ANALYSIS OF ACCESS TO MARKET INFORMATION SOURCES AND FARM LEVEL PRODUCTIVITY: THE CASE STUDY OF KILOSA AND MVOMERO DISTRICTS

BY

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A DISSERTATION SUBMITTED IN PARTIAL FULFILMENT OF THE REQUIREMENTS FOR THE DEGREE OF MASTER OF SCIENCE IN AGRICULTURAL ECONOMICS OF SOKOINE UNIVERSITY OF AGRICULTURE. MOROGORO, TANZANIA.

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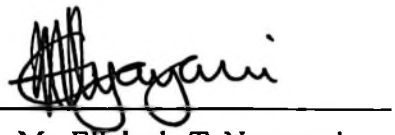
ABSTRACT

The purpose of this study was to assess the relationship between accessing market information sources and farm level productivity to smallholder farmers in Kilosa and Mvomero districts in Morogoro region. Specifically the study aimed at (i) identifying market information sources in smallholder production system (ii) examine the relationship between farm productivity and accessing market information sources (iii) examine factors that influence farmers to access and use market information and (iv) harmonize types of market information sources by farmers and farm product types. A cross sectional single-visit survey of 173 farmers from both Kilosa and Mvomero districts was done. Data were collected using structured questionnaire from the sampled farmers and by reviewing various secondary data from various sources. Data were analysed by descriptive statistics analysis such as frequencies, mean, cross tabulations and percentages. Quantitative statistics such as Principal Component Analysis (PCA) and multivariate linear regression were used to determine relationship between farm productivity (output) and farmer's accessing market information sources. Finally the logistic regression was used to examine factors that influence to access and use to market information sources. Results show that majority (82.7%) of the farmers use friends/neighbours as information source. Other sources include radio (68.2%) and traders (44.5%). In harmonizing market information source by farmer and product types, sugarcane was ranked as number one in terms of yield, reliable market and price information accessibility followed by sunflower, maize, rice and lastly simsim. Productivity (output) index was tested against the farmer's access to market information sources. The results showed that 56.5% of farmers who have accessed market information were found in low productivity index while 97.1% who did not accessed market information sources were found in high productivity index, hence there was significant relationship ($P < 0.05$) between household farm productivity index and accessing information sources. Linear regression results showed that there is positive relationship between farm size and farm output while labour intensity was negatively associated with farm output. In addition, education, farm size and radio ownership

influenced farmers to use and access market information. Based on the study findings, we recommend that some of the problems experienced by market participants in accessing market information can be solved by improving institutional and organizational arrangements, localization of market information, improving means of delivering market information and by promoting market information dissemination.

DECLARATION

I, **ELLYKEDO THEOPHILUS NGONYANI** do hereby declare to the senate of Sokoine University of Agriculture that this thesis is my own original work, and has never been submitted, nor concurrently being submitted for a degree award in any other university



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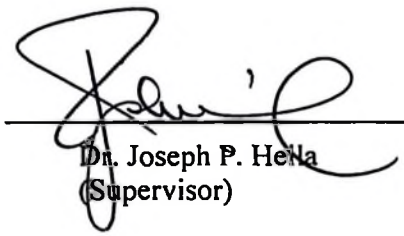

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DEDICATION

I dedicate this work to my beloved parents; Monica M. Ngonyani and Theophilus M. Ngonyani for their anonymous moral and financial support. "**God bless them**".

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LIST OF ABBREVIATIONS

AMSDP:	Agriculture Marketing System Development Programme
ASDS:	Agricultural Sector Development Strategy
ASU:	Agricultural Statistical Unit
BIS:	Business Information Services
EWCMU:	Early Warning and Crop Monitoring Unit
FAO:	Food and Agriculture Organization
ICT:	Information Communication Technology
KACE:	Kenya Agriculture Commodity Exchange
KMDP:	Kenya Marketing Development Programme
MAFS:	Ministry of Agriculture and Food security
MCA:	Multi-Criteria Analysis
MCDM:	Multi-Criteria Decision Making
MCM:	Ministry of Cooperatives and Marketing
MCMIS:	Malian Cereal Market Information System
MDB:	Market Development Bureau
MIS:	Market Information Services
MIU:	Market Information Unit
MLD:	Ministry of Livestock Development
MT:	Metric tones
MWLD:	Ministry of Water and Livestock Development
NBS:	National Bureau of Statistics
NGO:	Non Governmental Organization
PCA:	Principle Component Analysis
PRA:	Participatory Rural Appraisal
RTD:	Radio Tanzania Dar es Salaam
Tshs	Tanzania shillings
URT:	United Republic of Tanzania
VEO:	Village Executive Officer
WEO:	Ward Executive Officer

CHAPTER ONE

1.0 INTRODUCTION

1.1 Background information

Information is an important resource needed by every individual at all levels of education. One basic attribute of information is that it must help in solving problems. Farmers need information in order to solve various farming problems ranging from production to marketing. Production information is necessary for optimum and quality yields while market information is vital for farmers' profitability (Dulle and Lwehabura, 2002). There is growing pressure to improve the efficiency and effectiveness of agricultural productivity. Production and marketing information on the type and variety of crops to grow at a given season are important factors in decision making among farmers in developing countries.

Improving the production capacity of agriculture in developing countries through productivity increases is an important goal where agriculture represents an important sector in the economy. Raising farm productivity as well as output depends mainly upon the use of increased quantities of purchased inputs. The ability to purchase inputs, however, depends very much upon farmers' receipts from sales of farm products. This in turn is determined by an efficient marketing system. But there are limited information available to farmers for making informed comprehensive assessment of the factors that determine agricultural productivity (Lee and Zepeda, 2001).

Information about climate, resources availability, prices, credit to farmers, market demand, would be extremely valuable in identifying major constraints on productivity growth and in formulating strategies to overcome them (Owuor, 1999). Farmers' demand for information has also increased in recent years due to greater market instability, more complex production technologies, and greater need for financial planning and control (George *et al.*, 1993).

Improved information enables farmers to plan their production, harvesting, and selling according to market demand and in some cases to choose the optimal marketing channel (i.e. selling at one or a combination of marketing channels e.g. the farm gate, local market, wholesaler, processor, and retailer). In Zambia, during the early stages of agricultural liberalization, it was discovered that price information alone did not satisfy farmers' needs. It was revealed that farmers also needed information about who was purchasing, at which markets, and under what conditions i.e. cash, credit, bagged or bulk (Shepherd, 2001). Understanding information generation, dissemination, and application in agricultural markets is especially important given public and private agencies significant engagement in agricultural research, extension, and market regulation. According to Just *et al.* (2006) processes of market liberalization and privatization of state functions in agriculture raise questions regarding patterns of information exchange and capacity to respond to competitiveness, environmental, and food security demands.

Accessing relevant market information will assist in adjusting production and distribution and thus enhance agricultural productivity. This is an important step in alleviating rural poverty and increasing household food security (Owuor, 1999). Market information is viewed as an intermediate good in the production of agricultural commodities. Increasing in the productivity of agriculture through agricultural information and increased market access is growing concern in most of small scale farmers to raise their living standard (Just *et al.*, 2006).

While there is growth in modelling of the role of information in decision making, there is a dearth of quantitative measurement and empirical analysis of information use by economic agents. Current analysis of information in economics employs expected utility and expected value frameworks to understand how agents ascribe value to information. Within this framework, information is a homogeneous commodity differentiated only on the basis of who observes it. Based on the belief that information supports both decision making under uncertainty (static logic associated with risk management) and production

of new knowledge (dynamic logic associated with innovation), we must enhance our understanding of production, transmission, and application of information (Just *et al.*, 2006).

1.2 Problem statement and justification

Tanzania's main economic pillar is embedded in the agricultural sector. For the agricultural sector to fully contribute towards the sustainable development target, it should grow annually by 7% which implies a need to more than double the current annual growth rate of 5% (Amani, 2005; URT, 2005). The contribution of the agriculture sector would have been higher if the sector performed near to its full potential, but one of the attributing factors that led to the failure of agriculture to reach its full potential is inefficient market information (Mdoe *et al.*, 2002).

Previous evidence showed that Tanzanian government through it Ministry of Co-operatives and Marketing (MCM) in collaboration with Ministry of Water and Livestock Development (MWLD) was responsible for collection and dissemination of agricultural market information. Also several other public and private institutions participate at different capacities in the process (MCM, 2004). Such information was intended to help farmers to make informed production and marketing decisions. However, according to Ministry of Co-operatives and Marketing report (2004), agriculture marketing information was ranked as the most critical problem by average of 67.1% when compared to other common problems in marketing agriculture crops.

Over the years, agricultural development initiatives in Tanzania have concentrated a lot on the development of technologies to increase output. Indeed given the rates of population growth and intermittent occurrences of famine it is no wonders that output increases received more attention. While productivity is still a major issue, it is being questioned whether efforts should also be directed to marketing. To be able to increase

their welfare and incomes in particular, farmers require the best production system but also this must be accompanied by best input distribution methods and best access to markets (Mbiha *et al.*, 2003). A number of studies have addressed the issues of market and productivity in recent years, for example (Shepherd, 2001; Ashimogo *et al.*, 2002; Kashuliza, *et al.*, 2002; Mbiha *et al.*, 2003). In recent years there has been a proliferating carrier of information both in number and quality. This proliferation could be associated with availability of market information and hence productivity. Although it is widely recognised that productivity and market information are important factors in agricultural and rural development, little or no empirical study that has linked agricultural market information with farm productivity.

For these reasons, this study was proposed to study the relationship between different market information sources and farm level productivity. Furthermore, the study attempted to explain diversity among the services of information providers and the ways in which producers meet their information requirements. It is envisaged that the findings and information from this study will draw lessons that can be supportive of efforts aimed at empowering and improving conditions of the small farmers who are among the major shareholders of the agriculture industry in Tanzania. Moreover, it is hoped that these findings will help agricultural experts (especially extension officers) and other information specialists to make agricultural information more easily accessible to crop farmers and others agricultural producers.

1.3 Objectives

1.3.1 Overall objective

The overall objective of the study is to assess the relationship between accessing market information sources and farm level productivity.

1.3.2 Specific objectives

(i) To identify market information sources in smallholder production system.

(ii) To examine the relationship between farm productivity and accessibility market information source

(iii) To examine factors that influence farmers to access and use market information

(iv) To harmonize information source by farmers and product types.

1.4 Hypothesis

(i) Farm productivity and accessing market information sources are significantly independent.

(ii) Farmer's decision to access and use market information is significantly independent from socio-economic and demographic variables.

1.5 Organization of the thesis

This thesis is organised into five chapters including this introduction. The remaining chapters of the thesis are arranged as follows. Chapter two present a review of relevant literature. The methodology is explained in Chapter three. Chapter four gives the results and discussion of the study. Concluding remarks and policy recommendations are narrated in Chapter five.

CHAPTER TWO

2.0 REVIEW OF LITERATURE

2.1 Theoretical framework

Information sourcing decisions are usually modelled in terms of value of information. The value of information is generally defined as the expected benefit from using the information. The notion of value of information has generally been used to model the choice between information sources, where each source is represented by a random signal. The study briefly reviewed the theoretical framework of Hirshleifer and Riley (1992) cited by Gervais *et al.* (2002) in order to build our empirical model. The study derived expectations about the impact of different exogenous variables on demand for information services. The study supposed that there exist a finite number of different states (S) in the world. Producers' profits can take a different value in each state. A producer can obtain information from J different information sources about future states of the world. Each information source can provide one of M information messages. Based upon the message received, a producer will choose the optimal course of actions and/or will update his/her planned actions. A producer initially assigns his/her own subjective probabilities about each of the random states, $P_s, s = 1,...,S$. Let q_m represent the unconditional probability of receiving message m $(m = 1,..., M)$ and define the joint probability of state s and message m as j_{sm}, such that $\bullet_m j_{sm} = P_s$ and $\bullet_s j_{sm} = q_m$

With this framework, the study wished to emphasize the conditions under which an individual producer will decide to obtain information from source j. The study supposed that each information service can only provide a message to a producer among the set of available messages, M. Upon reception of the new information, a producer will convert his/her prior probabilities, P_s, into posterior probabilities, ρ_{sm}, where ρ_{sm} is the conditional probability of state s given the message m. Following Bayes theorem, the posterior probability (ρ) is calculated a $\rho_{sm} = j_{sm}/q_m$.

Under Bayesian rules, the more confident a producer is about her own prior beliefs, the less likely he/she is to acquire information about future random states of the world, since any new information will marginally impact his/her posterior probabilities. Hence, empirical application of the theory must approximate a producer's confidence in his/her beliefs. Moreover, the joint probability of state s given message m can be rewritten as $j_{sm} = \frac{l_{sm}}{q_m}$, where the element l_{sm} is used to form the likelihood matrix or, equivalently, is the conditional probability of message m given state s. Hirshleifer and Riley (1992) cited by Gervais *et al.* (2002) labelled the matrix of conditional probabilities as the credence matrix of the producer. The credibility of the information message should be directly related to the producers' confidence in the information service.

The expected value of information service j for producer i, denoted Ω_{ij}, is the sum of the expected utility of information message m weighted by the marginal probabilities of receiving that message minus the expected utility of the uninformed action. Hence, expected value of the message service is simply the difference between expected utility with and without the service:

$$\Omega_{ij} = \bullet_m \bullet_s q_m \rho_{sm} U_i(\pi_{sm}) - \bullet_m \bullet_s q_m \rho_{sm} U_i(\pi_{s0}) \quad \text{..... [1]}$$

Where;

Ω_{ij} = The expected value of information service j for producer I.
π_{sm} = Is the informed profit level in state s
π_{s0} = Is the uninformed profit level in state s.
ρ_{sm} = The conditional probability of state s given the message m
q_m = Unconditional probability of receiving message m
U_i = Is an independently distributed random variable.
$\bullet$ = Joint factor between information source (s) and information message (m)

Equation [1] does not include the costs associated with the acquisition of information from source j. It can be shown that the value of information is a decreasing function of the

producer's confidence in his/her beliefs. This is rather intuitive since higher prior confidence implies smaller revisions of beliefs for any given message.

In this application, producers can choose among a set of different information services. A message service *h* will be more informative than another service *j* if using the service *h* provides a higher expected utility than information service *j*. Obviously, the preference for an information service over another will depend upon the prior belief of a producer and his/her preference mapping over all possible outcomes. Using the definition of posterior probabilities, we can substitute for ρ_{sm} in equation [1] and adjust equation [1] for the cost of obtaining the information (C_j):

$$\Omega^{*}_{ij} = E\left[U_i\left(\pi_{sm} - c_j\right) \Big/ l_{sm}, p_s\right] - E\left[U_i\left(\pi_0\right) \Big/ p_s\right] \quad \text{..... [2]}$$

Therefore, a producer will refer to information service *j* if $\Omega^{*}_{ij} > 0$. The utility function of the producer is unobservable by the researcher and thus the study considered it as a random variable.

The study denoted the potentially observable portion of the expected utility function by $V[\pi;\theta]$, where θ is the vector of all parameters of interest to be estimated. The utility function becomes:

$$E\left[U_i\left(\pi_{sm} - c_j\right) \Big/ l_{sm}, p_s\right] = V_i[\pi_i;\theta] + u_i \quad \text{..... [3]}$$

The study later assumed that the portion of the utility function that is observable can be approximated by an index function of producer's characteristics. For the purpose of estimation, the study used the random utility framework to impose a little more structure on Equation [2]:

$$\Omega^{*}_{ij} = V(\pi_{sm} - C_j) + u_{ij} - V_i(\pi_0) - u_{i0} > 0 \quad \text{..... [4]}$$

To make it simpler for implementation in the analysis program, abbreviations in Equation [4] above were defined as:

$$\Omega_{ij}^{*} \equiv y_{ij}^{*}$$
$$V_i(\pi_{sm} - C_j) - V_i(\pi_0) \equiv \beta_j X_{ij} \text{ and}$$
$$u_{ij} - u_{i0} = \varepsilon_{ij}$$

Therefore the observed producer's decision to acquire information from source j was represented as:

$$i_{ij} = \begin{cases} 1 \text{ if } i_{ij} \equiv \Sigma \beta_{ij} X_{ij} + \varepsilon_{ij} > 0 \\ 0 \text{ otherwise} \end{cases} \quad \text{..... [5]}$$

Where if;

$y_i = 1$ Indicates valid response
$y_i = 0$ Indicates invalid response

This was observable by the researcher. The first two moments of the random error term ε_i are $E[\varepsilon_i] = 0$ and $Var[\varepsilon_i] = 1$. From Equation [5], the probability that producer i will access information from source j is $P[y_i^{*} > 0] = P[\varepsilon <_i \beta' X_i]$ if the distribution of ε_i is symmetric, we can rewrite the probability of getting information as $P[y_i^{*} > 0] = P[\varepsilon_i <' \beta' X_i]$

2.2 Conceptual framework for decision making

Producers usually face a real complex economic environment. They face multiple risks and must carefully choose information among a multitude of messages divulged by an equivalently large number of information services (sources). Hence it is necessary to conceptualize a model of farming decision process in order to specify what information is required for decision making. Timko and Loyns (1989) viewed farm management as the continual processing of information from all sources in order for the household to make a decision. Since acquiring information influences alternatives of all activities, efforts to

improve marketing information processing (such as availability, learning, analytical support, etc.) should improve the system. Information sourcing decisions are generally modelled in terms of the value of information. The value of information is generally defined as the expected benefit from using the information.

The conceptual framework (Figure 1) illustrates the relationship between diversity of market information sources and farm level productivity of an agricultural produce. The framework illustrates the types of market information the farmer can access and the benefits obtained from accessing particular type of knowledge (increased productivity) by using the Multi-criteria analysis as a decision making tool in the household. The model conceptualises that farmers perceive a need for a particular type of information in the context of his/her environment (such as marketing system) e.g. information on input markets, output markets, technological and production. These kinds of information assist the farmer to answer daily basic market questions such as; what, where, when and how to produce (i.e. whether to produce out of season or not). Access to market information can facilitate optimal decision-making based on market incentives. In other words access to information will assist a farmer in making decisions concerning the type of crop and the quantity to produce and concerning the best time to produce to maximize returns.

What to produce? – Availability of relevant, reliable production and market information on inputs and output markets is important to assist farmers to improve technical and allocative decisions. Information also has another vital function to assist the farmer to decide what to produce, since there may be a time delay of months or years between investing in a crop or herd and getting a profit. Farmers who understand market trends and market opportunities have a better chance of succeeding than those who do not (Mdoe *at al.*, 2002).

For purpose of this study it is essential to understand market information as a component of farm management decision making rather than an event occurring after production.

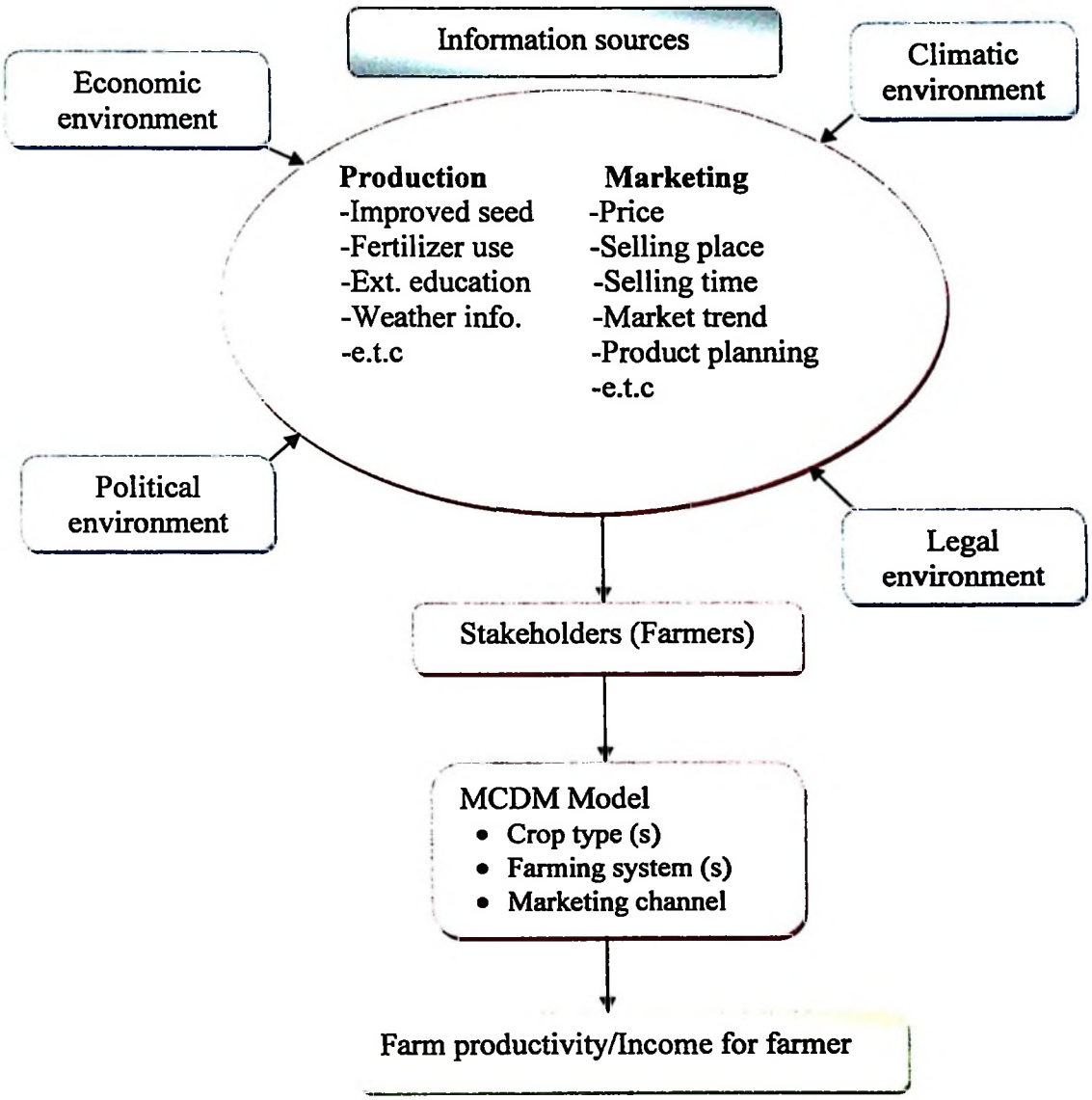

Figure 1. Conceptual framework

Information reduces the risk and uncertainty of the household, hence directly affecting the outcome of the decision. However information varies from producer to producer. For example, each producer is concerned with production level, marketing options in relation to time, space and form of the markets she/he faces, terms and conditions of sale for the

product as a result decision making requires knowing best production and marketing skills.

2.3 Definition of terms

2.3.1 Market information

Market information is usually regarded as data on prices, qualities and quantities exchanged, duly processed and made available to market participants. Market information reflects the current conditions on supply, demand, price trend, movement, and any other information pertinent to trading. This kind of information aids producers in production to plan and is reported in uniform terminology that places the producer and buyer on a more equal bargaining basis and enables exchange of information bringing up business related issues with one voice (Shepherd and Schalke, 1995; Shepherd, 1997).

2.3.2 Market information services

The market information service is a mechanism through which collection, analysis and dissemination of information needed to help farmer in making decision are organized and systematized. Service usually involves the collection on regular basis of information on prices, and in some cases quantities supplied, of widely consumed agricultural products, from wholesale markets, rural assembly and retail markets, as appropriate, and dissemination of this information on regular basis through various means (bulletin boards, radio, or television bulletins, news papers) to farmers, traders, government officials, policy markers and others (Shepherd and Schalke, 1995; Shepherd, 1997).

2.3.3 Difference between market and marketing information

Shepherd and Schalke (1995) and Shepherd (1997) distinguished market information and marketing information whereby the latter represents a much wider concept, include details on potential market channels, payment requirements, packaging, quality and a whole range of other information, including market information.

2.3.4 Market information and agricultural production

To make informed decision and manage risk, all stakeholders in the agricultural production, processing and marketing chain, must have reliable and timely information. Farmers need information for choosing what commodity to produce, what technology to apply for production, when to produce, for whom to produce, when to and at what price to sell (Mukhebi, 2004). However, in most rain-fed production systems, the cropping calendar limits the cultivation and harvesting period to several months during a year. The question "when to produce" is thereby limited to a fixed period. Nevertheless, this makes the question "when to sell" more important. Availability of information about seasonal price movements should, in time, facilitate decisions about when to sell the crop (Shepherd and Schalke, 1995; Shepherd, 2001).

Historical information, such as time series of prices over several years, can be used to make decision regarding product diversification and the production of out-of-season crops (Shepherd, 2001). Even though small scale farmers' accessibility to agricultural innovations is often limited by unfavourable economic, socio-cultural and institutional conditions, they have achieved some level of efficiency through deployment of their indigenous knowledge. If provided with the right inputs, feasible technology and relevant information, they are capable of transforming traditional agriculture (Ozowa, 1995).

There is a general consensus among experts in the agricultural sector that information plays an important role in improving the agricultural production of any nation. Schnitkey *et al.* (1992) pointed out that, the demand for information is likely to be increasing in farm size and production (scale effect), and since production increases can mostly be sold exclusively on new markets. Moreover, larger expenditures in information can be easily amortized over large output. Fatimah *et al.* (1994) reported that, in Japan, the Ministry of Agriculture, Forestry and Fisheries spends US $ 9.5 million (Tshs 10.5 billion) every year maintaining and operating its information service for perishable foods alone (fruit and vegetables). It is clear that the government is aware of the importance of information technology and has invested heavily in a marketing information service.

Also Giovannuci (1999), Shepherd (1997) and Shepherd and Schalke (1995) documented that, after more than 20 years of operation the Indonesian Market Information Service (MIS) continues to provide valuable services to growers and has been replicated for meat and fish. The 1997 cost of operating the service was approximately US $ 850 000 (0.1% of annual vegetable production value). It has proven to be remarkably sustainable and compares favourably with the US $ 9.5 million Japan spends for its horticultural MIS.

2.3.5 Market information in the functioning of agricultural markets

Marketing of agricultural products begins at the farm when the farmer plans production to meet specific demands and market prospects. This is a very complicated process that so far has not been adequately incorporated in the tools used by change agents in agriculture (Mbiha *et al.,* 2003). The market provides information from consumers to producers who in turn, respond to price signals by producing products in quantities and forms commensurate with prices and cost.

Availability of information encourages new entrants into the marketing system. In long term it also provides farmers with the opportunity to plan and diversify their production in line with market demand and to schedule deliveries to the market at times when returns are most rewarding. Access to timely information on prices and quantities plays a crucial role in reducing the risk of losing money on a market transaction (Shepherd, 2001). In the extreme case, farmers with information can decide whether or not to harvest, so avoiding sending produce to market in times of glut only to discover that the price received does not cover harvest, packaging and transport costs (Barret *et al.*, 1996). A study in Ghana, for example, found that many producers, lacking market information, feared that the cost of marketing would exceed their selling prices and thus did not go to market (Shepherd, 2001). Information on market conditions may change farmers' marketing strategies.

Several scholars have tried to address the issue of Market information in the function of markets where by, Dembélé *et al.* (1999) reported that The Malian Cereal Market Information System (MCMIS) as a key component of Mali's cereal market reforms.

According to Shepherd (1997) in the mid-1990s an Food Agricultural Organisation (FAO) project in Zambia recognized that the grain marketing liberalization process would be assisted if farmers had access to information about market prices, crop buyers and their buying terms and conditions at provincial level as well as at national level. The same author reported that, in Benin there was until recently no Market Information Service, so farmers who wanted to sell their surpluses had to search for information about market conditions. Information on conditions in markets further away was more difficult to obtain. The costs of a journey to visit these outlets and gather information constituted an entry barrier, as the quantities handled were often small (less than a few hundred kilograms).

Furthermore, Mukhebi (2004) revealed that Kenya Marketing Development Programme (KMDP) project in District of Bungoma in Kenya, farmers who sold maize via Kenya Agricultural Commodity Exchange (KACE) during the 2003/04 maize season achieved a higher average price as compared to those who did not. However, while market information can be seen as being most appropriate for crops, where prices fluctuate on a daily basis, the liberalisation of staple food markets in many countries also opens up a need for information on prices of these crops to be disseminated, in order to assist the developing private sector (Shepherd and Schalke, 1995). Unfortunately, in many countries there are market information systems that do not provide a service, i.e. they devote considerable resources to collecting market information but do not distribute it in any commercial useful way. The essence of a market information service is that the information provided should be up-to-date, in order to permit its use for commercial purposes.

2.3.6 Approaches to market information provision

Market information aims at improving market access and efficiency for producers, traders and processors both at the macro and micro levels. At macro-level market information targets the needs of the policy sector and larger traders and at micro-level market information aims to provide localized information to small-scale producers and traders.

Thus there has been increased effort to build approaches, which will work closely with other market information providers such as private. The need for these approaches has increased in resent years; this increase has been due to market liberalization in almost all African economies (Ferris and Muganga, 2002). Though, these efforts have been made to offer access to relevant and timely market information to the bulk of stakeholder in African agriculture by African governments. It is clear, however, that these systems are inadequate and do not help in day to day problem of making commercial transactions in agriculture goods. To meet the increased need of market information, Africa has turned to new approaches.

2.3.7 New approaches to market information provision

For agricultural development programs approaches are to work, African governments need to take new approaches to information dissemination and management that grow out from a clear understanding of what farmers information needs are. The result of difficulties associated with national-level market information services, have encouraged the development of new approaches, emphasizing the importance of information dissemination and collection, at the local level. This, of course, reflects a general trend towards decentralization of government services (Shepherd, 2001). For example in Kenya, the KACE Limited has developed a market information system (MIS) based on the application of modern Information and Communication Technologies (ICT) to help farmers, especially smallholder poor farmers in remote areas, to access better markets and price for their produce (KACE, 2006). A similar model adopted by KACE is being replicated in Malawi (Mukhebi, 2004). Such efforts are being developed in other countries such as Uganda, Rwanda, and Ethiopia where there are ongoing interventions to commercialise market information (Robbins, 1999).

The renewed interest from some donors is due to the potential use of local FM radio stations that is making the localization of market information really feasible (Shepherd, 2001). For example, the core activities of Uganda Market Information Services are

collection, compilation, and dissemination of market information-mainly price. The process of collecting information covers the whole country and the collected information is broadcasted using nine radio stations through 12 programmes per week (Temu *et al.*, 2004). One of the three pilot radios in Uganda presently uses local-language. Such a move is important in other African countries as well. However, emphasis should not just be on duplicating the price information collected by the national MIS but also on obtaining other relevant marketing information, such as the prevailing transport situation, the markets' turnover, and the number and type of buyers.

Another example is that of Mali, where Mali's MIS was decentralized 1999, with the creation of 22 local offices throughout the country, in addition to the central office in Bamako. These local units are now responsible for collecting information and arranging for its local dissemination. This new service, funded by the government has contracts with 24 local radio stations to disseminate price and quantity information's regarding food crops of local interest. Currently eight of the main local units are linked together by an FM radio-telephone system, and are equipped with e-mail. They can thus exchange price information among themselves and farmers have also asked that this service should be used for them to place "buy and sell" offers (Shepherd, 2001).

The above examples are of tentative activities to localize market information provision, taking advantage of the growing number of local fm radio stations. To date, external donors have mainly supported these experiments and it's too early to say whether these activities will be sustainable or whether they will experience the same problem as donor supported national MIS (Shepherd, 2001).

In other countries like Ghana, Zimbabwe, and Bangladesh market traders gather and convey information effectively via the use of cellular telephones. Also in Columbia daily prices are transmitted by satellite to the farmers (Giovannucci, 1999; Shepherd, 1997). Also according to Shepherd and Schalke (1995), and Shepherd (2001) in Indonesia, horticultural market prices are broadcast daily for all major production areas via radio and

bulletin boards. Furthermore, Fatimah *et al.* (1994) reported that, in Indonesia, Japan, Korea, Malaysia, Philippines, Taiwan, and Thailand, agricultural marketing information is a national government service that receives regular government funding. The ministry of agriculture or its equivalent, sometimes by several ministries, usually runs it.

2.3.8 Market information in Tanzania

Market information in Tanzania dates back into 1970 when the Marketing Development Bureau (MDB) was established under the Ministry of Agriculture. When it started, information reported by MDB was official commodity prices and volumes. In early 1980s even before market liberalization MDB had already extended its coverage to include unofficial parallel markets. However, such information became legitimate and acknowledge by the government after adoption of market-oriented economic policies in late 1980s. Since then MDB has been undergoing gradual transformation in terms of functions, organization structure and commodity coverage. As reflection to such changes the department's name has been alternating from MDB to Agricultural Information Service (AIS) and MIS. But changes in many economic policies in recent years (1990s), particularly the adoption of market economy has rendered some of the functions of many institutions obsolete. MIS being not exception had been affected by these policy changes (MAL, 1982) cited by Nyange *et al.* (2002).

Under recent changes Marketing Information System has been transferred from the Ministry of Agriculture into the Ministry of Industries and Trade. Also other agents involved for the provision of market information include, Business Information Services (BIS) and Marketing, Agricultural Marketing System Development Programme (AMSDP). Up-to-date and relevant information is crucial for all stakeholders in a market economy. Currently the collection and dissemination of agricultural information is focused on data collection, analysis and dissemination for planning purpose at the national level. The Agricultural Statistics Unit (ASU) and Early Warning and Crop Monitoring Unit (EWCMU), both under MAFS, and National Bureau of Statistics (NBS) of the PC

undertake various production surveys. The ASU generates agricultural information and the Market Research and Information Section of MCM generates market information.

2.4 Awareness of market information dissemination in Tanzania

Results of the survey conducted by the Ministry of Cooperative and Marketing (2004) to examine whether stakeholders in agricultural marketing were aware of marketing information dissemination by government through news media revealed that 76.0% of respondents were aware of existence of a program on Radio Tanzania (RTD), which gives market snapshots about prices of selected commodities. Nevertheless, those who were aware of the marketing information broadcast did not make close follow-up. As it was found that only 17.2% of all stakeholders interviewed make close follow up of the programme because they had listened to the marketing information program on the day of the interview or the day before. That means, the remaining 82.8% had heard the program for the last time a week or earlier than that.

Those who had heard the program a month earlier accounted for 33.4% this being the highest percentage. A similar trend was observed on the part of newspaper, but it seems a follow-up in the newspaper is better than on the radio. About 27% of respondents had read the marketing information in the newspaper on the day of interview or a day before, while 73% of respondents, a week or more time had elapsed since they read marketing information in the newspaper. This situation suggest that there is a weakness in the information system as stakeholders do not pay adequate attention to information disseminated as it does not provide an accurate reflection of prevailing market prices or they receive the information too infrequently.

2.5 Sources of general information

Identification of existing information sources for farmers and traders is of great importance; in understanding their availability, which gives insight of information constrains facing agriculture marketing system.

2.5.1 Farmers and traders source of information

Smallholder producers usually are poorly accessible to markets and information sources compared to traders. Information networks are important to producers. Even in agricultural markets of advanced economies, farmers tend to be passive marketers, reliant on informal sources and 'word of mouth' (Mdoe *at al.*, 2002). Constrains are due to geographical distance, physical access, time and attitudinal considerations. In additional to neighbours and friends, traders often assume a significance rule as suppliers of information to smallholder producers.

Field studies carried out by Bagnall-Oakeley and Ocilaje (2002) in Lira and Soroti districts in Uganda, "revealed considerable differences in the number and quality of information sources between differing wealth groups of farmers, but not much difference between farmers in the 'poor men' and 'poor women' groupings''. The poorest groups obtained most of their agricultural information from farmer-farmer sources (other farmers and neighbours, family, friends and 'contact farmers'), whilst the middle and wealthy groups obtained more information from local government sources, public extension, agri-business sources and NGOs. The more wealthy groups tend to discount farmer-farmer information sources as not always reliable as other sources. Public extension and FM radio were cited as important information sources for all wealth categories, but more wealthy groups gave higher assessments in terms of frequency and quality of information flow from these sources than did the poorest groups.

Larger-scale traders usually have their own information networks relying on more or less modern communications technology (e.g. fax, e-mail, mobile phones etc). Although they are generally well informed about local markets, small-scale traders lack the resources to monitor such market on regular basis (Shepherd, 1997). They depend more on word-of-mouth information, which in turn depend on the existence of traditional communication channels such as telephone lines, and a functioning transport infrastructure (Kleih *et al.*, 2004).

2.5.2 Farmers and traders sources of information in Tanzania

Result of the assessment of market information need to agriculture marketing stakeholders by the Ministry of Co-operative and Marketing in Tanzania (2004) revealed that sources of market information depend on the type of and the level of the market, but friends and neighbour, traders and radio were important sources of agricultural market information to all stakeholders in agriculture marketing supply chain in Tanzania.

2.6 Types of information required by farmers

All business activities involved in the movement of commodities from production to consumption is marketing. The farmer's market information needs are those that enable him make rational and relevant decisions. Market information services have the function of collecting and processing market data systematically and continuously, and of making it available to market participants in a form relevant to their decision making (Ozowa, 1995).

Kleih *et al.* (2004) in the study of community access to market opportunities in Uganda reported that farmers and traders required more than market information, which is primarily based on prices. They needed other types of information, which include technical information such as both pre-and post-harvest aspects of farming. Traditionally, extension services were given a leading role in providing this information. However, at best, their results have been mixed; particular emphasis has been on production while farmers in commercial agriculture equally require technical information on post-harvest aspects, including storage, transport, processing and marketing.

As a consequence the latter points need to be strengthened, such that farmers should be supported by market information as well. The following types of information other than market price information are required; information on different food security and cash crops (i.e. not only cereals should be covered), supply and demand situation, availability and prices of inputs (i.e. transport, equipment, fertilizer), availability and condition of credit, processing, information on weather and storage.

It was also stressed by Robbins (1999) that, farmers need to be able to compare local market conditions with those further away, prices between one grade of product and another and they need information on individual traders, track records so that they can avoid those that are untrustworthy.

Market information for small scale farmers include:

a) Information on current prices.
b) Information on availability of market. Information where to sell the produce will give farmers spatial arbitrage advantage i.e. the ability of farmers to ship produce to markets offering the most profitable trading opportunities
c) Information on sales timing. This assists farmers in ensuring that they do not cause a market glut. It enables them to stagger harvesting and quantity for marketing.
d) Information on product planning. This is information on what crop and variety to grow at a given season with marketability of such a crop as an important deciding factor.
e) Information on forecast of market trends. This type of information assists farmers in planning their market products.
f) Information on improved marketing practices. It includes information on improved harvesting methods. Field level extension workers disseminate this information by demonstration on farmer's fields, at local and wholesale markets.
g) Information on group marketing. This enables small-scale farmers to have organised sales of marketable surplus and bulk transport of produce.
h) Extension Education: The general lack of awareness among small-scale farmers can be attributed to their high level of illiteracy. This contributes to the low level of adoption of agricultural production technology. Extension is a type of education that is functional rather than formal.
i) Agricultural Credit and credit information: Agricultural credit encompasses all loans and advances granted borrowers to finance and service production activities relating to agriculture, processing, marketing, storage and distribution of products.

Small-scale farmers are among the potential beneficiaries of agricultural credit but because of their low level of literacy they are mostly unaware of existing loan facilities. To reap the benefit of credit, farmers need information relating to sources of loan such as names of lenders, location and types of existing credit sources. They need information on the terms of loans such as the interest rates, loanable amount and mode of repayment.

Credit is among the important sources of capital which however not yet available to the majority of the smallholders farmers. The credit system in Tanzania is not favourable to smallholder although in recent years Tanzanian government through its agricultural reform policy (MCM, 2004) have tried to easy credit availability to farmers by providing collateral as the farmer accessing credits but still majority of farmers do not use the opportunity. Lack of credit has been one of the impediments to introduction of new technology. Cash constraints that prevent the adoption of new technology have been the rationale for large credit programmes directed to small farmers. Credit provision by government and other NGOs has been instrumental in boosting agricultural production of smallholders who have limited income to purchase inputs (Madadi, 1998).

2.7 Means of communication of information

Several means of communication of information exist worldwide. But few are particularly applicable to African environment; these include, radio, word of mouth, dialogue, Printed media, audio-visual tools, information and communication tools.

2.7.1 Radio

Radio is among the most effective and appropriate means of communicating information in remote areas to farmers many of whom have poor literacy skills (Robbins, 1999). This centrally also applies to the dissemination of market information. There is a considerable effort within Africa region to localize market information provision, taking advantage of the growing number of local FM radio stations. This is due to the fact that it has been increasingly being recognized that farmers who sell mainly to local retail or assembly

markets have considerable difficulties in relating information about a few central markets to their own needs and thus there is a need to make information available about local markets. This has been supported by findings by Kleih *et al.* (2004) in Uganda, which revealed that farmers have a preference for local radio stations broadcasting in vernacular language. This study indicates also that at least part of the information should be related to the context of specific locality (i.e. commune or region) rather than state as a whole.

Problems noted with radio-broadcast information included uncertain reliability (few broadcasts use professional agricultural staff), difficulties in knowing when agricultural broadcasts will occur, and choice of commodities and enterprises to be discussed, choices that are often made according to sponsors' interests rather than users' needs. Sometimes where broadcast are used these are usually in the national radio and are often only in one or two languages and are often broadcast when farmers are in the field (Shepherd, 2001).

2.7.2 Word of mouth

This is type of communication, which plays an important role in most parts of Africa. The volume of traffic and movement of people, which is a function of road infrastructure, availability of means of transportation, etc, influence this type of information flow. Market and other centres of social gathering are places of high turnover of word of mouth information (Kleih *et al.*, 2004).

2.7.3 Dialogue

This is the type of communication used at workshops or seminars. Agricultural extension staff providing farmer with information commonly uses this type of communication. Exhibition, trade fairs and study tours are forms of communicating information where farmers and traders mainly benefit from the visual impression of an object. Although they can be very useful, it is unlikely that the majority of the population in rural areas will be able to benefit from this type of communication (Kleih *et al.*, 2004).

2.7.4 Printed media

This type of information communication has played an important role in market information dissemination. Often, information has been disseminated in newspapers, newsletters and bulletin boards. Key problems with printed media include literacy and language where the majority of farmers in isolated communities are unlikely to read English. Other constraints with printed media such as newspapers are delay in reaching remote villages. On the other hand, in other places, posters written in vernacular languages have proved to be effective in communicating straightforward technical messages (Kleih *et al.*, 2004). A research report in Uganda by Janowski *et al.* (2003) in Uganda has reported the findings that the more wealthy groups of farmers mentioned newspapers as occasional information sources.

2.7.5 Audiovisual tools

Mobile video van is an effective form of audiovisual tool in areas with easy road access. However, they are less appropriate in remote areas and where large population numbers need to be reached. Maintenance of equipment can be an issue too (Kleih *et al.*, 2004).

2.7.6 New communication technologies

New communication technologies, which started only to exist during the 1990s, can be very useful. Examples include cellular phones, e-mail connections, internet and Television etc. Cheaper satellite technology has greatly helped to spread these means of communication. Consequently the development of an Information and Communication Technology (ICT) is a basic ingredient in any competitive strategy to foster efficient flow of information in decision-making (Mdoe *et al.*, 2002).

Progress in ICT has not only made possible for business to process and communicate vastly more information at reduced cost, but to manage day-to-day, far-flung and widely dispersed production and service networks. Moreover, advances in ICT have increased the transportability of many information-based services, enabling them to be traded across

distances without necessarily being embodied in people or goods (UNCTAD, 1996). Advances in ICT can induce more trade and foreign direct investment in countries with appropriate policy (Kamuzora, 2001).

2.8 Farm production and productivity

Productivity index is a measure of output produced divided by a measure of input used. Agricultural productivity is often assessed by measuring the production of an agricultural product e.g. the yield of a food crop and by estimating its value on the market thus knowing the potential for profits. However for many farmers, agricultural productivity may mean more than that. A productive farm is one that provides most of the resources necessary for the farmer family to live such as food, fuel, fibre etc. (Owuor, 1999; Lee and Zepeda, 2001; Zepeda, 2001).

Agriculture Policy of 1997 recognizes the need to improve agriculture practices, to enhance the agriculture activities for higher productivity. As a policy, the government will establish effective information system order to inform traders, livestock keepers and farmers about supply shortage and availability and prices. The Agricultural Information Services section will improve data collection at national, regional and district levels; coordinate information services within the Ministry and with other agencies. Also analyse, interpret and disseminate such information to users (URT, 1997). But most of these efforts are still directed at increasing production without considering that this is only one component of agro-industrial chain. According to Mbiha *et al.* (2003) to be able to increase their welfare and incomes, farmers require the best production systems but also this must be accompanied by best input distribution methods, markets and market information in particular.

In late 2001 the Tanzanian government produced the Agricultural Sector Development Strategy (ASDS) that aims to provide the basis for the rural sector of the economy to become an engine of growth, leading to a substantial reduction of poverty. This goal is also discussed in the Poverty Reduction Strategy Paper (PRSP) of 2000, where growth in

agriculture was set as one of the pillars for achieving medium term targets for poverty reduction. The focus of the discussion on the agricultural sector as a source of wealth and livelihood has traditionally been on production. However, in recent years looking at agricultural marketing has gained more ground in the debate as farmers have failed to sell their crops or the prices paid have been lower than expected. In order to address the problems with agricultural marketing, the government of Tanzania is currently formulating a new Agricultural Marketing Policy (AMP), which is aimed at addressing problems in agricultural trade and facilitating the use of agricultural marketing as a means to enhance economic growth (MCM, 2004; Eskola, 2005).

Farmers clearly need the government to make investments aimed at increasing agricultural productivity. But these investments could depress commodity prices and farm incomes if they are not linked to market opportunities for farmers. Poorly functioning markets and market information, weak domestic demand, and lack of export possibilities are major constraints on farmers' agricultural growth prospects. The study by Kashuliza *et al.* (2002) tried to address the challenges facing agricultural productivity improvement in Tanzania, thereby concluding that agriculture improvement in Tanzania faces number of problems and market information is one of them.

2.9 The need for Multi-criteria analysis

Farmers are decision makers that must continuously assume the role of problem solvers in a complex production sector that has always been dependent upon many factors that are often difficult to predict or control. In addition farmers are under increasing pressure of some challenges like market problems, underproductions, competition, quality, and environment (Gallenti, 1997). However, for many years, analysis of smallholder problems was centred on the traditional approach where information was modelled based on optimisation of single objective such as utility or profit and many of these traditional methodologies were useful when the problem analysed can be represented by a single objective. However, drawback appears when more than one objective with several criteria/alternatives is considered (Hella *et al.*, 2001).

One attractive way of dealing with this kind of problem is to use multi-criteria techniques, which are designed to evaluate a discrete number of alternatives by means of explicit formulated criteria (Hella *et al.*, 2001). The great advantage of this method is that it allows the farmer to test a wide range of alternative adjustments and to analyse their consequences thoroughly with a small input of managerial time (Gallenti, 1997).

Multi-Criteria Analysis is a decision-making tool developed for complex multi-criteria problems that include qualitative and/or quantitative aspects of the problem in the decision-making process. It is used for comparison in which several points of view are taken into account, and therefore is particularly useful during the formulation of a judgement on complex problems. The analysis can be used with contradictory judgement criteria or when a choice between the criteria is difficult (Mendoza and Macoun, 1999).

Decision-making is a subjective process, as the perception regarding a problem can diverge from person to person. One cannot expect a decision maker or an expert to be highly consistent while dealing with such a subjective process. The real world problems are influenced by many natural factors and processes that are difficult to measure and model precisely. Multi-Criteria Decision Making (MCDM) method deal with real world problems that are multi dimensional in nature. When it comes to environmental issue the methods have to deal with heterogeneous criteria that are both qualitative and quantitative in nature (Prakash, 2003).

A number of studies have addressed the use of Multi-criteria analysis as decision-making process. For example José *et al.* (2004) assessed the multi-criteria analysis of input use in agriculture basing on the "multi-attribute utility" and "multi-attribute marginal utility" and reported that multi-attribute utility functions explained differences in irrigation water use in relatively homogeneous agricultural systems, albeit exhibiting dissimilar partial utility functions for water use. The authors concluded that these differences came from the dissimilar weights that farmers attached to each attribute in the aggregate utility function.

Furthermore, Siskos *et al.* (1999) analysed the use of multi-criteria analysis in agricultural olive oil marketing in assessing consumer behaviour and concluded that among the six criteria which were segmented, into three categories according to their importance and olive oil colour and company image were the most determinant criteria for the choice of a specific olive oil brand, while price and packaging consisted of a criteria group of medium importance to French consumer and olive oil taste and odour were the least determinant criteria for the consumer behaviour. Another study by Hella *et al.* (2001) that assessed the applicability of multi-criteria model for analysis of farm-level information found that multi-criteria offer a more ideal option for analysing smallholder farmers' information than traditional single approaches. But despite its usefulness, Multi-criteria analysis model is yet to receive sufficient attention.

As showed previously multi-criteria analysis as a tool for simplifying complex decision-making tasks, which involve many stakeholders, diversity of possible outcomes and many, sometimes intangible, criteria by which to assess the outcome. Different approaches and techniques that exist for Multi-Criteria Analysis (MCA) approaches make the options and their contribution to the different criteria explicit, and all require the exercise of judgement. MCA techniques to use will differ depending on type of decision, time to undertake the analysis, amount and nature of the data available, analytical skills of those supporting the decision and differences in administrative and cultural requirements (Nijkamp and van Deflt, 1977) cited by (Tenge, 2005; Mendoza and Macoun, 1999). The general analytical steps in MCA are described hereunder:

a) **Determination of objectives:** The objectives indicate the direction of state of change of a system desired by the decision maker. The objectives should be SMART (i.e. Specific, Measurable, Agreed, Realistic and Time-dependent).
b) **Identification of option for achieving the objectives.** The option should be independent and should compete more or less about the same resource

c) **Determination of the evaluation criteria:** This stage decides how to compare the contributions of the different options toward the objectives. This requires selection of criteria to reflect performance in meeting the objectives.

d) **Determination of effects:** The effects of the alternatives are assessed according to the measurable criteria set.

e) **Standardisation of the effects:** This step aims at eliminating the influence of different dimensions in which each criterion has been expressed. The score of each criteria have to be expressed in the same unit of measurement i.e. standardisation.

f) **Formulation of weights:** Different criteria usually have levels of importance to each farmer. This is expressed by the weights attached to each criterion. It is therefore necessary to incorporate some form of criteria weighting to take care of their relative importance. These weights are established directly by interviewing farmers who were in the survey (Nijkamp and van Deflt, 1977) cited by (Tenge, 2005; Mendoza and Macoun, 1999).

g) **Aggregation and ranking:** Weighted scores for each criterion are combined. Additive weighting method is mostly used. The total weighted scores are then arranged according to the size.

CHAPTER THREE

3.0 METHODOLOGY OF THE STUDY

3.1 Description of study area

The study was conducted in Kilosa and Mvomero districts in Morogoro region. The districts were selected because of different types of crops grown in the area.

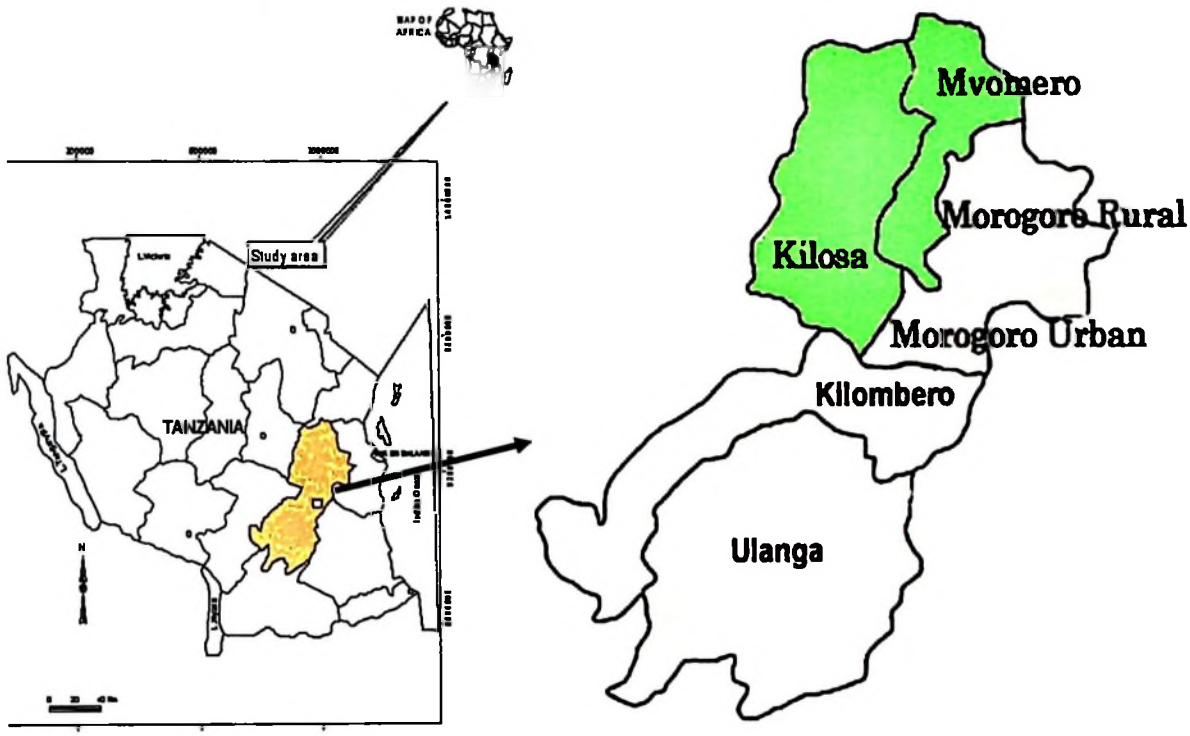

Figure 2. Map of Tanzania showing position of Morogoro region and location of Kilosa and Mvomero districts

3.1.1 Mvomero district

This is the recently established district in the region. The district is among the six districts in Morgoro region other districts include Kilosa, Kilombero, Morogoro Rural, Morogoro Urban and Ulanga. The district is located at northeast of Morogoro region between latitudes 8^0 00" and 10^0 00" south of the equator and between longitudes 37^0 00" and 28^0 22" east of Greenwich. It borders Kilosa district to the east, Ulanga and Kilombero districts to the south, Kilosa district to the west and Arusha region to the North (URT, 2003). According to the population census of 2002, Mvomero District has a population of

about 260 525 people with a population growth rate of 2.6% and an average of 4.6 people per household and an average population density of 22.3 persons per square km URT, 2003).

The altitude of district is between 380 meters and 520 meters above sea level. This altitude provides a suitable climate for tropical and subtropical varieties of crops. The district receives a bimodal type of rainfall with peaks in April and December while May to October remains relatively dry. The average rainfall amounts to 1 200 mm per annum with variations from 800 mm to 2 000 mm. Average monthly rainfall is about 106 mm making up a total annual rainfall of about 1 270 mm. The district's economy like most of Morogoro districts depends on agriculture mainly from crop production.

The main crops grown are cassava, rice, maize, and bananas. Other crops include beans, millet, peas, potatoes, coffee, groundnuts, citrus fruits, mangoes, jackfruits, sugarcane, coconut, tomato and eggplant. With exception of paddy and sugarcane fields, cultivation is carried out mainly by use of the hand hoe, using primarily family labour and hired labour when the situation demands. Tractors are available only to a few individuals. Livestock keeping is also practiced in the area but with few numbers engaged.

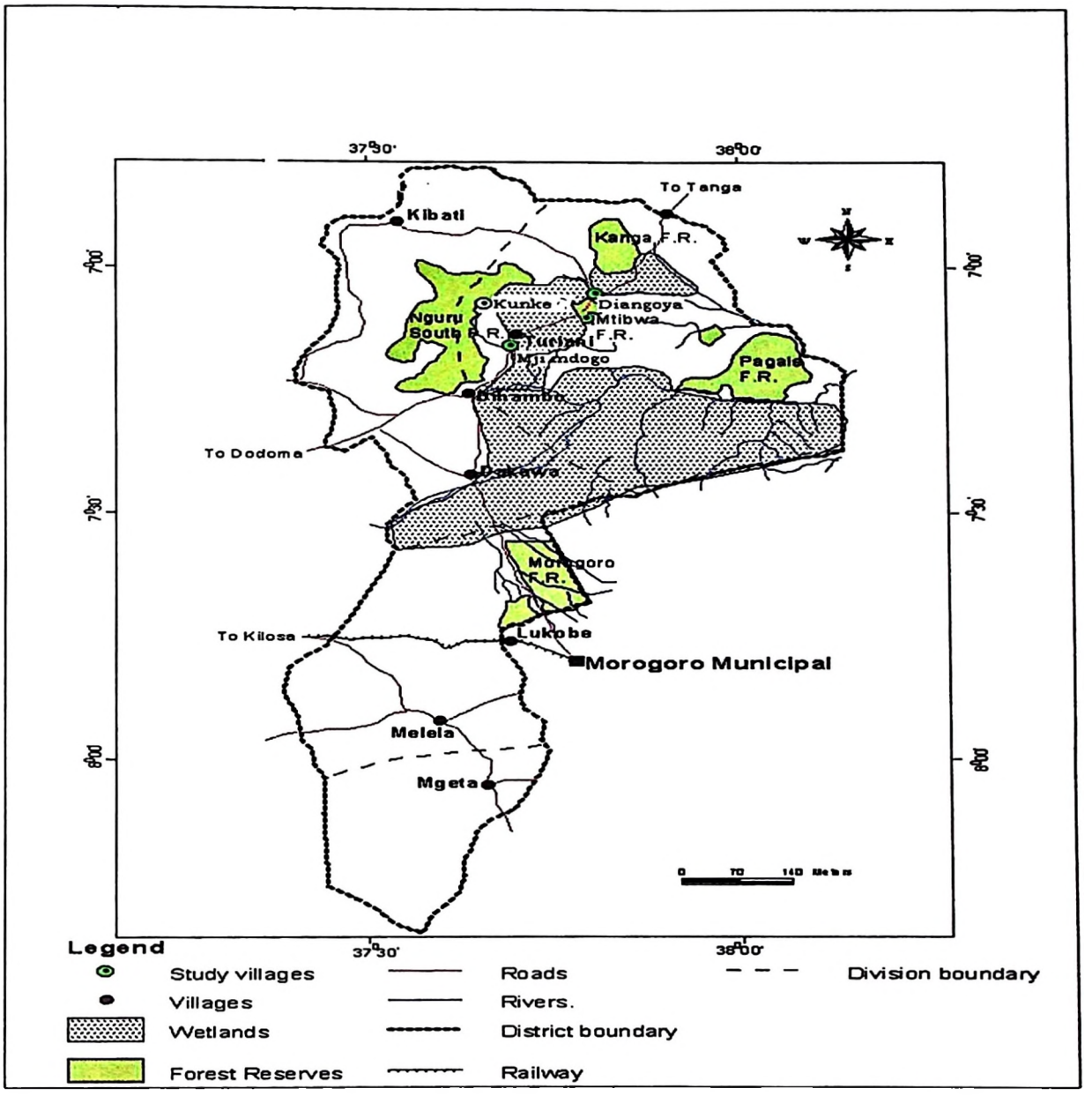

Figure 3. Map showing Mvomero district

3.1.2 Kilosa district

Kilosa district is the oldest district in Morogoro. To the north borders Tanga and Arusha regions, to the east is Mvomero district. On the western border are Dodoma and Iringa while Kilombero district borders to the south. It lies between latitudes 6° South and 8° South and longitudes 36° 30' East and 38° West (NBS, 2003). The district occupies an area of 14 918 square km and according to 2002 population census, the district has 1 753 362 people.

The area is characterised by semi humid climate, receiving an average rainfall of 800 mm annually. The district receives rainfall in eight months (October-May) with highest levels between February and March. Temperature ranges from 18°C in the hills to as high as 30°C in the lowlands. Although Kilosa district has two rain seasons, the pattern and amount of rainfall allow for one harvest of the main staples per cropping season. The early rains start in November and end in January followed by the period of heavy rainfall between March and June. The district experiences a long dry season in June to October.

The main economic activity in the district is crop production and livestock keeping. Over 77% of people in Kilosa district are engaging in agricultural activities (URT, 2003). Major crops cultivated include maize, paddy, sorghum, cassava, and legumes. Major cash crops are cotton, sisal, sugarcane and oilseeds. Livestock keeping is also an important economic activity in the region. Kilosa is the most favoured District in terms of densities in the region when compared to other districts. However, feeder roads are not passable during the rain season thus cutting the remote areas from other parts of the Districts (NBS, 2003).

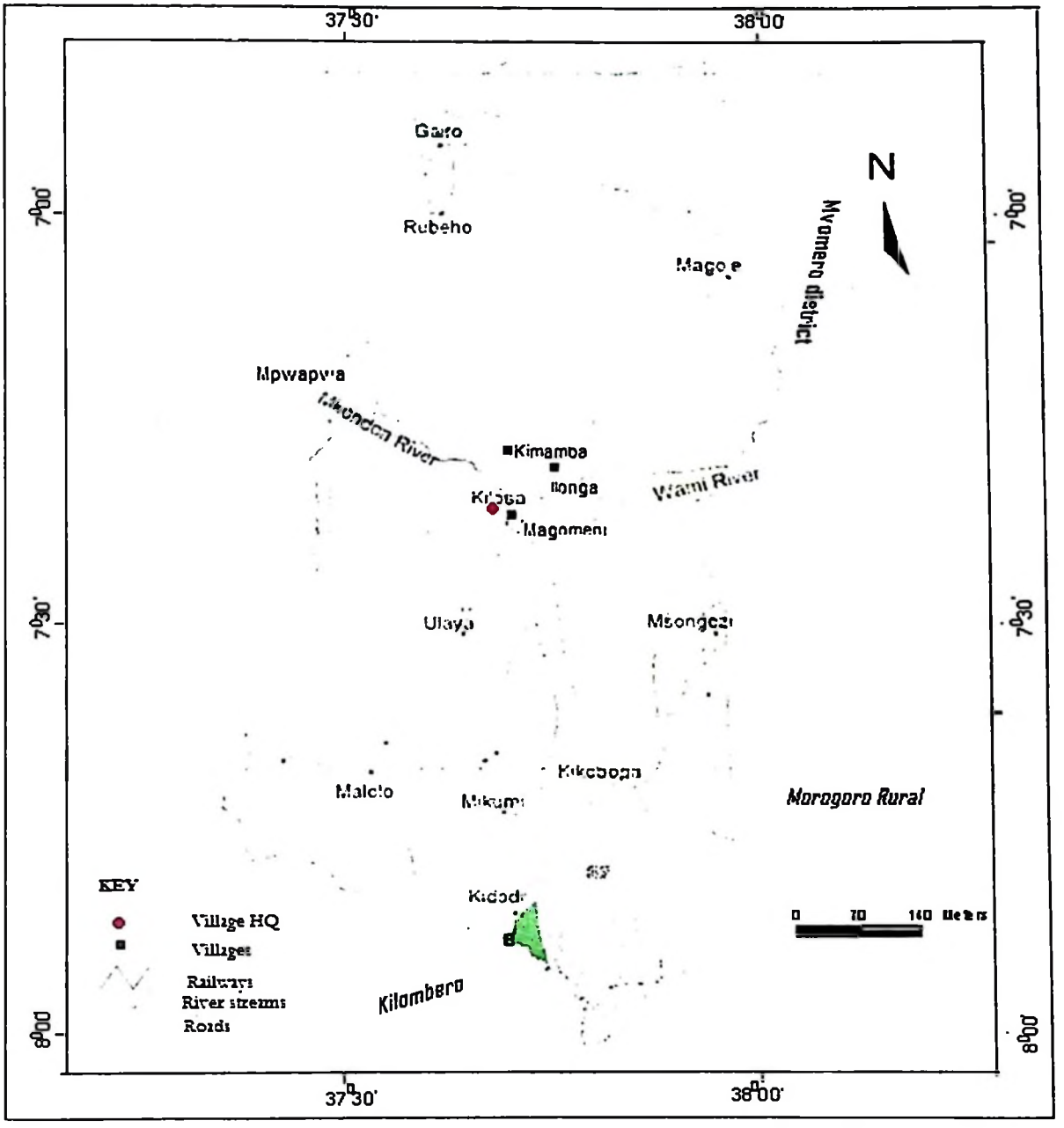

Figure 4. Map showing Kilosa district

3.2 Research design

A cross-sectional study design was employed. The design allows collection of in depth data on different groups of respondents at one point at a time (Bailey, 1998). This design was chosen because it is suitable for description purposes as well as the determination of relationships between variables. Limited time for fieldwork justifies the use of the selected design. However, secondary data were also used.

3.3 Study population

Sample of farmers were selected from the two selected districts. The study covered three divisions, namely Mtibwa in Mvomero district, Kilosa Mjini and Kimamba in Kilosa district.

3.4 Sampling procedure

3.4.1 Sampling method

Different sampling techniques were employed. The study employed a multistage sampling technique starting at the division and ending at the household level. Multistage was chosen because it took into cognisance the delineation of the study area into divisions, wards and villages scattered in a wide geographical area (Oakshot, 1994). A multistage sampling technique for this study had involved several stages. First stage involved selection of three divisions (i.e. Mtibwa, Kilosa Mjini and Kimamba). In this context, the two divisions were chosen because of having the reasonable number of farmers who grow different types of crops. Second stage involved selection of five wards (i.e. Madizini, Diangoya, Kunke in Mvomero district, and Magomeni and Chanzuru in Kilosa district). The last stage involved selection of five villages for the study (i.e. Mji mdogo, Manyinga, Kunke in Mvomero district and, Magomeni and Ilonga in Kilosa district) (Table 1), since majority of the inhabitants are crop farmers hence were ideal for the study.

After the multistage sampling technique, simple random sampling was subsequently employed. Using random numbers, respondent households for interview were selected randomly from the village government registry. All Ward Executive Officers (WEO) and Village Executive Officers (VEO) in the area of study were picked by virtue of being few. Random sampling was appropriate for selecting respondents for this study because it allows the use of statistical inference tests and thus avoiding conscious and unconscious biases in selection of the respondents.

Table 1. Distribution of respondents in the study villages

District	Village	Frequency	Percent
Mvomero	Mji mdogo	18	10.4
	Manyinga	15	8.7
	Kunke	34	19.7
Kilosa	Magomeni	46	26.6
	Ilonga	60	34.7
	Total	**173**	**100.0**

3.4.2 Sampling frame and sample size

The household was the sampling unit of the study. The sample comprised of 173 respondents that were household heads or their spouses and/or other responsible family members. Included in the study were 69 respondents from Mvomero district and 104 respondents from Kilosa district (Table 1). The sample size was found to be convenient since statistical computations are meaningful but also due to the time and finance resources convenience.

3.5 Data collection

Both primary and secondary data were used. Data for this study were collected through informal and formal surveys. The formal survey involved personal interviews using a pre-tested questionnaire (Appendix I). Questionnaire pre-testing involved five respondents, before main survey. This activity was undertaken in order to determine if there were any questions that would not yield responses from the farmers as well as checking if the questionnaire was compressive enough to collect the information required. It was also conducted to establish the sampling frames and units as well as to determine the approximate time required to complete the questionnaire. Pre-testing was conducted in Magomeni village in Kilosa district. After pre-testing, some of the questions were restructured and a final version was developed.

The information collected included socio-economic data, farm production practices and outputs as well as marketing and market information for the agricultural crops. The researcher and one trained enumerator conducted the interviews. To ensure a higher rate of response for the interview, the team conducted interviews with the respondents at their homesteads. Furthermore, discussions with the local leaders and some respondents were conducted to obtain supplementary information concerning production and marketing in the study area.

Secondary data such as production, marketing and market information, and other relevant secondary information were extracted from reports and other documentary materials from the relevant bodies/institutions such as journals, books both published and unpublished e.g. thesis and Sokoine National Agricultural Library (SNAL).

3.6 Data processing and analysis

Data collected by structured questionnaires were coded, summarized and entered in Statistical Package for Social Science (SPSS version 11.5) computer programme. Descriptive statistics such as frequency distribution, means, and percentage and cross tabulation were used to answer the first and fourth objectives whereby type of market information sources used by farmers in production systems and information sources by farmers and product characteristics were determined. Cross tabulation was used to establish the relationship between market information sources and farm productivity. For quantitative statistics, factor analysis, regressions and multi-criteria analysis were used.

3.6.1 Factor analysis

Principle Component Analysis (PCA) is a form of factor analysis used to reduce a large number of variables into few ones. PCA as method for factor extraction was used to prepare farm productivity and market information accessibility indices respectively, Varimax as method of rotation, and listwise deletion as the method of handling missing cases. The use of PCA made it possible to identify the best factors in terms of explaining the variance in the sample. The total variance explained by each factor is indicated by the

factor's Eigen value: a high Eigen value for a factor indicates that the factor accounts for a high total variance in the sample (Filmer and Pritchet, 1998).

The Varimax method of rotation minimizes the number of variables that have high loadings on a factor, thereby enhancing the interpretability of the factors. For each factor analysis, items in the factor with the highest Eigen value of greater than one were taken and those with Eigen value less than one were generally considered not substantial (Filmer and Pritchet, 1998). The scoring factor can have negative or positive value. Positive values indicate the variables associated with households of high farm productivity/output statuses while the negative factors denote the variable associated with households of low farm productivity/output statuses (Regnard, 2006). Since the values were entered in the computation as mentioned, the positive score increases the index while the negative score decreases it.

Using the PCA equation, farm productivity/output index values for each household were obtained. Index of farm productivity (farm output) measures respondent's perception of the current status of farm productivity potentials. A high score value on the scale indicate perceived high farm productivity. The bigger index value for the household denotes high farm output while smallest index value denotes low farm output. Basing on this fact, from the indices values, three households' farm output strata (quintiles) were obtained using 40 and 80 percentiles. The percentiles were used in order to get three groups. The use of index method was used to categorize the households in the relative three groups (i.e. High, medium and low for both indices respectively) (Filmer and Pritchet, 1998). The general formula for the index value is presented as follows;

$$A_{ij} = f_i \times \frac{\left(a_{ij} - \bar{a}_i\right)}{S_i} + \ldots + f_N \times \frac{\left(a_{jN} - \bar{a}_N\right)}{S_N} \quad \ldots\ldots [6]$$

Where;

A_{ij} = Index value

f = Factor scoring weight for each variable

a_{ij} = Number of the specific variable

$\bar{a}_i$ = Mean for each variable

S_N = Standard deviation of each variable

3.6.2 Regression analysis

Since there were many variables that influence farm productivity and accessing market information sources, the regression analysis was employed to test the two hypotheses. For the first hypothesis, the use of total amount of crop harvested by household as a dependent variable was regressed on eight independent variables to examine the effect of the dependent variable on independent variables. The following regression equation was used in the prediction of the model.

$$Y_i = \beta_o + \beta_1 X_1 + \ldots + \beta_8 X_8 + \varepsilon_i \quad \ldots\ldots [7]$$

Where:

Y_i = Dependent variable, total amount of crop harvested (Tonnes)

βS = Parameter to be estimated

X_1 = Age of the farmer in years

X_2 = Level of education of the farmer in years in school

X_3 = Total cultivated farm area measured in hectares

X_4 = Total number of crops grown by the farmer

X_5 = Total amount of labour power in numbers used by household

X_6 = Improved seed use, dummy (1 for yes and 0 otherwise)

X_7 = Fertilizer use, dummy (1 for yes and 0 otherwise)

X_8 = Index value for access to market information sources

ε_i = Error term.

Second hypothesis, binary regression logit model was used in the analysis. The choice of the model was based on the assumption that the random component of the response follows a binomial distribution and the logistic distribution of error term (Liao, 1994).

$$\ln\left(\frac{p_i}{1-p_i}\right) = \beta_0 + \beta_1 Z_1 + \ldots + \beta_{13} Z_{13} + \varepsilon_i \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots [8]$$

Where:

P_i = Probability that farmer has accessed market information

$1-P_i$ = Probability that farmer has not accessed market information

βs = Parameters to be estimated

Z_1 = Age of the farmer in years

Z_2 = Level of education of the farmer in years in school

Z_3 = Total cultivated farm area measured in hectares

Z_4 = Total number of crops grown by the farmer

Z_5 = Media ownership, dummy (1 for yes and 0 otherwise)

Z_6 = Contact with friends/neighbour, dummy (1 for yes and 0 otherwise)

Z_7 = Contact with radio, dummy (1 for yes and 0 otherwise)

Z_8 = Contact with extension agent, dummy (1 for yes and 0 otherwise)

Z_9 = Contact with trader, dummy (1 for yes and 0 otherwise)

Z_{10} = Contact with News paper, dummy (1 for yes and 0 otherwise)

Z_{11} = Contact with TV, dummy (1 for yes and 0 otherwise)

Z_{12} = Contact with bulletin boards, dummy (1 for yes and 0 otherwise)

Z_{13} = Contact with mobile phone, dummy (1 for yes and 0 otherwise)

ε_i = Error term.

3.6.3 Multi-Criteria analysis

Identification of the most important market information and production information options and formulation of weight for each criterion by the farmers from the interview were done. Farmers' key informants i.e. WEO, VEO, and Balozi gave scores to each criterion on the scale of 1 for not good and 4 for very good. Criteria with highest scores were short listed for the integrated analysis using MCA. Farmers (key informants) determined the relative importance of each criterion by pair wise ranking method (Defoer and Hilhorst, 1995) cited by (Tenge, 2005).

The results of farmers' ranking were expressed as weight, which is the ratio of total scores for individual criterion to the overall scores for all criteria. The additive weighting or weighted summation method was used to obtain the total weighted scores for each criterion. The criterion with the highest total weighted scores was considered as the most preferred to that farmer in improving productivity (Belton and Reeves, 2002; de Graaf *et al.*, 2001) cited by (Tenge, 2005). Sensitivity of the ranking was assessed by comparing the results of qualitative measurements by farmers and those from questionnaire. Scores of each criterion were standardized using equations [9] and [10]:

$$e_{ij} = {C_{ij}}/{MaxC_i} \quad \text{..... [9]}$$

$$e_{ij} = \frac{C_{ij} - MinC_{ij}}{MaxC_{ij} - MinC_{ij}} \quad \text{..... [10]}$$

Where:

e = Standardised criterion
i = Criterion i
j = Alternative j
C = Unstandardised score
$Max\ C_i$ = Highest score of criterion i
$Min\ C_i$ = Lowest score of criterion i

Method 9 implies that the criterion with the highest unstandardised score has always the standardised score of 1. In method 10 always standardized score range between 0 and 1. If a criterion has a negative effect, the standardized score is calculated as ($1 - e_{ij}$). The alternative with the highest value of total scores (P_i) is the best alternative.

$$P_i = \sum_{i=1}^{i} w_i \times e_{ij} \quad \text{..... [11]}$$

Where:

P_i = Score of alternative i
w_i = Weight to criterion j
e_{ij} = Standardised score of criterion i for alternative

3.7 Limitation of the study methodology

In conducting study 0f this magnitude, it is common to be confronted with number constraints. Listed below are some of them;

a) Availability of funds and time limit was a big problem. Thus cross sectional study design was opted to collect data only once at a time, thus limits the collection of much information as it would have been with longitudinal study

b) Use of cross sectional data limits observation over time. This makes it difficult for the study to account for changes due to time difference. But the large sample size enabled the study to capture the required information.

c) The sample size may affect the representativeness of the population parameters thus making it difficult to generalise the conclusion of the study to producers of other crops differently from the ones covered in this study. However the sample was large enough to allow for statistical analysis.

d) There was a problem with getting some of the respondents' information because of their lack of co-operation which led to discard some of the questionnaires in the analysis. But since the sample was large enough it allowed statistical analysis.

However the study was able to be conducted due to the fact that the sample size was large enough to capture the required information which also allowed statistical analysis. Furthermore, the study captured the information of major crops which are highly grown in the study area by most of farmers hence made the collected data realistic despite the list of constraints mentioned.

CHAPTER FOUR

4.0 RESULTS AND DISCUSSION

4.1 Sample profile

About 61.3% of the farmers were from Kilosa district while Mvomero had 38.7% (Table 2). The small number of respondents from Mvomero district was due to the fact that the presence of sugarcane factory would have made many farmers to be engaged in sugarcane production so only small sample was needed as a representative. Out of the 173 respondents 69.9% were males and the remaining 30.1% were females. The smaller percentage of female respondents can be explained by the fact that in both districts and Tanzania in general men are still heads of households.

Table 2. Districts sample profile

		Sex of the respondent (%)		Percent
District	**Frequency**	**Male (n = 121)**	**Female (n = 52)**	**total**
Kilosa	104	42.8	18.5	61.3
Mvomero	69	27.2	11.6	38.7
Total	**173**	**69.9**	**30.1**	**100.0**

4.2 Demographic characteristics

The demographic characteristics examined include age, marital status, level of education, family size and household land acquisition (Table 3). Like other household demographic and surveillance surveys this study considered the household to be composed by people who eat and sleep in the same house. For the case where the man was away/not living in the household, the woman became the *de facto* household head. Results are presented in Table 3.

4.2.1 Age

The range of age of the respondents was from 15 years to a maximum of 82 years with mean age of 42 years. About 53.2% of the respondents were between the age of 20 and 40

years, 32.9% between 41 – 60 years and 12.7% were over 60 years (Table 3). The mean age indicate that most of the respondents belong to the productive group hence; age of the farmer is one of the factors that can explain the level of labour force that could be employed by the household. Age is thought to influence attitudes towards information sources. This factor is related to experience, wealth and decision-making. In the Tanzania case where institutions that offer information for a price have never been operating, farmers rely heavily on personal experience as source of information for their farm work. This implies that they rely very much on their previous knowledge of agricultural practice for their cultivation of crops. A study by Schnitkey *et al.* (1992) reported that age is related to farming experience that farmers with more experience have less demand for external information for both production and marketing.

Table 3. Respondents' profile

Variable	Description	Frequency	Districts (%)		Total percent
			Kilosa	Mvomero	
Age	Below 20	2	1.2	0.0	1.2
	21 – 40	92	38.7	14.5	53.1
	41 – 60	57	16.8	16.2	33.0
	Above 60	22	4.6	8.1	12.7
	Total				**100.0**
Marital status	Single	25	20.8	4.5	14.5
	Married	134	71.7	86.6	77.4
	Widowed	12	6.6	7.5	6.9
	Divorced	2	0.9	1.5	1.2
	Total				**100.0**
Education level	No formal education	24	12.3	16.4	13.9
	Primary education	116	66.0	68.7	67.1
	Secondary education	30	19.8	13.4	17.3
	Collage/University	3	1.9	1.5	1.7
	Total				**100.0**
Household role	Head of the household	129	70.8	80.6	74.5
	Housewife	33	20.8	16.4	19.1
	Son/Daughter	11	8.5	3.0	6.4
	Total				**100.0**

4.2.2 Marital status

About 77.5% of the respondents were married. This shows that the society is stable; the divorce rate was low at only 1.2% (Table 3). A Stable family can concentrate more on production than an unstable one and thus may influence efficiency in production. It can also be seen from the table that 14.5% of the respondents were single. And 6.9% of the respondents are widowed. This explains the low death rate of the household heads hence production and marketing decision is well managed within the household.

4.2.3 Education level

Education especially literacy level is expected to increase farmers' ability to obtain, understand, analyse and supply the information relevant to production and marketing. The study showed that 67.1% of the respondents reported to have completed the primary education. Those with secondary education accounted for 17.3%, no formal education 13.9% whereas farmers with higher education were only 1.7% (Table 3). This implies that bigger percent of the respondents are relative literate therefore; they can understand basic instruction of information packages. Education therefore is expected to have a positive relationship with farmers' accessing market information sources. These results are similar to those reported by Dulle and Aina (1999), Gervais *et al.* (2002) and Just and Zilberman (2002) where they found that education is strongly associated with the use of formal information sources i.e. use of newsletter and facts sheets.

4.2.4 Household size

Results from survey showed that Mvomero district has significantly bigger household size with maximum of 9 members and mean of 6 members per household compared to Kilosa district which have lower members with maximum of 9 members and mean of 4 members per household (Table 4). Household sizes have effect on production. Household with fewer members tend to be relative productive compared to the one with many member since in the bigger households there are more mouth to feed than the one with fewer members.

Table 4. Household size of respondents

Districts	n	Household size (Number)			Std. Deviation
		Minimum	Maximum	Mean	
Kilosa	106	1	9	4	1.4
Mvomero	67	2	11	6	2.2

4.2.5 Land acquisition

Various methods of land acquisition exist in the study area. However, one has to acquire land through inheritance, purchasing or given by village government. The survey revealed that 29.5% were offered land by village authorities, 27.2% rented the land, 22.6% inherited land and 20.7% acquire land through purchasing. Table 5 shows farmers' land acquisition mechanisms in the two districts.

Table 5. Land acquisition and farm tools used

	Districts (%)		
Land acquisition	**Kilosa**	**Mvomero**	**Overall percent**
Village government	34.0	22.4	29.5
Rented	35.8	13.4	27.2
Inherited	20.8	25.4	22.6
Bought	9.4	38.8	20.7
Total			**100.0**
Farm tool			
Hand hoe	62.3	38.8	53.2
Tractor	12.3	7.5	10.4
Hand hoe and Tractor	25.5	53.7	36.4
Total			**100.0**

4.3 Production technology

4.3.1 Farm tools

Table 5 show the proportions of respondents who use various farm implements in the land preparation. Survey results revealed that 53.2% of the respondents use hand hoe as the major implement used in land preparation. About 10.4% of farmers indicated to have hired tractor from other farmers for land preparation. It was also reported that 34.6% of the respondents used both hand hoe and tractor for land preparation. The study found that

some of the farms do not allow usage of tractor due to high water contents hence tractor owners refuses to hire their tractors to these farms hence farmers have to use hand hoe for cultivation. Also the number of tractors for hire was very few therefore farmers have to wait for sometime in order to hire tractor. This in turn led to low output due to poor technology use. From these survey results, it seems that there is a need to improve the farm implement in Kilosa and Mvomero districts (Table 5).

4.3.2 Farming practices

Smallholder farmer has multiple objectives that contribute to maximising family satisfaction. Any enterprises or productive process that allows the family food security and satisfaction might take precedence over those that are more profitable. About 68.8% of the respondents were involved in the crop farming only while 31.2% of the respondents were engaged in mixed farming i.e. crop farming and livestock keeping. However bigger percent of the respondents who only practice crop farming were from Mvomero district while bigger percent of mixed farming practices were from Kilosa district (Table 6).

This could be explained by; firstly, the urban law in the Mvomero district banning livestock keeping around urban areas. Secondly, Kilosa district is amongst pastoralists districts in Tanzania and it is bordered to Dodoma region as well, which majority of its residence are pastoralists. Hence, livestock keeping is due to the intra and inter-linkages among crop farmers and pastoralists is a common practice.

Table 6. Type of farming practice and major crops grown by the household

Type of farming	Districts (%)		Overall percent
	Kilosa	Mvomero	
Mixed farming	40.6	16.4	31.2
Crop farming	59.4	83.6	68.8

The study also showed that most of the farm sizes in the surveyed area ranged between 1.03 hectares to a maximum of 58.22 hectares with mean of 4.79 hectares. On average farmers of the study area are better off compared with national average farmers who own an average of 3 hectares (Kashuliza *et al.*, 2003). Production and marketing information is necessary as the farm size increases. Increased farm size means more production technologies; different crops could be cultivated and hence bigger output. Schnitkey *et al.* (1992) reported that the demand for information is likely to be increased with farm size and level of production. In addition, John *et al.* (1996) documented that increased size have rapidly changed production technologies and have increased managerial input requirements as a results farmers have increased utilising outside (off-farm) information sources, particularly technical consultancy to improve the production and productivity of their farms.

4.4 Farm Productivity/output

4.4.1 Crop intensity

There were about eight different crops grown in the study area. These were maize, rice, sunflower, sugarcane, simsim, tomato, cassava and groundnuts to name in order of cultivation percentage; Figure 5 presents major crops of the study area. This is by virtue of number of grower met and relative importance accorded to the respondents. Both mono and inter-cropping of these crops are practiced in the surveyed area.

According to the area grown to each crop (Figure 5) maize is the leading main crop grown by majority of the respondents i.e. 86.1% followed by rice 46.8%, sunflower 18.5%, sugarcane 17.3%, simsim 15.6% while tomato, groundnuts and cassava was 5.1% respectively. However, some crops are only grown in one district, example sugarcane is grown only in Mvomero while in Kilosa Sunflower is predominantly grown followed by simsim. The reason behind is the presence of Mtibwa sugar estate factory in Mvomero district and sunflower oil refinery in Kilosa. The presence of these factory influence

farmers to specialize in one crop since they provide reliable market and become of the market information sources as shown in Figure 5.

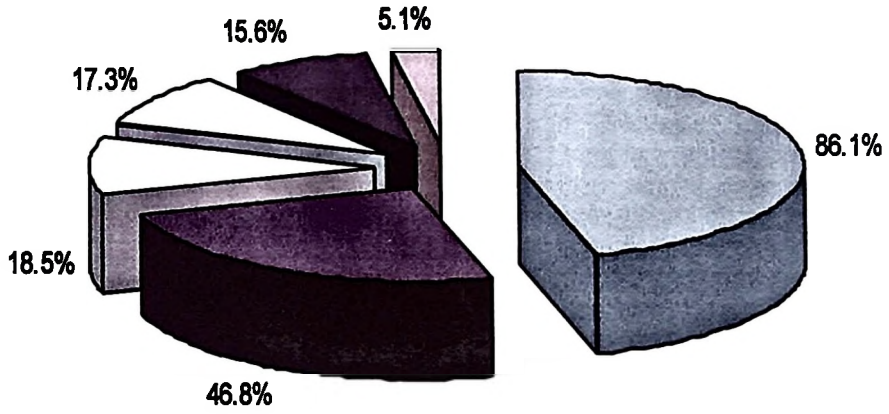

Figure 5. Major crops grown in the study area

4.4.2 Reason for growing crops

It was thought important to look into reasons for growing crops. And when asked the reasons for cultivating these crops, maize took the lead as the main staple food by 72.0%, and 59.1%, of the respondents reported that rice is grown both for food and generating cash, while sugarcane, simsim and sunflower are mainly for cash. It is indicative that higher percentage in the study area preferred maize due to its adoptability and cultural acquaintance to the crop, since most farmers depend on maize as their staple food hence it is rare to find a house which does not grow maize.

But, despite the fact that some crops are highly specialized as cash crops, it was observed that maize, rice, sunflower in surveyed area are treated as both food and cash crops. This can be explained in the Tanzanian Agricultural Policy (1997) where by agricultural liberalization made most of crops be treated as either food or cash crops respectively.

Therefore, regardless which crop the farmer grows, farmer can increase production to meet their subsistence (food) and increase income (selling) in the household.

4.4.3 Assessment of the household farm productivity/output status

As described in chapter three, the Principal Component Analysis (PCA) was applied to establish farm output index. The scoring factors and summary statistics for variables, which were entered in the computations of the PCA, are depicted in appendices V, VI, VII and VIII.

The survey results showed that respondents that do have accessed market information sources were 56.5% for the low farm output stratus while those that do not have accessed market information sources and fall under low farm output stratus were 43.5%. Furthermore, only 2.9% of the respondents reported to have accessed market information sources and fall under higher farm output strata while 97.1% of the respondents who fall under high farm output strata reported not to have accessed market information sources. Nevertheless, the relationship between farm productivity/output strata and accessing market information sources was found significant ($P < 0.05$) as shown in Table 7.

This could be explained by firstly, farmers do not rely very much on the market information sources to enhance their production and this could be due to the fact that either market information sources do not reach farmers or farmers do not access these sources. Secondly, traditionally farmers cultivate crops primarily in order to sustain their daily needs i.e. provide food for their family while the market information is meant for commercial purpose. Hence, farmer whose primary goal is food purposes will not be much interested in accessing market information. On the other hand, whether a farmer access or do not access market information sources has little to do with his farm output yield.

Table 7. Farm output strata and access to market information sources

Access to market information sources	Farm output strata (%)			χ^2
	Low (-1.82 up to -0.43) (n = 69)	Medium (-0.42 up to 0.8) (n = 70)	High (0.88 up to 2.38) (n = 34)	
Yes	56.5	27.1	2.9	0.000
No	43.5	72.9	97.1	
Total	100.0	100.0	100.0	

Respondent were asked to provide yield level of major crops for the last agricultural season. The status of agricultural productivity in any area can be judged from the yield levels of important crops as compared to the Ministry of Agricultural and Food Security (MAFS) yield levels of 2005/06. The survey results revealed that some crops had shown some improvement in yield levels compared to that of MAFS and other crops had lower yield (Table 8), this situation was found to be attributed by number of constraints like access to improved seeds, fertiliser, bad weather, access to credit, e.t.c (Appendix IV). It was also found that farm household cultivate an average of 1.00, 1.07, 0.66, 2.8, and 0.57 ha for maize, rice, simsim sugarcane and sunflower produces respectively.

Table 8. Farmer's mean acreage, yield estimates and MAFS mean yield as per 2005/2006

Crop	Mean acreage	Average yield (kg/ha)	MAFS yield (Kg/ha)
Maize	1.0	1949.3	2179.0
Rice	1.1	2103.6	2036.0
Simsim	0.7	504.6	297.0
Sugarcane	2.8	49153.3	89100.0
Sunflower	0.6	600.5	301.5

It should also noted that survey results on estimated yield per hectare of sampled farmers differ slightly from one provided by MAFS. This implies that there is a chance for the crops that were below national level to be improved. The improvement could be achieved by overcoming mentioned constraints to agricultural production (Appendix IV).

Furthermore, a linear multiple regression model was employed to asses farm productivity (farm output) as presented in Table 9 below. From the results, the null hypothesis i.e. farm productivity and market information sources access are significantly independent was rejected since F-value was statistically significant ($P < 0.001$). Among the eight variables, statistical significance is only evident in two: farm size and amount of labour power used towards the farm productivity (farm output). Farm size has the regression coefficient (β) of 1.081 that is statistically significant ($P < 0.001$). The positive regression coefficient implies that as unit increase in farm size the output also increases. Thus it entails that an increase in farm size is accompanied by an increase in the use of innovative farming practices than people with smaller farms. Further, disregarding other production factors, large farms are more likely to produce more total crops than smaller farms.

Also amount of labour power has a regression coefficient (β) of -0.81 and statistically significant ($P < 0.001$) (Table 9). The negative regression coefficient implies that increase in unit amount of labour power, the output decreases i.e. farm output and amount of labour employed are negatively related. This may be due to the fact that individual with large farms are more likely to adopt innovative farming practices than employing labourers since larger farms suffer labour shortage for increasing farm output. Also, increased number of labourers is associated with costs of hiring these labourers.

Age, education level, number of crops grown and index of market information access have no statistically significant effect on the total output in the study area (Table 9).

Table 9. Regression analysis for factors influencing farm productivity

Independent variables	Coefficient (β)	Std Error	t-test	Sig.
Age	0.022	0.239	0.957	0.340
Education	0.002	1.039	0.064	0.949
Farm size	1.081	0.999	37.014	0.000***
Number of crops	-0.018	6.702	-0.813	0.417
Labour power	-0.181	0.111	-6.345	0.000***
Access to market information sources index	0.039	4.372	1.457	0.147
Improved seed	-0.005	8.698	-0.204	0.838
Fertilizer use	0.033	7.942	1.381	0.169
Constant	-34.769	18.647	-1.865	0.064*

Dependent variable = Output (Amount of crop harvested by the household)
Adjusted $R^2 = 0.825$
F – Value = 258.179*, N = 173, *, ***Significant at 0.05 and 0.001 respectively

4.4.4 Marketing of agricultural produce

The survey revealed that there was no market place for farmers to sell their produce. About 67.4% of the respondents, who were selling their crops, sold them at home, 25.3% of the respondents sold at their farms and 6.8% sold at local gathering (Table 10).

Table 10. Place of selling crops

Place	Frequency	Percent
Home	94	67.4
Farm	35	25.3
Local gathering	10	6.8
Total	**139**	**100.0**

Results indicate that there is un-organised market system in the study area. Farmers do not have any place (market place) for selling their produces rather they go home and wait for the crop buyers to come. This is a disadvantage phenomenon, firstly, farmers will not be aware of the prevailing price for their produce and therefore bargaining power will decrease i.e. farmer will sell at lower price. Secondly, there is no price uniformity between one household to the other hence some farmers will sell their crops at very low price while others will not sell at all.

The study also revealed that farmers, who sell their produce at home, sell at retail price and those at the field sell at farm gate price but the difference between farm gate to retail does not justify their revenue differences i.e. farm gate price and retail price did not differ in the study area. Presence of market place could act as one of the market information sources to the both producers and sellers, thus farmers would have accessed the price information, and other information related to their produce.

Market can potentially contribute to the development process of crops or other commodity in two ways. Firstly, they can provide a way to allocate resources ensuring the highest value production and maximum farmer/consumer satisfaction. Secondly, and more controversially they may promote technology and increase supply and demand. Madadi (1998) suggested that aspects of farming system can be used to assess the structure of production and to analyse the effects of markets and marketing on farmers decision making.

4.4.5 Marketing channels

Defining marketing channels/chains for one or different commodities, regions and seasons indicate the links connecting one price series with another knowing when and where crops are sold. Market channels are important in understanding which firms/dealers are engaged and they can be used to illustrate and clarify not only the movement of commodities, but also financial, credit and information flows.

The survey results revealed that in marketing agricultural produce, price was the biggest criteria for farmers in selecting market channel (buyer). Table 11 below it shows that about 81.3% of the respondents consider price as the major criteria for accepting buyers to purchase their crop. While in some cases it showed that farmers did not have any place to sell their produce so they sold to any available trader who would offer to buy their produce (15.8%).

Table 11. Criteria considered when selecting market channel

Criteria	Frequency	Percent
Price offered	111	81.3
Any available trader	22	15.8
Market cost	4	2.9
Total	**139**	**100.0**

If market channels are efficient, they will induce farmers to become more commercialised. This is because access to efficient market serves as an incentive for farmers to specialize in the production of certain crops which are comparatively most advantageous for the study area. It follows therefore that policies to enhance efficiency in agricultural marketing are crucial especially market information.

4.5 Market information

4.5.1 Farmer's major sources of information

Sources of market information depend on the type and level of markets. Farmers need market information to be able to compare their prices with those of far away. In order to know the main information sources used by farmers in trying to solve their production and marketing problems, the respondents were asked to indicate such sources. Results in Figure 6 indicate that 82.7% of respondents obtain information from family members, neighbours and friends, followed by radio 68.2%, traders 44.5%, extension officers 42.2%, mobile phones 33.5%, news paper 28.3%, Television (TV) 26.6% and bulletin boards 24.3% which are relative less important for farmers as a general source.

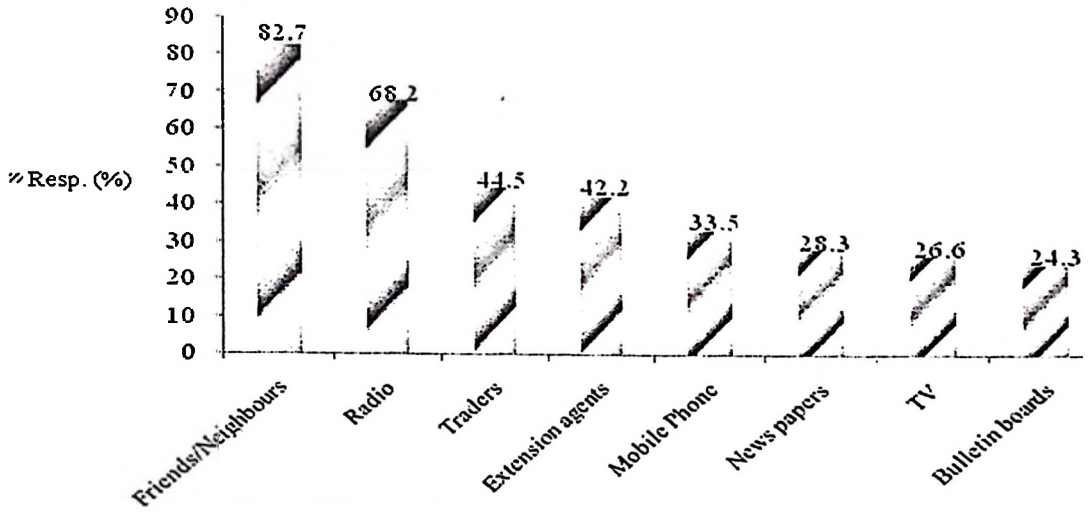

Figure 6. Farmers' main sources of market information

In general, results from the survey showed that friends and neighbours, radio and radio are important sources of agricultural marketing information to all respondents. The tendency of family, friends and neighbours being major source of information were also reported by Adomi *et al.* (2003), Kleih *et al.* (2004) and MCM report (2004). Also Shepherd and Schalke (1995) and Shepherd, (2001) found that radio is used as a major source of information to majority of farmers.

4.5.2 Ownership and access to market information

Ownership and access to telecommunication and media are prerequisite to accessing market information. Most Tanzanian depend more on radio for information regardless of gender, age or education. Results from the survey indicated that 65.3% of the respondents owned radio as an information media, 26.7% own mobile phone and only 8% own television (Table 12). The higher percentage of respondents to own radio was contributed by the fact that radio is the one of the oldest technology relative to mobile phone and television, and since market liberalisation, radios are becoming cheaper and hence affordable to ordinary farmers. This suggests that, if radio is used to disseminate market information, it would cover more than 70.0% of the agricultural market information to stakeholders.

Unlike radio, TV set is expensive hence owned by few people with relatively high disposable income. In addition, electricity power supply is very limited or not available at all around the study area hence despite the expensiveness of the TV power supply is another limiting factor.

4.5.3 Perception on sources of market information

Farmers were asked to evaluate the market information received from variety of sources in terms of accessibility, timing, reliability and frequency of dissemination. From Table 12, about 82.7% of the respondents ranked friend and neighbours as the highest scorer for its usefulness. Further, respondents considered the information from this source as easy to understand and to access. The results also showed that 66.5% of respondents rank radio as secondly most usefully source, 46.8% traders, 40.5% extension services, 35.8% bulletin boards, 22.0% mobile phone, 15.6% Television and news paper is 11.6%. Table 13 below summarizes farmers' responses to usefulness of information received from variety of information sources.

Table 12. Usefulness of information from variety of sources

Information source	Frequency	Percent
Friends/Neighbours	143	82.7
Radio	115	66.5
Traders	81	46.8
Extension agents	70	40.5
Bulletin boards	62	35.8
Mobile Phone	38	22.0
TV	27	15.6
News papers	20	11.6

Although agricultural extension services which is considered to be the best method for disseminating agricultural information has been criticized by farmers themselves; inadequate number of agricultural extension staffs and timely and the slow rate at which information on improved practices reaches them from extension agents. In spite of the problems associated with extension agents in providing information to farmers, it is still

the method used mainly for disseminating information to farmers. In Tanzania it is recognized among government and non-governmental organizations, that effort towards the provision of information to rural communities can best be carried out using extension methodology (Dulle and Aina, 1999).

4.5.4 Awareness of market information

It is assumed that the better-informed producers the better free markets are. In Tanzania, collection of market data is mainly done by MDB. Availability of such information is, however, limited at village level especially in remote areas. The survey examined whether farmers were aware of market information dissemination from any media or source. This was important to determine the effectiveness of the approach used in disseminating market information by the government. In practice, information flows were inadequate.

Farmers were asked whether they have accessed market information. Overwhelming, it was observed that the number of respondents who had access to marketing information was higher (66.5%) than the number of those who did not have access to Market information (33.5%) as it can be seen from Table 13 below;

Table 13. Market information access and ownership of information media

Market information access	**Percent**
Yes	66.5
No	33.5
Total	**100.0**
Ownership of information media	
Radio	65.3
Mobile phone	26.7
Television	8.0
Total	**100.0**

Results also revealed that majority were aware of existence of a programme on radio especially radio Tanzania, which gives market snapshots about prices of some selected commodities. However, those who were aware of market information did not make close

follow-up and the reason behind was because they believed that information provided from different sources does not help them and it only help traders and urban dwellers. Furthermore, respondents were well aware of biases associated with information in the media and information by crop buyers. Similar findings on market information was done by Ministry of Cooperation and Marketing (2004), it was found that majority of respondents (76.0%) were aware of market information dissemination.

4.5.5 Preferred time for market information dissemination

If market information are to help small farmers to make decisions about when and where to sell their crops, then the information they collect must not only be disseminated frequently, it must also be up-to-date. Results on consultations of preference of broadcasting time by small summarised under Table 14. It is noted that 51.4% of the respondents to have preferred harvesting time as the appropriate time for broadcasting market information, 36.9% preferred to receive market information during land preparation while 11.8% prefer after they have harvested their crops.

Prices of agricultural produce differ with periods. The study also revealed that during this period farmers are sure of their produce from their farms; hence they can save some for food and some for cash. On contrary, researcher found that during harvesting period prices most of agricultural produce go down because supply become high while demand is low. But if farmers had had market information they would have taken the advantage of arbitrage i.e. store the produce after harvest and sell afterwards when prices are more rewarding.

Table 14. Time of information dissemination

Variable	Frequency	Percent
During harvest	74	51.3
During land preparation	53	36.9
After harvest	17	11.8
Total	**144**	**100.0**

The researcher also found that however, information dissemination frequency preferred by farmers mostly is in a wider interval and can not be very useful. Information such as prices change significantly sometimes even in single day. Moreover prices are likely to become more volatile as local and region markets are becoming interconnected and more liberalized. Thus the provision of this kind of information on a wider interval would appear to have very limited use. The argument can be supported by Shepherd and Schalke (1995) and Shepherd when reported that prices for different commodity in Malaysia is collected every day from Monday to Friday from both rural assembly markets and wholesale markets. Furthermore, prices are reported daily in provincial and twice weekly in national newspapers.

4.5.6 Farmers' information needs

As it is known that information needs assessment is quite difficult to establish (Dulle and Aina, 1999). Direct questioning of farmers was used in order to overcome the named problem. At times researcher had to ask to the respondent, what market information is appropriate to the farmer.

Table 15 summarises market information needs of smallholder farmers. It was revealed that 44.4% of the respondent demand to know the prices for both farm inputs and for their produce in the market, 37.3% of the respondents needed information on the place where they could sell their product and 18.3% indicated information needs on credit accessibility availability.

This implies that farmers do not receive sufficient information on their mentioned information needs. This was revealed true to researcher when farmers were complaining about prices they receive from traders that were not sufficient to cover their production cost and for buy other necessities. In addition farmers were complaining the lack of market (place) where they could sell their produce at the agreeable price between farmers and traders and credit has already appear as problem the farmers farce. Nevertheless, if the above-mentioned needs can be translated into farmers' training and information

programmes through government assistance, most of the farmers' skills in management and marketing would increase and probably improve their productivity.

Table 15. Type of market information appropriate to the farmer

Market information	Percent
Price information	44.4
Selling place	37.3
Credit information	18.3
Total	**100.0**

4.5.7 Factors that influence farmers' to access market information

Regression analysis was adopted to assess factors that influence farmers' to access market information in the research area. Results in of the regression analysis are summarized in Table 16. The model was statistically significantly ($P < 0.05$) and the model predicted correctly at 78.0%. The results in Table 16 show that 5 out of 13 factors examined have positively significant influence on farmer accessing market information. The positive relationship between accessing market information and education level can be explained by the fact that higher level of education should be consistence with increased ability to process information and/or individuals that seek out information and this is due to increased level of understanding of different forms of information.

Farm size related positively to accessing market information because the owners of large farms would usually have higher capital investments and this would entice owner to look for external sources of information to guide in decision-making process. Also information received from friends/neighbour, radio and bulletin boards contacts was positively related to accessing market information since the accessibility of these information sources are very close to the farmers and can be affordable. The positive relation may be due to the fact that individual farmers get exposed to new ideas from these sources

The analysis indicates that there is relationship between accessing market information sources and respondent's socio-economic such as education and farm size and contacts with friends/neighbours, radio and bulletin boards. Therefore, there is indication of

existing demand for improved market information especially by relatively bigger farmers and more educated farmers. This suggests that more education is needed to farmers make them able to understand more information received from variety of sources and hence to improve their production and marketing skills.

Table 16. Results on factors influencing farmers accessing market information

Independent variables	Coefficient value (β)	Standard Error	Wald
Constant	0.129	1.197	2.927
Age	0.996	0.015	0.086
Education	1.140	0.066	3.983*
Farm size	1.269	0.152	2.447**
Number of crops	1.336	0.434	0.445
Ownership of media	1.041	0.704	0.003
Friends/Neighbours	0.495	0.648	1.181*
Radio	3.330	0.541	4.947*
Extension agent	7.913	0.624	10.977
Trader	1.853	0.472	1.705
News paper	2.528	0.790	1.378
TV	0.475	0.927	0.644
Bulletin boards	3.896	0.671	4.110*
Mobile phone	0.748	0.924	0.098

Note: *, ** significant at 0.05 and 0.1 respectively

4.6 Multi-criteria analysis

4.6.1 Farm productivity alternatives

One of the alternatives for achieving farmers' objective (i.e. improved farmers' livelihood) is to increase farm productivity. A number of criteria were defined to evaluate the farm productivity from different points of view with respect to different constraints imposed on the problem. During the interview and discussion with farmers a total of 11 criteria were proposed on the basis by which they will assess farm productivity. These criteria were categorised into farm production and marketing information. Several indicators in the two criteria were looked into. For farm production, indicators were; farm

input (i.e. fertilisers and improved seeds) availability, farm credit availability, labour availability, extension services availability and weather information availability which will assist farmers to either cultivate more farms and more crops for the good weather or cultivate the drought tolerant crops for bad weather. And market information indicators were; current price information, place of selling produce, sales time information of farmers' produce, information on market forecast, information on group marketing and information on product planning (Table 17).

A multi-criteria method that attempted to consider all criteria simultaneously was employed in the process. Farmers were asked to compare the productivity prosperity of major crops grown against the proposed productivity criteria. Major crops which were listed by farmers for assessment and ranking included maize, rice, simsim, sugarcane and sunflower. The evaluation for productivity prosperity of all major crops against the proposed criteria revealed the following results.

Table 17. Farmers' ranking score of different crop for increased productivity options

	Crops and Scores				
Criteria	**Maize**	**Paddy**	**Simsim**	**Sugarcane**	**Sunflower**
Farm production					
Farm inputs (a_1)	1	1	1	2	3
Farm credit (a_2)	1	1	1	3	1
Labour (a_3)	3	3	3	3	3
Extension services (a_4)	2	1	1	1	2
Weather information (a_5)	1	1	1	1	1
Market information					
Price (b_1)	1	1	1	1	1
Selling place (b_2)	1	1	1	3	2
Sales time (b_3)	3	3	2	3	2
Market forecast (b_4)	2	2	2	2	2
Group marketing (b_5)	1	1	1	3	1
Product planning (b_6)	2	1	1	2	2
Overall score	**18**	**16**	**15**	**24**	**20**
Rank	**3**	**4**	**5**	**1**	**2**

‡ Scores: 4 = Very good, 3 = Good, 2 = Average, 1 = Not good

4.6.1.1 Sugarcane

According to farmers, productivity of sugarcane was ranked as number one to improve (Table 17). This is because of increased yield, reliable market (selling place) and price information dissemination. The study revealed that sugarcane farmers have assured market for their produce unlike other farmers who grow other crops. Sugarcane was evaluated as average to good in many criteria except in extension services, weather information and prices. It was also revealed Mtibwa Outgrowers Association (MOA) is the reason for sugarcane to show some productivity improvement. The association makes sure that farmers are getting enough production and marketing assistance (example supplying of improved farm input, paid on time and at the right price). However the in Kilosa there were no sugarcane farmers hence the analysis based on other crops but sugercan.

4.6.1.2 Sunflower

According to farmers' response, sunflower was ranked as number two crop to improve its productivity (Table 17). Farmers ranking was base on the presence of extension services, availability of the improved seeds. Presence of agricultural research institute in the area where sunflower is grown helps nearby farmers by provide them with improved seeds, farming technology advice. Although sunflower was mentioned as second crop to improve its productivity against the proposed criteria, but it was averaged not good in farm credit availability, selling price, place of selling and group marketing.

4.6.1.3 Maize

Farmers ranked maize in third position in order of improved productivity against the given criteria (Table 17). Maize was ranked good only on the availability of labour and crop sales time information. Maize crop is grown by majority of farmers in the study area also there is abundance of labour availability by majority of farmers. The survey also revealed that maize to score low is because is grown as a staple food by most farmers hence farmers put a little score in the marketing criteria aspects.

4.6.1.4 Rice

Close to maize, productivity of rice was ranked in fourth place to improve (Table 17). The reasons for the low rank are similar to those mentioned in maize. Rice like maize was ranked on average not good in almost all criteria except labour availability and crop sales time. The ranking of good in labour availability criteria was based on the fact that availability of hired labourers in the study area is plenty but the problem arises with the capital to hire them.

4.6.1.5 Simsim

Simsim was ranked as the lowest crop to increase its productivity against the given the assessed criteria (Table 17). The lowest score of simsim can be explained to as very few respondents grow simsim crop in their farms. Furthermore, the study revealed that simsim is a very vulnerable to crop diseases attack hence cultivating simsim needs much inputs such as improved seeds, pesticides and insecticides used. Apart from the reason of high production cost, marketing is another aspect which made the crop productivity improvement difficult. Simsim like maize, and rice was ranked on average not good in almost all criteria except labour availability and crop sales time.

The relative importance of evaluation criteria and weights given by farmers are indicated in Table 18. The results show that in order for farm productivity to improve, farmers attach a relative high importance to farm credit and weather information availability for the case of crop production while for the case of marketing; high importance is on the price information and place of selling their produce (market place). Other important criteria are farm inputs, labour, sales time and group marketing information. Other criteria have on average a lower weight but can be important to some farmers.

Table 18. Farmers' pairwise ranking of productivity criteria

Criteria	Pairwise ranking						Score	Weight
Farm production	a_1	a_2	a_3	a_4	a_5			
Farm inputs (a_1)	x	a_2	a_1	a_1	a_5		2	0.2
Farm credit (a_2)		x	a_2	a_2	a_2		4	0.3
Labour (a_3)			x	a_3	a_5		0	0.1
Extension services (a_4)				x	a_5		1	0.1
Weather information (a_5)					x		3	0.3
Market information	b_1	b_2	b_3	b_4	b_5	b_6		
Price (b_1)	x	b_1	b_1	b_1	b_1	b_1	5	0.36
Selling place (b_2)		x	b_2	b_2	b_2	b_2	4	0.29
Sales time (b_3)			x	I	I	b_3	1	0.07
Market forecast (b_4)				x	b_5	b_6	0	0.14
Group marketing (b_5)					x	b_6	1	0.07
Product planning (b_6)						x	2	0.07
Rank:	$a_2>a_5>a_1>a_4>a_3$ and $b_1>b_2>b_4>b_3=b_6>b_5$							

Results from Table 18 show that, in order to improve production farmers consider farm credit and weather information availability to be most important criteria at a weight of 0.3 with respect to the other criteria, 0.2 weight score was given to farm input availability while 0.1 were given to both labour availability and extension service advice. The reason behind ranking is that farmers believe once they acquire farm credit, they may be able to purchase improved seeds and fertilizers and whereas labour is inadequate they can hire tractor to enhance production. Also information on weather forecast is very important for agricultural purpose as farmers receive timely weather information they may know when to start cultivating their fields since most of farmers in the study area depend heavily on rainfed agriculture.

In addition, based on the marketing criteria, ranking according to the level of significance, price and place of selling are the most important criteria at given weight of 0.36 and 0.29 respectively while other marketing criteria such as group marketing information was given the score of 0.14 and sales time information, market forecast information and product planning information were given lower score of 0.07 each (Table 18). This implies that prices of different crops offered in the study area are not satisfactory enough to meet farmers' needs and therefore price setting for crops need some improvement in

order to benefit farmers i.e the prices should reflects more to farmers than the current situation whereby traders are the beneficial. The survey also revealed that farmers do not have permanent place where they can sell their produce at reasonable uniform price.

The comparisons of both criteria preference indicators (i.e. production and market information) make it possible to distinguish between the preferences. Analysis diagram for pairwise ranking is presented in Figure 7. Farm credit (a_2) and weather information (a_5) show highest preference than farm inputs (a_1), labour (a_3) and extension services (a_4) for the case of farm production while price (b_1) and selling place (b_2) showed the highest preference than sales time (b_3), market forecast (b_4), group marketing (b_5) and product planning (b_6). Based on the criteria suggested in this study, production information preference of farm credit and weather information and market information preference of sales time, group marketing and product planning are indifferent respectively.

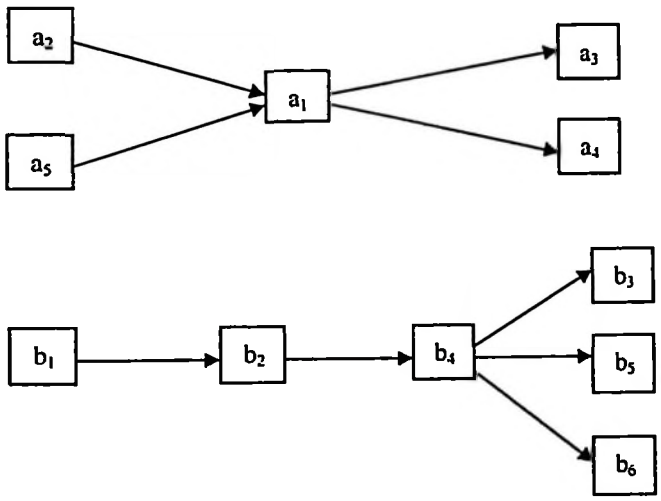

Figure 7. Preference flow diagram for different information choices

Where:

a_1 = Farm inputs
a_2 = Farm credit
a_3 = Labour
a_4 = Extension services
a_5 = Weather information

b_1 = Price
b_2 = Selling place
b_3 = Sales time
b_4 = Market forecast
b_5 = Group marketing and
b_6 = Product planning

Hence, it is clear that improving farmers' production technologies and marketing system can increase productivity. The initial results presented here have enlighten that MCA can give an insight into productivity problems that the farmer faces. However, we can conclude that a multi-criteria approach provides flexibility in the handling of different types of constraints, which is not possible when using a single objective function. Of course, the criteria have different levels of importance in different situations and for different farmers.

CHAPTER FIVE

5.0 CONCLUSION AND RECOMMENDATIONS

5.1 Conclusion

5.1.1 Types of market information sources in smallholder production systems

In attempt to identify types of information sources to farmers, the analysis revealed that there is high degree of market information awareness specifically on selling price, information on where to obtain credits and information on where to rent agricultural equipments. In terms of ownership and access to media revealed that 65.3% of farmers own radio while 26.7% own mobile phone, only 8% own television while contact with extension agents, bulletin boards was also reported to be very low. Even though, majority of farmers have access to radio, analysis indicates that there is minimum use of conventional sources of market information such as friends/neighbours, radio, television, newspapers, Internet, telephones, bulletin boards and extension services. This means that the current information practices within the survey group were overwhelmingly informal in nature and offer very limited information to satisfy farmers' needs.

5.1.2 Relationship between farm productivity and access to market information sources

From the analysis, results revealed that market information sources have very little if not at all influence on the farm productivity even though the relationship reported to be statistical significant. Among the eight variables analysed, access to market information sources included, only farm size and amount of labour were found to influence farm productivity. The little dependence of farmers to market information sources in their farming decision is due to the nature of farming practice that is subsistence farming system. And this could also be explained by majority farmers do not use any kind of fertilizer in their farms, local seed was used by majority of farmers for all major crops grown contrary to improved seeds and application of insecticides/pesticides was very low.

About 30.6% of farmers reported to have used insecticides/pesticides while the remaining percent do not use. Had farmers moved to commercialised farming system the use of market information would have been higher in their farming decisions. Hence, all these results underline the need for taking initiative to improve the delivery of market information services in the country.

5.1.3 Factors that influence farmers to access and use market information sources

In examining factors influencing farmers accessing market information sources, several factors were analysed include; age, educational level, farm size, number of crops grown, ownership of information media; contact with friends/neighbours, radio, extension agent, traders, news paper, TV, bulletin boards and mobile phones. However, only education level, farm size contact with friends/neighbours, radio and bulletin boards were found to be significant at the 1% and 5% levels of significance.

Better-educated farmers were found to be more efficient than the less educated. This may be because their knowledge, gained from education, has provided them with a background to take correct decisions. For example it would be easier for them to grasp information provided to them by the extension officers. Therefore, it is necessary to increase educational facilities in the area. This shows that there exists demand for improved market information delivery especially by the relatively bigger farmers.

5.1.4 Harmonization of information sources by farmers and product characteristics

The study found that in the study area there is several outlets for the farmers produce such as; sell at home, sell at wholesale market and sell at the local assembly markets. Demand analysis for marketing information indicated that prices information was highly demanded starting with wholesale, retail and farm-gate markets in the decreasing order. Also place of selling farm produce was the second demanded market information. Factors that were found to affect farmer's decision to select a certain channel include; production level and place to sale. Farmers who sold at the whole market mentioned higher prices they got from sales at this market as the reasons for choosing this outlet and also they mentioned

that they had no other option to sale their produce. Furthermore, it was found that sugarcane was ranked as number one in terms of yield, reliable market and price information accessibility followed by sunflower, maize, rice and lastly simsim.

5.2 Recommendations

Based on the findings of the study the following recommendations are geared towards improving market access to market information for smallholder farmers.

5.2.1 Localization of market information

The study found that those farmers who are selling mainly to local retail or assembly markets found considerable difficulties in relating information about a few central markets to their own needs and thus there is a need to make information available about local markets. Furthermore, the information provided nationally is often in the complex language, difficult to understand and difficult to access. The study thus recommended the use of radio to take advantage of the growing number of local FM radio stations to broadcast market information appropriate for particular locality.

5.2.2 Promotion of market information need

The study found that farmers in the study area lack information from outside their localities thus demand for information need to be created. This study recommends that farmers need to be made aware of their right to information, how they can use it, and how to influence its delivery. Well-targeted campaigns could be useful in order to stimulate the interest of the general public to access and use market information published or provided through mass media.

5.2.3 Improving means of delivering market information

The study found that government provision of market information has little impact, deliberately effort to improve the situation are to be directed to making dissemination programs listener friendly and attractive. The study recommends that timing of radio programs is crucial to ensure that when the programs are in air gives greatest impact.

5.2.4 Facilitation of knowledge and information transfer

At first step, there a need to identify information generation points, mechanism of information flow and users needs for effective and efficient market information. The private sector could be encouraged to collaborate with NGOs in providing market-relevant technical training for producers.

5.2.5 Institutional support

The study found that institutional support such as provision of training and extension services on: agricultural production and marketing; were not adequate in the study areas. Smallholder organizations and cooperatives are missing in the area. The study thus recommends increase in provision of training and extension services on establishment of smallholder cooperatives and association that would empower smallholder farmers and enable them to access markets. These organizations assist farmers to organize themselves for purpose of bulking and marketing crops together. This will enable them generate sufficient critical mass and their bargaining power will increase substantially. Farmers should also be encouraged to form and participate in saving and credit association through which they will be able to access seasonal loans for inputs. Also smallholders' farmers need to be assisted to store their maize, such as set up warehouse receipting as a new business line.

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APPENDICES

Appendix I. Questionnaire for smallholder farmers

ACCESS TO MARKET INFORMATION SOURCES AND FARM LEVEL PRODUCTIVITY

i. Date of Interview ..... Region.....
ii. Name of the Ward ..... Village.....
iii. Name of the District .....
iv. Number/Name of the Respondent .....

A: HOUSEHOLD CHARACTERISTICS

1. Sex of respondent. 1 = Male, 2 = Female [ ]

2. Age of respondent .....

3. Number of years in formal education the respondent has completed .....

4. Is there any other course (s) have you taken? Yes = 1, No = 0 [ ]

5. If yes mention them.....

6. Marital Status of the respondent
   1) Single
   2) Married
   3) widowed/widower [ ]
   4) divorced
   5) Other (specify) .....

7. Role in the household.....
   1) Head of the household
   2) Housewife of the head [ ]
   3) Son/Daughter of the head
   4) Others specify .....

8. Household composition of the respondent

name	sex	age	Years of Schooling	Relationship in the household	extra courses taken

9. For how long have you been residing in this village? ..... (Years)

10. What are your off-farm income generating activities?
    1) Trade
    2) Employment [ ]
    3) Carpentry
    4) Others (specify) .....

B: FARM PRODUCTIVITY

11. What is the size of your farm land ..... (Acre)

12. What is the size of your cultivated land ..... (Acre)

13. How did you acquire most of your land?
    1) Inherited
    2) Bought
    3) Hired [ ]
    4) Given by village government
    5) Others (specify).....

14. What type of farming system have you adopted on your farm?

Farming system	Reason for practising
Mixed farming	
Livestock farming only	
Crop farming only	
Others (specify)	

15. Which major crops do your household grow? (Start with the most important ones)

Crop name	Purpose for cultivating 1 = For sale 2 = Consumption 3 = Both	Acreage per season (acres)	Amount harvested (Kg)/acre
	TOTAL		

16. What is the labour source (s) for your farm?

Type of power predominantly used 1 = Labour power 2 = Mechanical power 3 = Others (specify	Type of labour (s) force 1 = Family labour 2 = Hired labour 3 = Others (specify)	Amount of labour force/acre

17. What type of farm tools do you use in land preparation?

Farm tool	Crop involved	Reason for using
Hand hoe		
Ox-plough		
Tractor		
Others (specify)		

18. What type of seed do you use?

Seed Variety	Name of crop	Amount /acre
Local		
Improved		

19. If local why?
    1) Not aware of the use of improved one
    2) No need for them
    3) Expensive to obtain [ ]
    4) Lack of accessibility
    5) Others (specify) .....

20. If improved what is your major source?
    1) Government
    2) Open market [ ]
    3) Cooperative society
    4) Others (specify) .....

21. What type of fertilizer do you use?

Fertilizer type	Name of crop	Amount /acre
Local		
Improved		

22. If local why?
    1) Not aware of the use of improved one
    2) No need for them
    3) Expensive to obtain [ ]
    4) Lack of accessibility
    5) Others (specify) .....

23. If improved what is your major source?
    1) Government
    2) Open market [ ]
    3) Cooperative society
    4) Others (specify) .....

24. Do you use pesticides? Yes = 1, No = 0 [ ]

25. If yes,

Type of pesticide used	Name of crop applied	Amount /acre

26. If no why?
    1) Not aware of their use
    2) No need for them
    3) Expensive to obtain [ ]
    4) Lack of accessibility
    5) Others (specify) .....

27. Over the past, were there any changes of crops, quality and area cultivated?
    Yes = 1, No = 0 [ ]
28. Which were the reasons for change?
    1) Change in relative price
    2) Lack of market
    3) Climatic change [ ]
    4) Soil depletion
    5) Others (specify) .....

29. Which of the following are constraints to agricultural production for your household?
    1 = very important
    2 = somehow important
    3= less important

Constraint	1	2	3
Draught			
Access to farm labour			
Access to good seed			
Access to land			
Access to credit			
Access to fertilizer			
Access to market			
Access to marketing information			
Access to extension service			

30. Does your production plans depend on any kind of information? Yes = 1, No = 0 [ ]

31. If yes, mention them .....

32. Where do you mostly obtain information about crop production?
    1= very important
    2= important
    3= I don't know
    4= less important

Information source	1	2	3	4
Friends/other farmers				
Radio				
Extension officers				
Traders				
News papers				
Suppliers farm input				
Bulletin boards				

C: MARKETING AND MARKET INFORMATION

33. Do you have access to market information your produce/crop? Yes = 1, No = 0 [ ]

34. What is your current major source of market information?

Market information	Major source	Crop involved
Farm-gate price		
Retail price		
Wholesale price		
Credit information		
Product information		
Market trends		

35. Do you own any of the information media/telecommunication means? Yes = 1, No = 0 [ ]

36. What kind of information do you normally read/listen from the following information sources?

News paper	.....
Radio	.....
Extension agent	.....
Bulletin board	.....
TV	.....
Mobile phone	.....
Friend and neighbours	.....
Traders	.....
Others	.....

37. When did you last receive market information form your major source (s) .....

38. In your opinion what would be the appropriate time for broadcasting of Market Information?
.....

39. What is your preferred frequency of market information dissemination?
    1) Daily
    2) Twice per week
    3) Weekly [ ]
    4) Monthly
    5) Others (specify) .....

40. Accessing the Market Information, has it helped at all on your decision on the type of crop to produce? Yes = 1, No = 0 [ ]

41. Explain your answer .....

42. Crop sales

Crop	Amount harvested	Amount kept for consumption (Kg)	Amount sold (Kg)	Price sold Tsh/kg	Place of selling 1.= At home/farm 2 = at local 3 = at wholesale 4 = Others	Distance

43. What channels do you use to sell your crops? (Main buyers of your crops)
    1. Cooperative Societies
    2. Private Traders
    3. Government
    4. Processor [ ]
    5. Others (specify) .....

44. Do you use the above mentioned channel as one of your information sources?
    Yes = 1, No = 0 [ ]

45. Do you have market problems for your produce? Yes = 1, No = 0 [ ]

46. If yes, mention .....
.....

47. How do you compare the present (2 years ago) and past (5 years ago) crop Marketing system?
    1. Better
    2. No difference [ ]
    3. Poor
    4. Worse

48. Give reasons to the answer above .....
    .....

49. Do you see market information as one of marketing problems for your crop?
    Yes = 1, No = 0 [ ]

50. Explain your answer .....

51. Do you use the Market Information sources as a guide to your product and marketing?
    Yes = 1, No = 0 [ ]

52. If no, give reason .....

53. What criteria do you consider when selecting the market channel to sell your produce?
    1. Price offered
    2. Market cost
    3. Any available trader [ ]
    4. Others (specify) .....

54. Do you normally know price before taking your consignment to the market?
    Yes = 1, No = 0 [ ]

55. What type of Market Information do you think is appropriate to the farmer?
    1. .....
    2. .....
    3. .....
    4. .....

56. What is your evaluation on the information received from different sources?
    1= not useful
    2= not sure
    3= useful
    4= very useful

Information Source	1	2	3	4
Friends/neighbours				
Radio				
Extension agent				
Traders				
News papers				
TV				
Bulletin boards				
Mobile phones				

58. How do you rate the accessibility of the information from following sources?

1 = Inaccessible
2 = I don't know
3 = Accessible
4 = readily accessible

Information Source	1	2	3	4	5
Friends/neighbours					
Radio					
Extension agent					
Traders					
News papers					
TV					
Bulletin boards					
Mobile phones					

THANK YOU FOR YOUR COOPERATION

Appendix II. Multi-criteria pairwise comparison form

- The purpose of the form is to estimate the relative importance or weight of each indicator under each criterion

Key Scale for comparative judgment of indicators:

1. Equal importance
3. Moderate importance
5. Strong importance
7. Very strong importance
9. Extreme more importance

Criterion:

Indicator																		Indicator
	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	
	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	
	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	
	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	
	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	
	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	
	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	
	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	
	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	
	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	
	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	
	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	
	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	
	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	
	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	

Appendix III. Farmer's ranking different crops based on crop production and marketing

Key:
4 = Very good
3 = Good
2 = Average
1 = Not good

	CROP SCORE				
Production	maize	rice	simsim	sugarcane	sunflower
Farm inputs					
Farm credit					
Labour					
Extension services					
Weather information					
Marketing					
Price					
Selling place					
Sales time					
Market forecast					
Group marketing					
Product planning					

Appendix IV. Farmers' response to agricultural production constraints

Constraint	n	Percent
Draught	140	91.9
Access to credit	148	77.7
Access to good seed	131	63.4
Access to fertilizer	126	60.3
Access to market	124	55.6
Access to market information	119	55.5
Access to farm labour	139	46.0
Access to extension services	131	45.0
Access to land	125	44.0

Appendix V. Descriptive for variables entered in factor analysis and scoring factor

Variables	Mean	Std. Deviation	Factor score
Age in years	42.10	15.24	-0.06
Education completed in years	7.10	2.75	-0.08
Farm size (hectares)	2.09	4.45	0.07
Amount of labour power	34.43	39.69	0.07
Grow maize	0.86	0.35	0.06
Grow rice	0.47	0.50	0.11
Grow simsim	0.16	0.36	-0.02
Grow sugarcane	0.17	0.38	-0.08
Grow sunflower	0.18	0.39	-0.13
Number of crops grown	1.49	0.50	-0.05
Use of maize improved seed	0.26	0.44	0.08
Use of rice improved seed	0.21	0.41	0.31
usage of simsim improved seed	0.01	0.11	0.08
usage of sugarcane improved seed	0.08	0.27	-0.15
Use of sunflower improved seed for	0.16	0.37	-0.10
Use of fertilizers	0.69	0.46	-0.28
Crop production information-Friends	0.64	0.48	0.08
Crop production information-Radio	0.48	0.50	0.08
Crop production information-Ext. officers	0.38	0.49	0.04
Crop production information-Traders	0.26	0.44	0.05
Crop production information -News papers	0.16	0.37	0.02
Crop production information-Suppliers	0.11	0.31	-0.07
Crop production information-Bulletin boards	0.18	0.39	-0.03

Appendix VI. Variation for variables entered in factor analysis

Total Variance Explained

Component	Initial Eigenvalues			Extraction Sums of Squared Loadings			Rotation Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	5.285	22.979	22.979	5.285	22.979	22.979	3.171	13.788	13.788
2	2.941	12.785	35.764	2.941	12.785	35.764	3.072	13.358	27.146
3	1.857	8.075	43.839	1.857	8.075	43.839	2.756	11.983	39.130
4	1.494	6.495	50.334	1.494	6.495	50.334	2.120	9.219	48.348
5	1.418	6.163	56.498	1.418	6.163	56.498	1.529	6.648	54.996
6	1.184	5.148	61.645	1.184	5.148	61.645	1.337	5.811	60.807
7	1.066	4.637	66.282	1.066	4.637	66.282	1.259	5.475	66.282
8	.987	4.290	70.572						
9	.771	3.354	73.925						
10	.762	3.311	77.237						
11	.715	3.111	80.348						
12	.583	2.536	82.884						
13	.577	2.507	85.391						
14	.519	2.256	87.647						
15	.462	2.008	89.655						
16	.443	1.926	91.581						
17	.424	1.844	93.425						
18	.379	1.646	95.071						
19	.352	1.531	96.602						
20	.260	1.130	97.732						
21	.254	1.105	98.837						
22	.174	.757	99.594						
23	.093	.406	100.000						

Extraction Method: Principal Component Analysis.

Appendix VII. Component score coefficients for factor analysis

Variables	Component						
	1	2	3	4	5	6	7
Years of education	.158	-.082	.097	.105	.088	-.083	-.038
Farm size (hectares)	.092	-.144	.067	.491	.166	.011	-.160
Grow Maize	-.031	-.053	-.030	.108	.055	.596	-.005
Grow Rice	.361	-.093	-.218	.011	-.038	.114	.080
Grow Simsim	.025	.007	-.038	-.005	.471	-.011	-.023
Grow Sugarcane	-.081	.089	-.024	.241	-.084	-.057	.173
Grow Sunflower	-.126	-.071	.430	.056	.027	-.045	.054
Total number of crops	-.055	.088	.017	-.145	.123	.193	.528
improved seed maize	.075	.025	.060	-.078	-.062	.492	-.037
improved seed rice	.306	-.019	-.099	-.057	.058	.057	-.071
improved seed simsim	.081	.029	.053	.071	.522	.008	.007
improved seed sugarcane	-.147	.198	.025	.226	.044	-.129	.082
improved seed sunflower	-.102	-.077	.421	.078	.058	-.012	-.035
use of fertilizer	-.276	.030	.050	-.021	-.158	.027	.035
Information: Friends	.084	.055	.091	.022	-.107	-.026	.149
information -Radio	.082	.067	.068	.033	-.112	-.017	.048
information -Extension officers	.036	.178	.056	-.031	.027	-.098	-.054
Information -Traders	.050	.074	.065	-.140	-.127	.030	.074
information -News papers	.020	.266	-.122	-.118	-.070	.069	-.041
information Suppliers	-.073	.355	-.093	-.132	.052	-.019	.108
Information-Bulletin boards	-.034	.237	.031	.109	.176	-.024	-.246

Extraction Method: Principal Component Analysis. Rotation Method: Varimax with Kaiser Normalization.