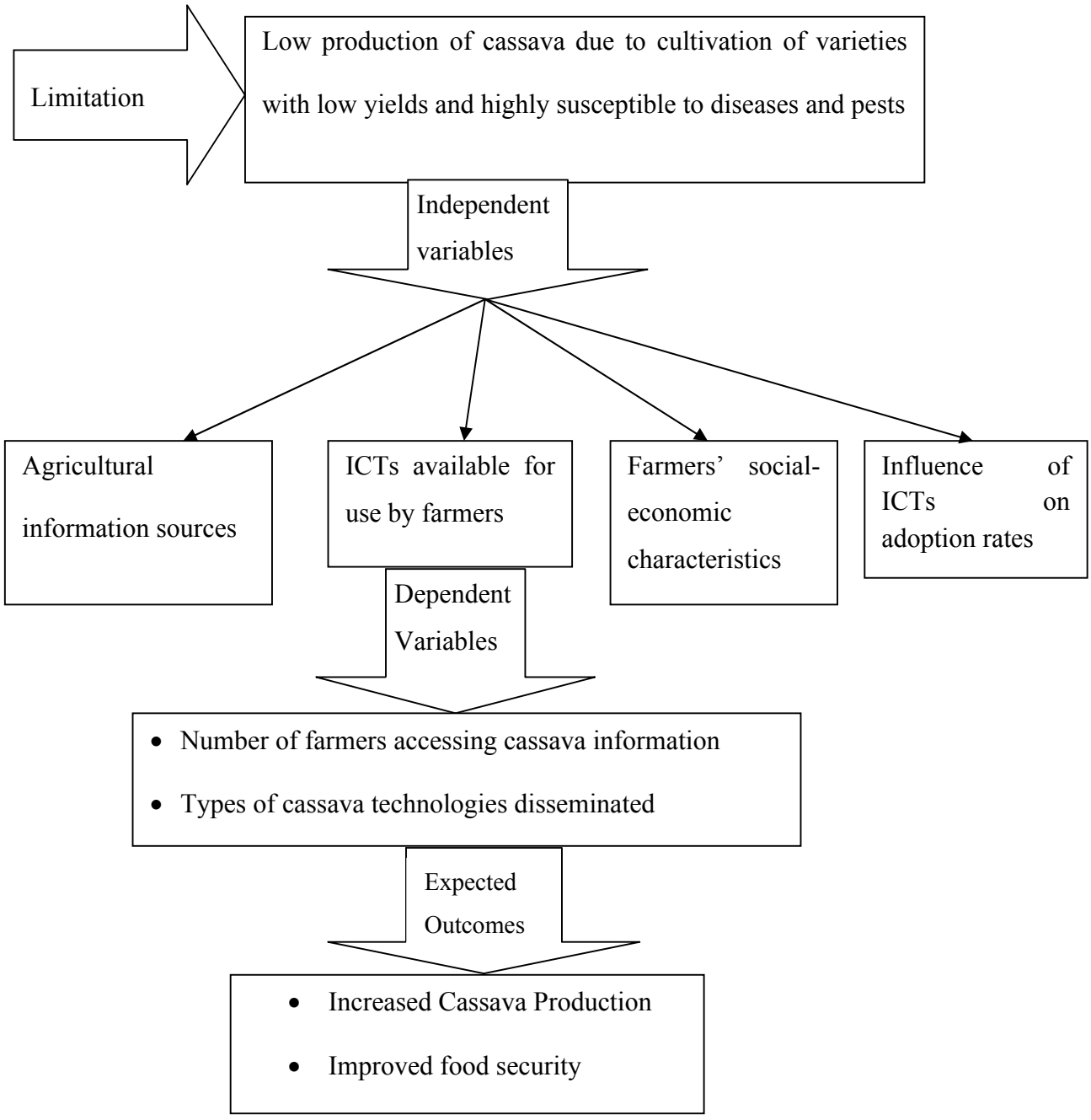

Figure 1.1: Conceptual Framework

CHAPTER TWO

LITERATURE REVIEW

2.1 Theoretical Framework

Three theories were applied as they were relevant to this study. The theories are the Diffusion of Innovations Theory, the Two Step Theory of Information flow and Structuration Theory of Technology.

2.1.1 Diffusion of Innovations Theory

Rogers (1997), defines diffusion as the 'process in which an innovation is communicated over certain channels over time among members of a social system'. The diffusion of innovations theory describes the process of communicating a new idea among the members of a community over time. The focus of the theory is not only on awareness and knowledge but also on attitude change and the decision making process that leads to the adoption or non-adoption of an innovation. Rogers (1997), further adds that, communication is a process in which participants create and share information with one another in order to reach a mutual understanding while a channel is the means by which a message gets from source to receiver.

Diffusion of innovations scholars' recognize five factors that determine the success of an innovation. First is the relative advantage of the innovation, (Majanja and Kiplagat, 2005). This is the degree to which an innovation is perceived by users as better than the idea it supersedes and is measured in terms that matter to those users, like economic advantage, social prestige, convenience or satisfaction. The greater the perceived relative advantage of an innovation, the

more rapid its rate of adoption is likely to be. Compared to traditional modes of communication and information dissemination, the adoption of ICTs in agriculture is more advantageous as they enable farmers to send and receive information about their farming business faster and cheaply. The second factor is compatibility with existing values and practices. This is the degree to which an innovation is perceived as being consistent with the values, past experiences and needs of potential adopters. An idea that is incompatible with the farmers' values, norms or practices will not be adopted as rapidly as an innovation that is compatible, (Majanja and Kiplagat, 2005).

The third factor that affects the diffusion of a technology is its complexity or simplicity and ease of use. This is the degree to which an innovation is perceived as difficult to understand and use. Farmers adopt new ideas that are simpler to understand more rapidly than innovations that require them to develop new skills and understandings. The fourth factor is trialability which is the degree to which an innovation can be experimented with on a limited basis. An innovation that can be experimented represents less uncertainty to the individual who is considering it. Farmers find it easier and are more willing to adopt technology that has been tried and tested by farmers elsewhere. Finally, a technology will diffuse faster if the users see the results. This is because visible results lower the uncertainty and also stimulate peer discussion of a new idea, as friends and neighbours of an adopter usually request information about it, (Majanja and Kiplagat, 2005).

In this study, cassava technologies along the value chain are innovations as they are perceived as new by the farmers. The use of the ICTs may facilitate or restrict farmers' adoption of the cassava technologies. The transfer of information through ICTs can lead to changes in ideas,

increased knowledge and changes in attitudes and practices of cassava farming. Where ICTs are not available, the farmers may lack the information to adopt new agricultural innovations.

2.1.2 Two Step Flow Theory of Information

In the two step flow theory, information flow from the source passes through intermediaries before it is received by the final consumers. In agricultural innovations, the information and knowledge is generated by the knowledge creating institution, for example KALRO and Universities and this passes through the extension staff of the Ministry of Agriculture, Livestock and Fisheries. Interactions among the research and extension staff through forums like research-extension advisory meetings determine how the information is articulated and passed on to the users of who include farmers, agro-processors and marketing agents.

2.1.3 Structuration Theory of Technology

The Structuration theory of technology examines how people, as they interact with a technology in their practices, enact structures which shape their use of that technology. The theory implies that social structure is the result of repeated interaction among the human agents, institutional rules and material resources. This theory can be used to develop an understanding about how human capital (the farmers) through interaction with material resources (ICTs) and institutionalized rules (government/donor policies, extension/research policies) can overcome the problems pertaining to the existing agricultural business. This theory can also be used to identify how social structures facilitate or restrict the farmers in making use of the modern technology in agriculture. Desanctis and Poole (1994), adapted this theory to study the interaction of groups and organizations with information technology. The two researchers emphasize the social aspects

on how technology is used. Groups and organizations using information technology for their work create perceptions about the role and utility of the technology and how it can be applied to their activities.

In this study, the communication and adoption of cassava technologies is influenced by the development of technologies that the farmers perceive as beneficial to them, the persuasiveness of the extension service, the policies of the national and county governments that promote farmers investment in agriculture. For example, the ongoing issuance of title deeds to farm owners may be a policy that will promote investment by farmers in their farm businesses. On adoption of new cassava varieties by farmers, their perceptions on the accrued benefits compared to the traditional varieties can influence the adoption rate. Nevertheless, the farmers' livelihoods and agricultural practices determine if farmers are going to use ICTs.

2.2 Cassava Farming in Kenya

In Kenya, cassava is widely cultivated in the arid and semi-arid lands of the country and has been promoted as food security crop by the government and private extension service providers. However, the perceptions that it is a poor man's crop require to be addressed so as to popularise it among the citizens of the country. This is due to the fact that, it can be used for human consumption, combined with other ingredients and processed into animal feeds, (GoK, 2007). The Policy further notes that, cassava production in the country has been decreasing due to shift to other crops that seem to give more returns, use of poor quality seed and endemic pests and diseases that attack the crop. The Ministry of Agriculture, Livestock and Fisheries, (2013) adds that, the area under cassava has been on the decline from 86,190 hectares in 1995 to 54,673

hectares in 2008. However, the area again increased to 69,169 hectares by June 2013. This was attributed to the efforts that have been made to develop cassava varieties that are high yielding and tolerant to pests and diseases. The annual production of cassava in the country stands at about 700,000 metric tons while the average production stands at 5 to 9 tons per/hectare which is low compared to a global average of 15 tons/hectare, (Ministry of Agriculture, Livestock and Fisheries, 2013). This low production of the crop has contributed to food insecurity in regions where it is widely cultivated. Cassava production in the country is further hampered by weak research-extension-farmer linkages due to insufficient funding to disseminate information on cassava technologies to farmers, marketing agents, processors and consumers.

2.3 Sources of the Agricultural Information Available to the Farmers

Information needs of farmers should be organized to meet their conditions and priorities, (Kiplagat & Ochola, 2005). This is important as farming practices change over time due to factors like population pressure, availability of markets, climate change, change in production technologies and channels of transferring information. In addition, farmers have priorities on the enterprises that they consider more useful than others. Their priorities are also dictated by other factors like the resources available, weather patterns, soil types, social set up, markets and information sources available to them.

Kiplagat & Ochola, (2005) further add that, farmers need information that is specific to their production activities. This include information on climate and weather patterns, agricultural inputs, agronomic practices, water harvesting, pests and diseases management, post harvest and

value addition technologies. In addition, farmers require to be updated on the agricultural policies and how they will affect their production activities.

Evanson and Mwabu (2001) add that, information is needed to improve production techniques of crops and livestock that include land preparation, crops spacing, appropriate varieties, pests management, livestock production, acquisition of credit facilities and marketing of agricultural products, farm record keeping and basic accounting procedures including calculations of profits and losses.

World Bank (2006) notes that, in the absence of information, smallholder producers face problems of adverse selection that limit the performance of agricultural commodities and input markets and in turn the participation of small producers in these markets. ICTs offer the ability to increase the amount of information provided to all participants in the agricultural sector and to decrease the cost of disseminating the information. Further, they facilitate knowledge sharing within and among a variety of agriculture networks including researchers, extension services, traders and farmers.

2.4 Agricultural Information and Communication Tools

According to Barret (2008), ICTs have been known to strengthen the capacities of rural development workers, farmers, farmer organizations and rural communities as a whole. They have become a cornerstone of agricultural development in contemporary times as they can increase the efficiency, productivity and sustainability of agricultural sector. The sector is important as it provides income and food for a large segment of the population in developing countries. ICTs play a key role in providing extension personnel and rural people with

information needed for their work that includes crop production, farm credit, input supply, pest and disease control, post-harvest techniques and improvement of market access. Barret (2008) further observes that, farmers demand for information has increased in recent years due to greater market instability and emergence of more complex production technologies. Lack of timely information can prevent good quality decisions and thus lower the efficiency of production among farmers. The decisions about what crops to grow can be attributed to differences in farmers' resource endowments, levels of knowledge and the environment. Cassava farmers require information on production technologies, access inputs at reasonable prices and link their product to markets.

Murage (2011) notes that, ICTs that are used to transfer agricultural information electronically in Kenya are the radio, television, internet, computers and mobile phones. Okumu & Obora (2013) add that, now more than ever, information dissemination is crucial in enhancing and developing the adaptive capacities of all economies especially in rural areas to adopt new agricultural concepts. They recommend that, such information should be transmitted to farmers using technologies available in their settings such as rural radios and other community based forums like religious services and gatherings like farmers' field days. In addition, the rapid development of mobile telephone technology and the internet has opened up new opportunities and avenues to be exploited fully for the enhancement of information transfer to the rural areas.

A strong agricultural extension linkage complimented by flawless information flow and enhanced by the effective use of ICTs can significantly boost agricultural production and improve rural livelihoods in developing countries, (Arokoyo, 2005). Agriculture being a

purposive activity of producing products from controlled use of characteristic plants, animals and other life forms like fungi is also an economic activity that uses inputs or resources and for it to be meaningful, it should produce more value than that of the resources used.

Mishra and Williams (2006) mentioned that from the perspective of agricultural knowledge and information systems, ICTs are useful tools in improving linkages between the research and agricultural extension systems. The experience of rural tele-centres in India has proved that ICT can help in enabling rural development workers to gather, store, retrieve, adapt, localize and disseminate a broad range of information needed by rural families. Mishra and Williams (2006) further note that, the role of ICT in enhancing food security in Chinese rural areas has been officially recognized and endorsed by the World Information Society.

ICTs have several forms that include mobile phone calls, short message services, radio and television programs, electronic mails and internet blogs. The use of these ICT forms are changing the way that farmers communicate, coordinate and collaborate among themselves and service providers. They enable them to exchange information across a unified area of interest that may be agricultural market prices, innovations, crop varieties, connecting farmer groups and agricultural policies advocacy, (Barret, 2008). As indicated by Mishra and Williams (2006), ICTs provides speedy, inexpensive and convenient means of communication which have resulted in immediate positive impact upon adoption in almost all different sectors across the globe. Kajogbola (2004) adds that, in most small scale farm environments, the most commonly used ICTs are television, radio and mobile phones which attests to significant improvement in information dissemination. Information delivery is critical requirement for all sectors and should

be probed and developed further to incorporate important subjects of discussion such as agriculture.

2.5 Socio-economic Characteristics

The choice of ICTs for communicating agricultural information in a particular region should be based on their effectiveness and capacity to reach the farmers in addition to meeting the perceived credibility, relevance and preference among target farmers. Murage (2011) notes that, the cost of using a particular channel should also be considered as most farmers in Kenya have low financial capital to facilitate acquisition of agricultural information. He notes that, farmers also have varying capacities to use the different ICTs as they are dictated by their levels of education, age, gender, perceived benefits and availability of the relevant infrastructure to operate some like the internet. In view of this, there is need to promote use of participatory learning approaches and improve the reliability of information sources and channels of communication. The latter can be addressed through interventions such as rural electrification and lowering tariffs on solar power to set up and operate information communication rural based centres.

Mutula (2005) adds that remoteness of farming areas, government support to establishment of ICTs, awareness programs about ICTs, farmers' confidence in use of ICTs, costs of using ICT services, objectives of farmers to use ICTs, general importance of ICTs, and farmers' literacy levels also influence farmers' adoption of ICTs. Nikbakhsh (2011) notes that, potential adopters of an innovation can find about it if they are informed about it through use of ICTs, in addition to interpersonal channels like mass media. Use of ICT has become one of the most influential

factors that determine both the present performance and the future conditions for the individual and the social system.

Though ICTs are important tools in diffusion of agricultural innovations, lack of ICTs infrastructure at regional levels, the low number of professionals who maintain the network and provide services in rural regions, lack of knowledge in national languages and relatively high costs of ICTs like computers and Internet enabled cell phones are major obstacles for rural residents (Nikbakhsh, 2011). Individuals in rural regions especially the retired, elderly and unemployed people who constitute the majority of the farmers use the ICTs very little or do not use them at all, (Nikbakhsh, 2011).

Jayathilake, et al (2008) suggested in the result of their study that the most important limiting factor which affects the use of ICTs in agriculture is cost of technology. Lack of training and inability of farmers to use ICTs is the second factor that affects their use. The third factor is lack of technological infrastructure and lack of ICT skills.

The use of ICT can progressively reduce the costs of managing information, enabling individuals and organizations to undertake information-related tasks much more efficiently. However, it reveals a certain number of disparities among farmers according to their socio-economic situation, gender and infrastructure availability.

2.6 Communication Tools and Adoption of Agricultural Technologies

Meinezen and Gregorio (2004), noted that adoption of agricultural innovations is influenced by time, space, land tenure and collective action of a community. They explain that the adoption of agricultural innovations is greatly influenced by the time horizon between their adoption and

payoff. In addition, adoption of the technologies in agriculture depends on the strengths and weaknesses of communities, markets, government policies and strong research-extension-farmer linkages.

It has also been observed that, now more than ever, information dissemination is crucial in enhancing and developing the adaptive capacities of all economies especially in rural areas to adopt new agricultural concepts to improve socio-economic development (Okumu & Obora, 2013). They recommend that such information should be transmitted to farmers using technologies available in their settings such as rural radios and other community based forums like religious services and gatherings like farmers' field days. In addition, the rapid development of mobile telephone technology and the internet has opened up new opportunities and avenues to be exploited fully for the enhancement of information transfer to the rural areas.

With the ICT system, there is increased efficiency in extension services since databases can be kept on relevant information and new research findings and discoveries relayed to farmers as soon as they are generated. Trainings and demonstrations can also be conducted easily through videos, DVDs and VCDs. ICTs also provide real time updates on market information thus giving farmers the potential to bargain and improve their incomes, to seize market opportunities through the adjustment of production plans and better allocation of production factors, and also to use the information to make choices about marketing (Adetumbi et al, 2013). The choice of delivery systems of ICT knowledge should be based on what is efficient, effective and not expensive as people should use their resources carefully to derive maximum utility.

Due to Kenya's limited availability of agricultural land, increasing agricultural production will require intensification of production through use of better inputs and equipments, diversification of crops grown from low to high value crops, commercialization of small scale agriculture, increased value addition through creation of stronger linkages with other sectors and enhanced access to the right and timely information, (Alila & Atieno, 2006).

The GOK, (2012) further states that, information delivery is critical in the process of enhancing the adaptive capacities of the rural areas to adopt agricultural technologies for economic development. People and organizations involved in agricultural development such as development workers, researchers, government and non-government officials and decision makers will enhance the widespread availability of such developmental information. There is need for the establishment of strong linkages between farmers and extension officers who are the carriers of agricultural messages (Robinson and Maganga, 2009). They further argue that, communication strategies that are targeted at different stakeholders such as farmers and extension officers can reduce adoption challenges.

CHAPTER THREE

RESEARCH METHODOLOGY

3.1 Study Area

The study was conducted in Msambweni Sub-county of Kwale County.

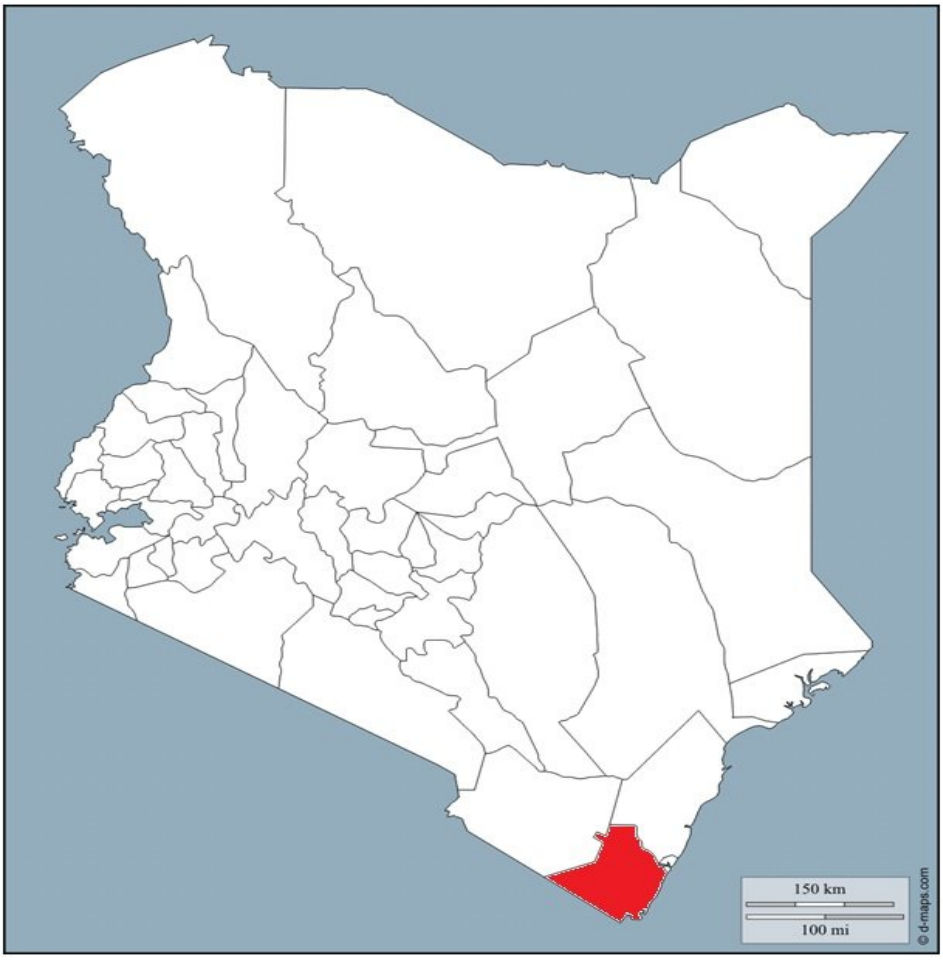

Figure 3.1: Map of Kenya showing location of Kwale County

Source: Kenya County Fact Sheets (2011)

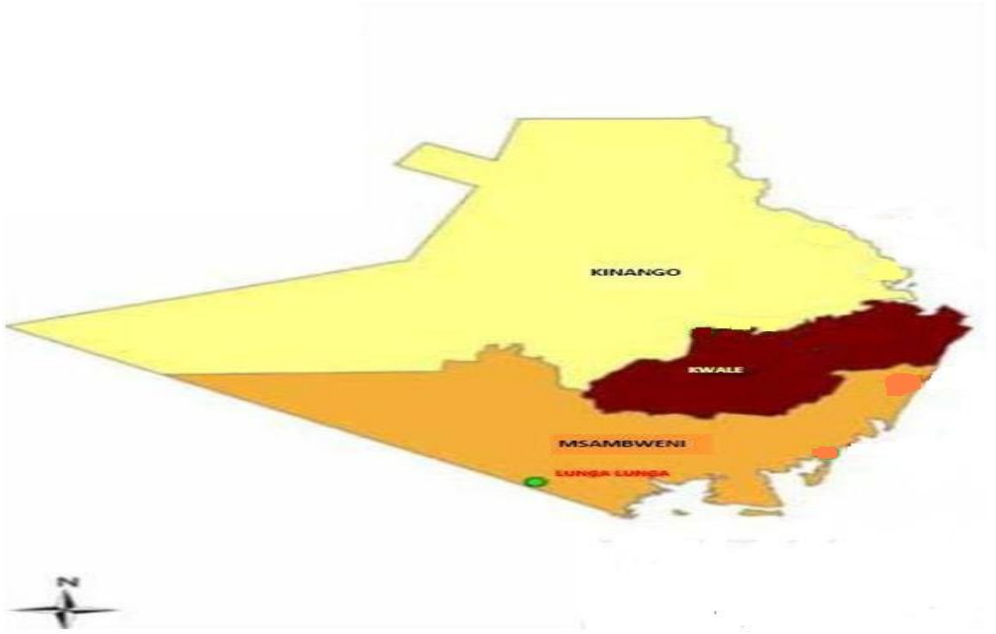

Figure 3.2: Map of Kwale County showing Msambweni Sub-County

Source: Kenya County Fact Sheets (2011)

Msambweni is one of eight sub-counties in Kenya that are implementing cassava production activities supported by the East African Agricultural Productivity Project (EAAPP) since 2010 through introduction of new high yielding varieties. The sub-county is one of three sub-counties in Kwale County and covers an area of 3,236km^2 of which 2,122km^2 is suitable for agriculture. It has a total of 9 Wards, 11 locations, 29 sub-locations and a population of 288,393 (2009 population census) spread over 57,200 farm holdings with an average farm size of 3 hectares. The average annual rainfall is 1200mm which is bimodal, received during the long rains in March to June and the short rains in October to December.

The Communication Commission of Kenya (2011) indicates that, Kwale County is known to have very poor infrastructure in terms of roads network, rental and other commercial buildings, television, radio and mobile telephone coverage with some regions registering no access to any television channel. Specifically, Msambweni sub-county has very poor communication structure with some areas recording very low mobile telephone network coverage that can't support any call.

3.2 Study Design

The study employed a descriptive research design which involved a one-time interaction with individual farmers in the study area. Through this, the author and his research assistants interviewed the farmers to collect the necessary information.

3.3 Target Population

This study targeted a population of 3800 farmers in Msambweni sub-county growing more than 0.5 acres of cassava. The selection was based on the EAAPP efforts to promote cassava farming in the sub-county and the entire Kenyan coastal region.

3.4 Sampling Technique

The sampling technique used was a multistage sampling that involved selection of the wards with preferred characteristics of farmers followed by selection of farmers from these wards. Three out of the six wards that are suitable for cultivation of cassava in the sub-county were purposively selected. These wards were Pogwe, Vanga and Dzombo with a total population of 3800 cassava farmers. Further, one sub-location in each ward was selected and all cassava farmers with an acreage of more than 0.5 acres were listed to generate a sampling frame. The

sub-locations selected were Kikoneni in Pogwe Ward, Lungalunga in Vanga Ward and Malamba in Nzombo Ward.

The sample size was determined using Fisher's method (Fisher, et al, 1998) formula for 95% confidence level shown below;

$$n = \frac{Z^2 pq}{d^2}$$

Where; n = sample size for infinite population

Z = 1.96 (at 95% Confidence level)

p = estimated proportion of those using communication tools (0.1)

q = 1-p

d = precision of the estimate at 5% (0.05)

The sample size was;

$$n = \frac{(1.96)^2 \times 0.1 \times 0.9}{(0.05)^2}$$

$$n = \frac{0.3457}{0.0025} = 138$$

The adjusted sample size for the finite population of 3800 farmers was;

$$n^1 = \frac{1}{1/n + 1/N}$$

Where; n^1 = adjusted sample size

n = estimated sample size for infinite population

N = Finite population size

$$n^1 = \frac{1}{1/138 + 1/3800} = 133$$

A sample of 133 farmers was randomly selected from the sampling frame of cassava farmers in the three wards using MS Excel program.

3.5 Data Collection

Primary quantitative data was collected through face-to-face interviewing of the sampled cassava farmers using semi-structured questionnaires. The questionnaires were administered to individual farmers by the author and three research assistants who were familiar with the study area and had been trained and participated in pre-testing of the questionnaire. Permission to collect the data was requested from the county and sub-county directors' of agriculture.

3.6 Data Analysis

Data collected was entered into a spread sheet package (MS Excel) and analyzed using Statistical Package for Social Sciences. Descriptive statistics were obtained for the variables while statistical tests used for comparison and hypothesis testing included chi-square tests and correlation analysis. The data was presented using percentages and frequencies and displayed as tables and charts.

CHAPTER FOUR

RESULTS

4.1 Background Characteristics of Respondents

In order to know the background characteristics of the respondents who participated in the study, their demographic profiles were sought and are presented in Table 4.1 below.

From Table 4.1, 58.6% of the respondents were male while 41.4% were female. Findings show that none of the respondents were aged below 20 years. 2.3% of the respondents were aged between 20 to 29 years, 18% were aged between 30 to 39 years, 29.3% were aged between 40 to 49 years while 50.4% were aged over 50 years. Studying the respondent's education level, 63.9% had achieved primary education, 18.8% had secondary education, 2% had middle level education while none had achieved a university degree. From the table also, majority of the respondents had farming as their main occupation as indicated by 88.7%, the self-employed were 6%; those employed were 3.8% while casual employees were 1.5%.

The study findings show that 7.5% of the respondents had been practicing agriculture for less than 5 years, 24.8% had practiced agriculture for 5 to 10 years while 67.7% had practiced agriculture for more than 10 years. Three percent (3.0%) of the farmers owned less than one acre of land, 22.6% owned 1 to 3 acres, 33.1% owned 3.1 to 6 acres and 10.5% owned 10 acres and above.

Table 4.1: Background Characteristics of the Respondents

Characteristic	Frequency	%
Gender		
Male	78	58.6
Female	55	41.4
Age		
<20	0	0
20-29	3	2.3
30-39	24	18.0
40-49	39	29.3
>50	67	50.4
Education Level		
None	21	15.8
Primary	85	63.9
Secondary	25	18.8
Middle level	2	1.5
University	0	0
Period of practicing agriculture		
< 5 years	10	7.5
5-10 years	33	24.8
>10 years	90	67.7
Land Size		
Less than 1 acre	4	3.0
1-3 acres	30	22.6
3.1 - 6 acres	44	33.1
6.1 - 10 acres	41	30.8
> 10 acres	14	10.5
Main Occupation		
Farmer	118	88.7
Self employed	8	6.0
Employed	5	3.8
Casual employee	2	1.5

4.2 Socio-economic Characteristics of the Respondents

On evaluating the farmers' sources of income, alongside cassava farming, farmers had other sources. The specific sources of income are captured in Table 4.2 below. Results show that 42.9% of the respondents practiced growing of other crops, 38.3% earned income from livestock sales, 13.5% from milk sales, 2.3% from business while 3% received extra income from remittances.

Table 4.2: Other Sources of Income of the Respondents

Exact Source of Income	Frequency	Percent
Other crops	57	42.9
Livestock sales	51	38.3
Milk sales	18	13.5
Business	3	2.3
Remittance	4	3
Total	133	100

4.2.1 Association between Socio-economic Characteristics and use of ICTs

Table 4.3 below gives the results of the associations between the socio-economic characteristics of the farmers and ICTs application in cassava farming. The results indicate that, ICTs application in farming has a significant correlation and positive association with the farmers' socio-economic characteristics; (Pearson correlation coefficient, $r = 0.863$, p-value = 0.011).

Table 4.3: Association between Socio-economic Characteristics and ICTs Application

Variables	Measure	ICTs Application
Socio-economic characteristics	Pearson Correlation	0.863
	Sig. (2-tailed)	0.011
Sample size (n)		133

4.2.2 Relationship between Socio-economic Factors and Use of ICTs

As shown in Table 4.4, the chi-square test results for the socio-economic characteristics (age, marital status, education level and occupation) and access to ICTs indicate that there is a significant association between the socio-economic characteristics and access to ICTs used to disseminate agricultural information to farmers; (Pearson correlation coefficient, r = 3.107 and p-value = 0.018 for age; r = 5.988 and p-value = 0.003 for marital status; r = 2.319 and p-value = 0.011 for education level; and r = 8.471 and p-value = 0.007 for occupation).

Table 4.4: Relationship between Socio-economic Factors and Use of ICTs

Socio-Economic Factor	Access to Information			Chi-Square Test
	YES	NO	Total	
Age 20-29	12 (9.0%)	1(.8%)	13(9.8%)	Pearson Chi-Square = 3.107
30-39	81(60.9%)	4(3.0%)	85(63.9%)	P-value = 0.018
Above 50	34(25.6%)	1(.8%)	35(26.3%)	
Total	127(95.5%)	6(4.5%)	133(100.0%)	
Marital Status				
Married	123(92.5%)	5(3.8%)	128(96.2%)	Pearson Chi-Square = 5.988
Separated	1(.8%)	0(.0%)	1(.8%)	P-value = 0.003
Widowed	2(1.5%)	1(.8%)	3(2.3%)	
Single	1(.8%)	0(.0%)	1(.8%)	
Total	127(95.5%)	6(4.5%)	133(100.0%)	
Level of Education				
No Education	6(4.5%)	0(.0%)	6(4.5%)	Pearson Chi-Square = 2.319
Primary	89(66.9%)	3(2.3%)	92(69.2%)	P-value = 0.011
Secondary	30(22.6%)	3(2.3%)	33(24.8%)	
Middle Level College	2(1.5%)	0(.0%)	2(1.5%)	
Total	127(95.5%)	6(4.5%)	133(100.0%)	
Occupation				
Farmer	114(85.7%)	4(3.0%)	118(88.7%)	Pearson Chi-Square = 8.471
Self Employed	6(4.5%)	2(1.5%)	8(6.0)	P-value = 0.007
Employed	5(3.8%)	0(.0%)	5(3.8%)	
Casual Employee	2(1.5%)	0(.0%)	2(1.5%)	
Total	127(95.5%)	6(4.5%)	133(100.0%)	

4.3 Agriculture Practices in Msambweni Sub-County

4.3.1 Available Land for Cultivation

As shown in Table 4.5, 24.8% of the farmers had 1 to 2 acres of land available for cultivation, 59.4% had 3 to 5 acres, and 14.3% had 6 to 10 acres while 1.5% had 10 and above acres. Based

on these results, majority of the farmers who participated in the study owned about 3 to 5 acres of land for cultivation.

Table 4.5: Available Land for Cultivation

Land in Acres	Frequency	Percent
1-2 acres	33	24.8
3-5 acres	79	59.4
6-10 acres	19	14.3
Over 10 acres	2	1.5
Total	133	100

4.3.2 Land Cultivated in the Last Two Seasons (2012 and 2013)

Table 4.6 indicates that 33.1% of the respondents had cultivated 1-2 acres of land, 37.6% had cultivated 3-4 acres of land while 29.3% had cultivated 5 and above acres in the first season of 2012. In 2013, 34.5% of the farmers studied had cultivated 1-2 acres, 27.8% had cultivated 3-4 acres while 37.5% had cultivated over 5 acres.

Table 4.6: Land cultivated in the last two seasons

Season one (2012)	**Frequency**	**Percent**
1-2 acres	44	33.1
3-4 acres	50	37.6
Over 5 acres	39	29.3
Season two (2013)		
1-2 acres	46	34.5
3-4 acres	37	27.8
Over 5 acres	50	37.5

4.3.3 Use of Improved Cassava Varieties

Majority of the respondents had not adopted cultivation of improved varieties of cassava as 78.2% of the respondents concurred. Those who had adopted and used improved varieties were 21.8%. The respondents reported they prefer the local varieties since they can be chewed when raw and have a better taste. The improved varieties are grown for sale out of the farm.

Figures 4.1 (a & b), 4.2 and 4.3 show the author and research assistants carrying out questionnaire administration.

a b

Figure 4.1: The Author Training Research Assistants (a); and Pre-testing Questionnaire (b)

Figure 4.2: The Author Interviewing a Cassava Farmer

Figure 4.3: A Research Assistant Interviewing a Cassava Farmer

4.4 Sources of Information on Cassava Farming

Table 4.7 presents results on the period which the respondents practiced cassava farming. It indicates that 24.1% of the respondents started growing cassava less than 5 years ago, 39.1% started between 5-10 years while 36.8% started more than 10 years ago. The study indicates that majority of the respondents had cassava growing experience of more than 5 years.

Table 4.7: Period of growing Cassava

Years	Frequency	Percent
Less Than 5 Years	32	24.1
5-10 Years	52	39.1
More than 10 Years ago	49	36.8
Total	133	100

4.4.1 Contact with the Extension Agents

Eighty nine percent (89.5%) of the respondents had contact with extension agents while 10.5% had no contact with these agents. The contact was useful to farmers since it provided them with the information that is vital in their cassava farming business. Table 4.8 below shows 69.2% of the respondents had contact with the Ministry of Agriculture, Livestock and Fisheries while 19.5% were found to have been in contact with NGOs. Eleven percent (11.3%) of the respondents had contacts with research officers.

Table 4.8: Main Extension Agents in Contact with Farmers

Main Agents	Frequency	Percent
Ministry of Agriculture	92	69.2
Research	15	11.3
NGO	26	19.5
Total	133	100

4.4.2 Farmer's Access to Agricultural Information

Ninety five percent (95.5%) of the respondents had access to information regarding farming and marketing of their produce while 4.5% had no access to information. Table 4.9 shows 75.9% of the respondents accessed information from the Ministry of Agriculture, Livestock and Fisheries; 20.3% had access to information through research while 3.8% had access to information through NGOs.

Table 4.9: Source of Agricultural Information

Source	Frequency	Percent
Ministry of Agriculture, Livestock and Fisheries	101	75.9
Research	27	20.3
NGOs	5	3.8
Total	133	100

4.5 ICTs Available to Farmers

4.5.1 Communication Methods

As shown in Figure 4.4, ICTs were the most commonly used tools to disseminate information to the farmers (91%). Farm visits were the second most prominent method used for communication with 69.9% of the respondents, 23.7% had used meetings to receive information, 10.1% received information through short courses and 4.3% had received information through written materials.

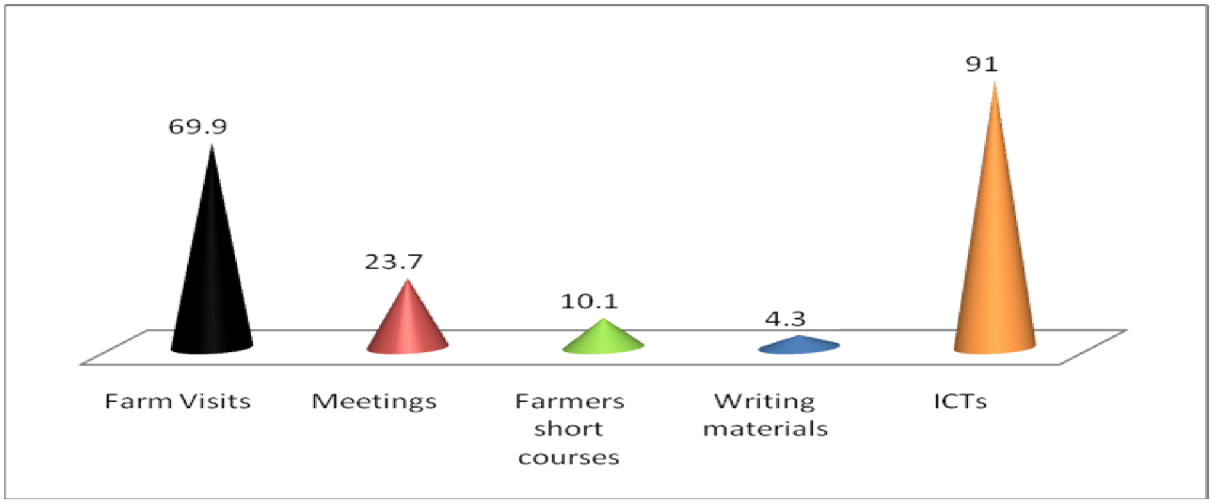

Figure 4.4: Method of Communication

4.5.2 Use of ICTs to Access Agricultural Information

Table 4.10 shows that 69.9% of the respondents had used radio as the ICT tool to convey agricultural information, 26.3% had used Television, 33.1% had used mobile phone while only 2.3% were able to access agricultural information through the internet.

Table 4.10: ICTs Used by Respondents to Receive Agricultural Information

Commonly Used Method	Frequency	Percent
Radio	93	69.9
Television	35	26.3
Mobile phone	44	33.1
Internet	3	2.3

4.5.3 Frequency of Receiving Information

The results on the frequency of information transfer are presented in Table 4.11 below. Forty eight percent (48.1%) received information on weekly basis, 47.4% received information on a daily basis, 3.8% on monthly basis and 0.8% on Quarterly basis. Findings as well show that 84.2% of the respondents found the information useful whereas 15.8% of the respondents felt that the information was not useful for their agricultural activities.

Table 4.11: Frequency of Receiving Information

Frequency of Receiving Information	Frequency	Percent
Daily	63	47.4
Weekly	64	48.1
Monthly	5	3.8
Quarterly	1	0.8
Total	133	100

4.5.4 Association between Information Sources and Application of ICTs in Cassava Farming

Table 4.12 indicates that, ICTs application in cassava farming had a strong correlation with the sources of information available for the farmers ($r = 0.771$, $p = 0.021$).

Table 4.12: Association between Information Sources and ICT Application

Variables	Measure	ICTs Application
Information Sources	Pearson Correlation	0.771
	Sig. (2-tailed)	0.021
Sample size (n)		133

4.6 ICTs use and its Influence on Cassava Farming

4.6.1 Cassava Cropping Systems

Figure 4.7 shows the cropping methods used for cassava farming. It shows that majority of the respondents (62.4%) practiced intercropping system in cassava production, 13.5% planted cassava in pure stands, 11.3% did rotational cropping while 12.8% practiced strip cropping.

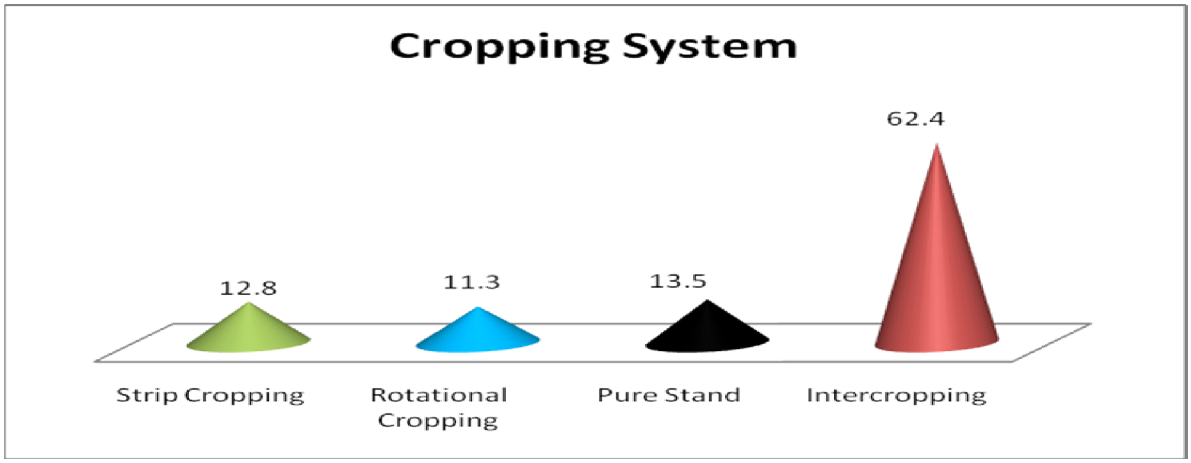

Figure 4.5: Cropping system used by farmers in growing Cassava

Figure 4.6: The author in a farm where cassava is inter-planted with maize and cashew nut

4.6.2 Use of Farm Inputs in Cultivation of Cassava

Table 4.13 shows that 56.4% of the respondents use farm yard manure, 20.3% use fertilizers, 14.3% use improved cassava varieties and 8.3% use pesticides in cassava production.

Table 4.13: Use of Farm Inputs

Farm Input	Frequency	Percent
Farm Yard Manure	75	56.4
Fertilizers	27	20.3
Pesticides	11	8.3
Improved Varieties	19	14.3
Total	133	100

4.6.3 Type of Information Communicated

Figure 4.9 shows that most of the respondents (53.4%) received no information regarding cassava farming, 22.6% received information regarding disease and pest management while 14.3% received information on new varieties of cassava.

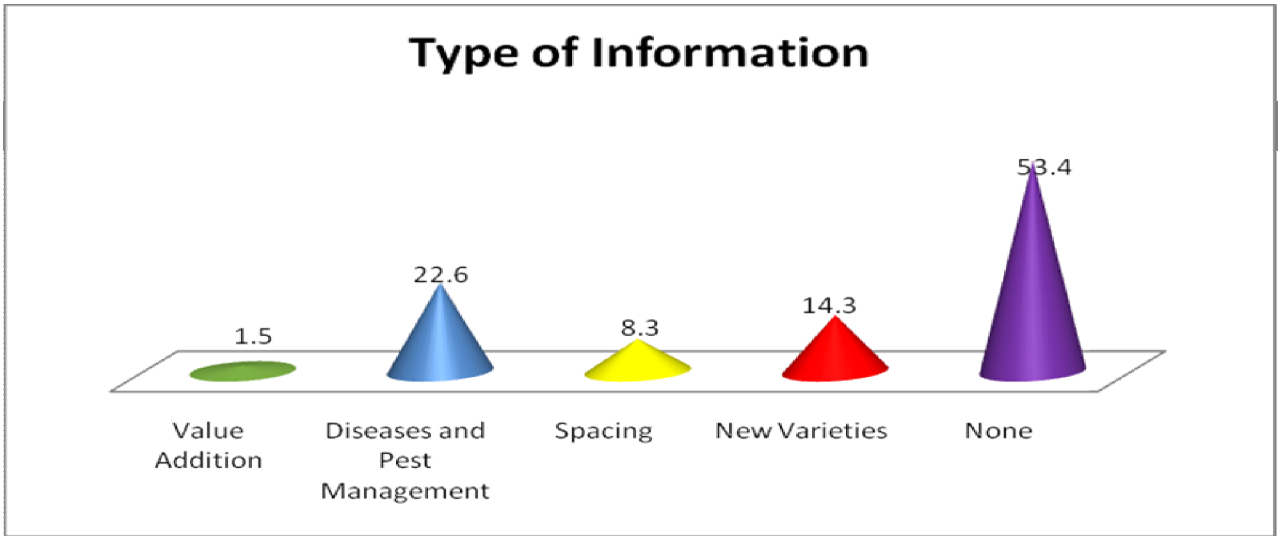

Figure 4.7: Type of Information Communicated

4.6.4 ICTs and adoption of Cassava Farming.

Table 4.14 shows that 36.8% of the respondents agreed, 32.3% were undecided while 30.8% disagreed that expanded telecommunications networks have increased the speed, reliability and accuracy of information exchange between farmers and other stakeholders. On the marketing of the cassava produce through ICTs use, the findings show that, 27.1 agreed, 26.3% were undecided and 46.6% disagreed that through the use of ICTs, farmers have been able to undertake cassava farming and marketing on their own. The table also shows that, 23.3% of the respondents agreed, 25.6% were undecided while 51.1% disagreed that through the use of mobile phones, farmers would get into contact with customers and facilitate a ready market for their farm produce.

Results as well show that, 22.5% agreed, 17.3% were undecided and 60.2% disagreed that farmers listen to the farming programs in radios presented by the local station and ask questions on how to improve their farming standards. On the application of the information obtained, farmers reacted as follows; 18.8% agreed, 25.6% were undecided while 55.6% disagreed indicating that the application of the farming information obtained through the radio had no significant effect on the quantities of cassava produced. Findings also show that ICTs have not had significant influence on cassava production as 32.3% of the respondents agreed, 7.5% were undecided and 60.1% disagreed with the idea that new forms of knowledge transfer have been made possible through the ICTs and farmers are able to access information regarding their farming business.

Table 4.14: ICTs and adoption of Cassava Farming.

Statement	Strongly agree	Agree	Undecided	Disagree	Strongly Disagree
1. ICTs and efficiency	24.8% (33)	12% (16)	32.3% (43)	21.8% (29)	9% (12)
2. ICTs and product marketing	3.8% (5)	23.3% (31)	26.3% (35)	33.1% (44)	13.5% (18)
3. ICTs and contact with customers	4.5% (6)	18.8% (25)	25.6% (34)	33.8% (45)	17.3% (23)
4. Radio programs that supports improvement in farming standards	15% (20)	7.5% (10)	17.3% (23)	45.9% (61)	14.3% (19)
5. ICTs and cassava production	12% (16)	6.8% (9)	25.6% (34)	45.1% (60)	10.5% (14)
6. ICTs and knowledge transfer	15.8% (21)	16.5% (22)	7.5% (10)	54.1% (72)	6% (8)

4.6.5 Association between ICTs Application in Agricultural Activities and Cassava Farming

Table 4.15 shows that, ICTs application in farming has a significant strong correlation and positive association with cassava farming in the region ($r = 0.926$, $p = 0.003$).

Table 4.15: Association Test for Cassava Farming and ICTs Application

Variables	Measure	ICTs Application
Cassava farming	Pearson Correlation	0.926
	Sig. (2-tailed)	0.003
Sample size (n)		133

4.6.6 Relationship between ICTs Use and Adoption of Cassava Technologies

Table 4.16 indicates that the use of ICTs does not influence adoption of cassava farming technologies ($\chi^2 = 2.078$, p= 0.214).

Table 4.16: Relationship between ICTs use and Adoption of Cassava Technologies

	Value	Degrees of freedom (df)	Asymp. Sig. (2-sided)
Pearson Chi-Square	2.078	2	0.214
Sample size (n)	133		

CHAPTER FIVE

DISCUSSION

From the results, radio, mobile phones, television and internet in a decreasing order were the commonly ICTs used by farmers. Farmers attributed this to the fact that, radio sets are relatively cheaper to purchase and maintain compared to other tools of ICT like mobile phones that requires frequent recharging and credit which makes them highly expensive. Further, the farmers indicated that, they are able to listen to the radio during the day as they rest when the temperatures rise. The mobile phone is used widely when they consult other farmers for general information including agriculture. The television is not widely used as many farmers did not own a set due to its high initial cost and low electricity connectivity. Also, regardless the fact that internet provides enviable volume and significant information regarding modern agricultural practices, farmers in the region had least access to it, which can be attributed to low electricity connectivity, lack of computers and low levels of literacy among the farmers. The results agree with Kajogbola, (2004) who noted that, in most small scale farm environments, the most commonly used ICTs are television, radio and mobile phones.

The study findings as well show that, the farmers' socio-economic characteristics of age, marital status, education level and occupation have an influence on access to ICTs in dissemination of agricultural information. As regards the low usage of internet to access agricultural information, the results agree with the Government of Kenya Sector Performance Standards (GoK, 2010), which estimated the average age of farmers in the country to be 60 years. This age is expected to

progressively reduce to 35 years by 2030 if the right policies are formulated and implemented to increase returns to agriculture which will encourage more youth to engage in agriculture.

On cassava farming, the findings indicated that, farmers in the region practice growing of both traditional and improved varieties of cassava. However, majority of the farmers have not adopted cultivation of improved varieties. They prefer cultivating the local varieties that include Kibanda meno, Nguzo, Kilesho and Rasta since they can be chewed when raw as they have a better taste than the improved varieties that are grown for sale out of the farm mostly for industrial use. These improved varieties are Karembo, Tajirika, Shibe and Nzalauka. On marketing of cassava produce, the investigation revealed that, mobile phones have not been fully utilized by the farmers as marketing tools though some farmers had used them to communicate with their customers thus enhancing their farming activities. The findings agree with Adetumbi et al, (2013) who observed that, ICTs provide real time updates on market information thus giving farmers the potential to bargain and improve their incomes.

CHAPTER SIX

CONCLUSIONS AND RECOMMENDATIONS

6.1 Conclusions

- Majority of the farmers in Msambweni sub-county cultivate less than 10 acres of land and cassava is one of the enterprises practised in the area. The use of ICTs in cassava farming depend on each farmer's ability to access and use them which is directly influenced by his or her socio-economic characteristics among them age, education level, occupation as well as marital status. Most farmers prefer cultivating local varieties of cassava as they are good for eating even when raw compared to the improved varieties that are grown for commercial purposes and are sold to generate income for the household.

- Though 91% of the farmers have used ICTs to access agricultural information, their effectiveness compared to other communication methods is still not known. However, farmers' in Msambweni sub-county face challenges in use of ICTs especially television and internet due to low levels of education, lack of electricity supply and lack of access to computers. ICTs are vital in enhancing agricultural development as it is a cheap way for transferring timely information. However, the users of agricultural information, majority of whom are farmers require to be equipped with the skills to use ICTs especially computers and internet. It is clear that ICTs have become a cornerstone of agricultural development in contemporary times as they can increase the efficiency, productivity and sustainability of agricultural sector. Conclusively, ICTs application in farming was found

to have a significant correlation with the source of information, the socio-economic characteristics of the farmers and cassava farming.

6.2 Recommendations

- With reference to the study results and conclusions presented above, the author recommends policy review to make ICTs more effective in disseminating agricultural information in the region as well as in the other parts of the country. This can be realized through creation of incentives to service providers by the national and county governments to enable them increase investments in power infrastructure, strengthen the reception of mobile telephony signals; and radio and television broadcast services to enable farmers receive information through the ICTs.

- Institutions that are mandated with provision of agricultural information to farmers should embrace a bottom-up approach when introducing e-extension services to achieve wider acceptance among the farmers. This would result in a deeper understanding of farmers' circumstances and the appropriate technologies packaged and disseminated in the right form using the ICTs available to the farmers. In addition, these institutions should capacity build farmers on use of ICTs to enable them use the facilities efficiently and effectively. This can be done through farmers' forums like workshops and short courses. In addition, extension service providers should be adequately equipped with skills and internet facilities to enable them source and transfer agricultural information to farmers at the right time.

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APPENDIX

Survey Questionnaire for Farmers

Topic: Assessment of Information and Communication Tools (ICTs) Used in the Diffusion of Agricultural Innovations: A Case Study of Cassava Production in Msambweni Sub-County, Kwale County

Dear Sir/Madam

My name is Timothy Gacheha, a student from the University of Nairobi. This questionnaire has been developed to gather data to develop a project report for the assessment of the Information and Communication Tools (ICTs) used in the diffusion of agricultural innovations in Msambweni Sub-County of Kwale County. The data gathered will be treated with confidentiality and only used for academic purposes. Indication of your name is optional and should you wish to have the findings of this study, kindly indicate mobile phone number and email address for easy sharing of study findings.

Identification:

Sub-County:	Ward:	Sub-location:	Village:
Name of Interviewer:	Mobile Phone No.	Date of Interview: ...../...../2014	
Name of Respondent:	Phone No.	Email address:	Questionnaire No.
Investigator's signature:			

Section A: Socio-economic Characteristics of the Household

1.1 Gender of the participant/farmer: 1 = Male 2 = Female

1.2 Age (In years): 1 = Below 20 2 = 20 – 29 3 = 30-39 3 = 40 -49 4= above 50

1.3 Relation to the owner of the land: 1 = Owner 2 = Husband 3 = Wife 4 = Daughter

5 = Son 6 = Not related 7 = Other (Specify)_____

1.4 Marital status of household head: 1 = Married 2 = Separated 3 = Divorced

4 = Widowed 5 = Single

1.5 Highest level of education received by the household head: 1 = No education

2 = Primary 3 = Secondary 4 = Middle Level College 5 = University

1.6 What is the main occupation of the household head?

1 = Farmer 2 = Self employed 3 = Employed, salaried 4 = Farm worker;

5 = Casual employee 6 = Others, (**specify**) _____, _____

1.7 When did you start practicing agriculture?

1 = Less than 5 years ago; 2 = 5-10 years ago; 3 = More than 10 years ago

1.8 What is the total size of your farm(s)?_____ acres

1.9 How much of this land is available for farming? _____acres

1.10 How much of the available land was cultivated in the last two seasons?

Season 1 (2012)_____acres, Season 2 (2013)_____ acres

1.11 Did you grow any improved cassava varieties? 1 = Yes 2 = No

1.12 Do you have other sources of incomes?

1 = Yes; 2 = No

1.13 If yes what sources? (Tick all that which apply)

1 = Other crops 2 = Livestock sales 3 = Milk sales 4 = Business

5 = Salary 6 = Casual wage 7 = Remittance 6 = Other(s), (**specify**)

1._____ 2. _____ 3. _____

Section B: Information Sources available to the Farmers

2.1 When did you start growing cassava?

1 = Less than 5 years ago 2 = 5-10 years ago 3 = More than 10 years ago

2.2 Do you have contact with extension agents?

1 = Yes 2 = No

2.3 If yes what agent? (Tick all that apply)

	Yes	No		Yes	No
(1) Ministry	☐	☐	(2) Research	☐	☐
(3) NGO	☐	☐			
(4) Other(s)					
_____	☐	☐	_____	☐	☐
_____	☐	☐			

2.4 Do you access cassava information that assists in your farming and marketing of the produce?

1 = Yes 2 = No

2.5 If yes, where do you obtain the cassava information from? (Tick all that apply)

	Yes	No		Yes	No
(1)Ministry	☐	☐	(2) Research	☐	☐
(2) NGO	☐	☐			

(4) Other(s) 1._____ 2. _____ 3._____

2.6 How is this information communicated to you? (Tick all that apply)

	Yes	No		Yes	No
(1) Farm visits	☐	☐	(2) Meetings	☐	☐
(3) Farmers short courses	☐	☐	(4) Written materials	☐	☐
(5) ICTs	☐	☐			

(6) Other Methods (specify) 1._____ 2. _____ 3._____

Section C: ICTs used in Dissemination of Agricultural Information

3.1 Have you ever used ICTs to source for agricultural information? 1 = Yes 2 = No

3.2 If yes, which of the following ICTs commonly used to transfer agricultural information electronically have you ever used?

	Yes	No		Yes	No
(1) Radio	☐	☐	(2) Television	☐	☐
(3) Mobile phone	☐	☐	(4) Internet	☐	☐

(5) Others (specify) 1._____ 2. _____ 3. _____

3.3 Of these ICTs, which one(s) do you own?

	Yes	No		Yes	No
(1) Radio	☐	☐	(2) Television	☐	☐

(3) Mobile phone ☐ ☐ (4) Internet ☐ ☐

(5) Others (specify) 1._____ 2. _____ 3. _____

3.4 Are there ICTs that are communally owned?

	Yes	No		Yes	No
(1) Radio	☐	☐	(2) Television	☐	☐
(3) Mobile phone	☐	☐	(4) Internet	☐	☐

(5) Others (specify) 1._____ 2. _____ 3. _____

3.5 How often do you receive agricultural information through each ICT which you have access to?

	ICT	Frequency			
		Daily	Weekly	Monthly	Quarterly
1	Radio				
2	Television				
3	Mobile phone				
4	Internet				
5	Others (specify)				
1					
2					
3					

3.6 Do you usually find the information useful to you in any way in your farming business?

Yes ☐ No ☐

3.7 If yes how useful?

(1)_____

(2)_____

(3)_____

Section D: Cassava Farming in Msambweni Sub-County

4.1 Which cropping system do you practice in your current cassava farming?

	Yes	No	Acre(s)
(1) Intercropping	☐	☐	_____
(2) Pure stand	☐	☐	_____
(3) Rotational cropping	☐	☐	_____
(4) Strip cropping	☐	☐	_____
Others (specify)			
1. _____	☐	☐	_____
2. _____	☐	☐	_____
3. _____	☐	☐	_____

4.2 Do you use the following in cassava farming?

	Yes	No	Amount	Acre(s)
(1) Farm Yard Manure	☐	☐	_____	_____
(2) Fertilizers	☐	☐	_____	_____
(3) Pesticides	☐	☐	_____	_____
(4) Improved varieties	☐	☐	_____	_____

4.3 Which information on cassava is communicated to you through ICTs?

	Yes	No		Yes	No
(1) None	☐	☐	(2) New Varieties	☐	☐
(3) Spacing	☐	☐	(4) Pests and diseases control	☐	☐
(5) Value addition	☐	☐	(5) Home utilisation	☐	☐
(6) Marketing	☐	☐			

(7) Others (**specify**)

1. _____ 2. _____ 3. _____

4.4 List three main challenges that you get in cassava farming in order of magnitude.

(1)_____

(2)_____

(3)_____

4.5 List two factors that in your opinion can promote cassava farming in this area

(1)_____

(2)_____

Section E: Influence of ICTs in the adoption of Cassava Farming

4. On a scale of 1-5 where; 1- strongly disagree, 2- disagree, 3- not sure, 4- agree, 5- strongly agree, indicate appropriately by ticking the extent to which you agree with the following regarding the influence of ICTs to the adoption of cassava farming.

	Description	1	2	3	4	5
i	ICTs have increased the speed, reliability and accuracy of information exchange between farmers and other stakeholders.					
ii	Through the use of ICTs, I have been able to undertake cassava farming and marketing on my own.					
iii	Through the use of my mobile phone, I get into contact with my customers for the produce thus I have a ready market for my farm produce.					
iv	I listen to the farming programs in my radio presented by the local station and ask questions on how to improve my farming standards.					
v	The application of the farming information obtained through the radio has led to increased cassava production in my farm					
vi	New forms of knowledge transfer have been made possible through the internet where farmers are able to access information regarding their farming business					

Thank you for the response