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Price Transmission and Integration of Maize Domestic Market: A Case Study of Tanzania

by

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ABSTRACT

Agriculture is the main stay to most of Tanzanian; it contributes 23.7 percent to the country's GDP and employs more than 75% of the population. Majority of farmers produce different kind of crops with maize as major crop for food security and cash earning. Production is mainly by smallholder farmers who live in rural area where road infrastructure and access to agriculture information are the main constraints in their productivity. The proposed research is based on the context of price transmission and market integration theories to study Tanzanian maize domestic markets. Specifically the study employed Contingent Valuation (CV) methods the Willingness to Pay (WTP) tool to determine factors that influence farmer's willingness to pay and estimation of amount that farmers are willing to pay to improve agriculture services (rural road infrastructure and access to agriculture marketing information). It is deemed necessary to improve rural communication infrastructure as it facilitates market efficiency. Increased market efficiency will motivate farmers to increase production as result increased income generation a consequence to decreased poverty. The research used both quantitative and qualitative research methods. Quantitatively maize price data covering a period of January 1998 to December 2011 obtained from the Ministry of Industry and Trade has been used to study the nature of price transmission and extent of market integration from selected regions of Arusha, Iringa, Dodoma and Dar es Salaam. The qualitative part used the survey questionnaires with two hypothetical scenarios about rural roads infrastructure and agriculture marketing information centre prepared by the researcher. The researcher managed to interview 291 out of 300 households targeted (Maize farmers) from three Districts which are Arusha, Njombe, and Kongwa. The selection of region and districts was based on Tanzanian maize production zone, village accessibility and farmer's awareness to agriculture services especially the communication infrastructure. Households interviewed selection was based on their potentiality in maize production with assistance from agriculture extension officer in area. Also the selection of households interviewed was from the communities or villages which have a market place or *gulio* nearby to make clear and easy understanding of the questions asked. Focus group discussions with selected group of respondents (Maize farmers, maize traders and both maize farmer and trader) was done earlier from one district to find out information to be included in the main survey questionnaires to household interviews. This research used SPSS for descriptive statistics, EViews to analyse price transmissions on market integration and Gauss statistical package to estimate amounts of WTP and factors that affect WTP from the information obtained in the survey. The preliminary findings indicate that markets are

positively correlated and integrated. On the case of WTP farmers have positive response with reasoning that it will save time and money, good quality or improved transportation system, improved price and good services in development. Social economic characteristics, institutional support and access to credit, production factors have positive influence on farmers WTP. The information obtained so far from the study is very useful and important to policy makers in Tanzania.

Key words: **Price transmission, Market integration, Contingent Valuation and Willingness to pay.**

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CHAPTER 1: INTRODUCTION

1.1 Background

Grain market failure is one of the most challenging problems facing Tanzania. Among the problems associated with this market failure are mainly caused by poor quality of rural road infrastructure and access to reliable agricultural marketing information as the case of most developing countries in Sub- Saharan Africa (Kilima 2006). It is well known from the literature that market failure is directly connected to poverty, population growth and agriculture productivity (see Alderman 1993; Hine and Ellis 2001; Baffes et al 2003; Barrett 2005; Van Campenhout 2008). Market failure poses threats to national and household food security and the overall welfare of rural population in Tanzania.

Tanzania is an agrarian country with economy depending heavily on earnings from agriculture which accounts for 23.7 percent of the country's Gross Domestic Product (GDP), provides 24 percent of export and employs about 75 percent of the work force (URT 2011). It is from this perspective that agriculture plays a dominant role in the economy. Approximately 75 percent of the population in Tanzania is engaged in agricultural farming activities for their livelihood. Thus, smallholder farming dominates agricultural production, of which a large proportion is subsistence farming. Farmers work in small plots growing crops for their domestic consumption chiefly maize, rice, cassava, potatoes, beans, various fruits and vegetables. Despite the sector being dominated by smallholder farmers it contributes significantly in terms of aggregate growth, exports, employment and linkages with other sectors (MAFC 2006). Due to heavy dependence on agriculture as building block to their economy, developing countries such as Tanzania have development plans which will increase agriculture productivity while maintaining their natural resources sustainable and support agricultural production but it has been hard to achieve (World Bank 1996).

Grain price volatility especially maize destabilises farm income in maize growing areas and is likely to endanger nutrition and rural investments in many poor communities. Farmer's response to price change to a great extent is an outcome of factors that influence the transmission of price signals which include structure of distribution sector, costs and marketing constraints, quality of infrastructure and resource endowment. Lack of quality transport system and storage capacities has been a problem in rural areas as a result discouraging traders from buying crop produce from remote areas and this makes rural farmers less competitive (Van Campenhout 2008).

Communication infrastructure especially roads and access to information plays important role in facilitating the price transmission[1] process within a country.

The relationship between commodity prices from one location to another explains the process at which prices quoted at higher market levels can affect the prices quoted at lower market levels within and outside the country. The extent to which prices are transmitted provides important insights as to how price change in one market can be transmitted to another market. This reflects the extent to which markets are integrated[2] within a country and they function efficiently (Diamond 1994). Where markets are well integrated price signals from urban areas (deficit area) can be transmitted to rural area (food surplus area) and agricultural producers can specialize can specialize according to long-term comparative advantage and they can make profit from trade. When markets are not integrated prices becomes more volatile and it's difficult to farmers to make decisions as their trade gains cannot be realized (Baulch 1997b). The extent of price transmission and the degree to which markets are integrated at different levels of market chain can have considerable impact on market liberalization, risk management and welfare in emerging markets especially in developing countries like Tanzania (Bateman 2002). It provides an insight on how producers can profit from sharp increases in price opportunities. In other words it helps to find out how closely the domestic market prices move with world market prices. Weak price transmission implies weak domestic supply responses to higher commodity prices and producers are not able to see what is being appreciated in the markets and what is not. This makes producers unable to make the best possible decision leading to inefficient market outcomes.

1.2 Problem Statement

Grain farmers especially maize farmers in Tanzania are subsistence and poor depend heavily on this commodity for livelihood and as a source of income generation for survival. Poverty is not only caused by the use of inefficient traditional techniques for their production activities but it originates from poor quality of roads infrastructure and inadequate availability and access to reliable agricultural

[1] The term price transmission refers to the process at which price from one location can affect price of the same commodity in a different location. It is how upstream prices (prices quoted on higher market level) affect downstream prices (prices quoted on lower market level). In the absence of external shocks the price relationship between the two shows some economic equilibrium while with existence of external shock the system should trigger short and long run adjustment towards long run equilibrium. The price transmission process provides information to rational economic agent to price their goods to maximize their utility function while for a long run the prices should reflect their scarcity Peltzman, S (2000).

[2] Market integration occurs when prices of the same commodity in different location follow similar pattern in a long period of time.

marketing information (Baffes 2005). As a result farmers are challenged in their production, selling and buying activities for this commodity.

An increase in maize production to Tanzanian farmers is not only relevant for food security but also an increase in income generation. Maize crop in Tanzania is grown in rural areas where road infrastructure and communication facilities are limited hence acting as a barrier to trade. Trade reforms in early 1980s in developing countries were aiming to offer more opportunities to countries to participate in international trade but lack of good quality road infrastructure networks and communication facilities within and between countries has made developing countries to be less responsive to economic signals arising from external markets. Winter et al (2003) have shown that transfer costs caused by poor quality of road infrastructure are usually high in developing countries compared to developing countries as price signals that are passed on to producers are completely different from the original price. In addition to that, economic signals are often lost completely in areas where markets are controlled by the public or few traders which is very common in developing countries such as Tanzania.

Price movement within a country or regionally is an area of economic importance to economists as it provides empirical analysis of how changes in prices from one domestic market can affect prices of the same commodity in another domestic market, its output, consumption and social welfare within the country. An understanding of price movements within a country and the degree at which prices are transmitted across region is of economic significance to a country as it provides forecast information on how producers and consumers in the domestic markets will react in response to price changes from external market. Studies of price transmission can provide important information on how prices are transmitted, how markets are integrated domestically and regionally, policy and marketing issues for intervention and implementation to improve market efficiency (Alderman 1993; Christopher, Barrett and Mutambatsere2005; Kilima 2006).

In spite of benefits of good quality roads and the use of modern technology like internet and mobile phones to access agriculture market information, Tanzanian farmer's willingness to pay (WTP)[3] for agriculture services is believed to be very low (Eggertsson 1990). Their transportation activities are mainly characterized by the use of animals (donkeys), tractors, pickups (small rigid tracks) and Lorries (trucks) while access to agriculture market information is by weekly newspaper, monthly magazine and radios or from their fellow farmers. Studies of the impact of

[3] Willingness to pay (WTP) is the maximum amount that individual states that are willing to pay for a good or services while willingness to accept compensation (WTA) is the minimum monetary amount required for an individual to forgo some good, or to bear some harm.

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transportation costs in agricultural production (such as Alderman 1993; Hine and Ellis 2003; Van Campenhout 2008) have indicated that total transport costs on agriculture are very high compared to what farmers receive for their produce at the farm gate. Transportation charges are found to be high in all seasons due to the fact that transportation charges are made in relation to road conditions and travel distance. Access to agriculture information to Tanzania farmers is mainly by the use of newspaper, magazine and radios in a weekly basis with a limited use of modern technology such as internet at household level. Access to information using modern technology to farmers is of economic importance in decision making in terms of production and marketing activities (VECO Tanzania 2006).

In perfectly functioning markets, the market mechanism ensures optimal investment levels in road infrastructure and communication services. Prices in perfectly functioning markets reflect values of commodities traded, resource availability for individuals welfare, constraints faced by individuals in the society and their social scarcity values (Shiferaw and Holden 2000). Rural areas in Tanzania like any other developing country economies face persistent market failure resulting from incomplete property rights, externalities, incomplete and asymmetric information and high transactions costs. It is quite often that decisions made by individual farmers at the household level in relation to agricultural production and services are incorrect. Efficient use and resource allocation requires perfect decision making in relation to market situations (McConnell 1983). Existence of externalities in the market prevents markets from achieving economic efficiency. According to Dahlman (1979), the underlying cause of externalities such as price volatility or fluctuations in developing countries is the transaction costs resulting from high transport costs where the transaction costs of removing them are also significant. In a market process without transaction costs market forces can easily internalize problems associated with externalities such as price volatility. Most of rural economies in developing countries are being characterised by high transaction costs associated with transport costs and imperfect market information (Janvry et al., 1992; Hoff 1993 ; Janvry et al., 1999; Van Campenhout 2008).

According to (Sterner 2003), of all the market failures, transportation systems and incomplete information are most persistent in developing countries. Accounting for farmer's limited use of modern technologies in their farming activities may be lack of reliable information about their long term impact on their agricultural activities, natural resource base sustainability and feasibility. It has been reported that lack of accurate information especially price is a big challenge to farmers in developing countries (Fafchamps 2005).

However, it has been noted that most of developing countries are faced with institutional failure and it has been the main source of all market failures compared to communication infrastructures. Most institutions have been created imperfectly with weak organisational structure such as government which is an important institution (Sterner 2003). Weak institutions are responsible for high transaction costs which are mostly found in developing countries (De Janvry et al ., 1991; Sadoulet et al.,1996; Wunder 2006).

Governments, policymakers and development practitioners in developing countries are facing challenges on how they can reduce the divergence between private and social interests in agricultural development while investing in rural road infrastructure and communication facilities at the same time. It is generally accepted in neoclassical economics that for all sources of market failure, the existence of some market failure is a sufficient condition for government intervention, for instance, to internalize price transmission. The World Bank and United Nation economic Commission for Africa in collaboration with African countries identified on road user fees strategy as the only sustainable initiative to road maintenance. The private sector expressed their willingness to pay (WTP) for infrastructure maintenance in the workshops organised by the World Bank and the United Nations if they can be guaranteed that the funds will be directed to the efficient maintenance of road infrastructure and not something else (Mbwana 1997). In respect of that initiative various governments in sub-Saharan Africa have shown their interest as it is the only way of seeing transport infrastructure as of a pure public good and bringing it into the marketplace. The initiative for user fees has been adopted by different governments in developing countries and it has proved to be a good plan for sustainable infrastructure maintenance programs. However, this may have adverse effects due to low traffic volumes in most of developing countries rural roads. In addition to that financing infrastructure maintenance from user charges may lead to higher charges that are difficult to pay in comparison to developed countries where the traffic volume is very high (Mbwana 1997). Most of developing countries rural areas are characterised by low traffic volume and there are no auto users to cross subsidized trucks in which when user fees are implemented they can bring the economy into failure. To stabilize infrastructure maintenance funds in developing countries such as Tanzania, user charges are important and will be sustainable where the revenues are in a special fund and being supplemented from the general tax base.

Off-site effects of high transaction costs, and decrease in output may be enough to justify the use of public funds to supplement the infrastructure maintenance fund program. One of the mechanisms that have been used to implement such program is the direct participation of users in terms of labour force or stated payment to the program in which non participants have been fined a stated higher amount as an incentive to induce them to participate.

Community owned properties and a service where information is accessible to all members has been an incentive to households to participate voluntarily due to benefits that they receive from such services. In comparison to public goods either voluntary or involuntary households seem to be rigid or reluctant to participate with a perception that they receive the same benefits whether they are participants or non-participants. Community ownership in goods and service provision in some parts of developing countries have proved to be a sustainable way to development especially where information about programs is accessible to all members (both participant and non-participant) in the payments. It is also an easy way to control fund management, free riders and members who did not pay from access. It is particularly important for policymakers to know, in such payment programmes, the appropriate level of amount households/users are willing to pay to encourage household's especially non participants.

1.3 Research Objectives

As literature (see Alderman 1993; Hine and Ellis 2001; Baffes 2003; Barrett 2005) indicated that economic analysis on price transmission and market integration provide a forecast information on how producers and consumers of certain commodities are likely to react on the price changes.

This research therefore will assess and examine market integration, extent of price transmission for domestic maize markets in Tanzania. It will also make an assessment of its impact on prices, output, consumption and welfare within the country. Secondly this research is aiming to use an institutional approach to study farm household's decision-making in terms of the amount they will be willing to pay to improve agriculture services (quality of roads infrastructure and access to agriculture information) in Tanzania and will also determine factors that affect their WTP.

Against this background the apparent research questions, hypotheses and specific objectives for this study are derived.

The sub-objectives include:

i. To examine the relationship between maize prices in Dar es Salaam to other domestic markets of Arusha, Iringa and Dodoma;

ii. To assess potential changes in the nature of price transmission between Dar es Salaam, Arusha, Iringa and Dodoma in the analytical period;

iii. Estimate the amount that maize farmers are WTP to improve quality of road infrastructure and access to agriculture market information; and

iv. Assess factors influencing/affecting their WTP for quality of road infrastructure and access to agriculture information especially price.

1.4 Research questions

(i) Does the change in the maize price in Dar es Salaam have any impact to the change of price in other domestic maize market (Arusha, Dodoma and Iringa) prices?

(ii) What is the nature of price relationship between Dar es Salaam and other domestic markets of Iringa, Arusha and Dodoma?

(iii) Are there potential changes in the nature of price relationship between Dar es Salaam, Arusha, Iringa and Dodoma in the analytical period?

(iv) Are the maize farmers willing to pay to improve quality of road infrastructure and access to agriculture market information in the rural areas to facilitate market integration?

(v) What are the factors that determine farmer's willingness to pay?

1.5 Hypotheses

(i) Maize prices in Dar es Salaam have significant positive influences on maize prices in other domestic markets of Iringa, Dodoma and Arusha.

(ii) Maize prices in Dar es Salaam have long run relationships with other domestic market prices.

(iii) Direction of Maize price movement is from Dar es Salaam towards the other domestic markets of Iringa, Dodoma and Arusha and not vice versa.

(iv) Maize farmers are willing to pay not more than Tsh 1000 per month for improved road infrastructure and Tsh 500 per month for improved access to agriculture market information.

(v) Farmer's socio-economic characteristics have positive effect on their willing to pay for agriculture services such as road quality improvement and access to agricultural market information.

(vi) Distance to the market determines farmer's willingness to pay for improved road infrastructure.

1.6 Relevance of the study

Most agricultural commodities in developing countries are produced in rural areas and are costly to transport to deficit areas relative to their total value. Poor quality of road infrastructure and access to agriculture information and unstable political environments lead to market fragmentation with complex price relationships. Market efficiency issue is very important one as it has an impact on poverty particularly in rural area, the environment and the general economy of Tanzania. Market integration is inseparably linked to agriculture in Tanzania as agricultural commodities are the major use of the market. Road infrastructure and access to agriculture information are the key elements in market integration facilitations which can lead to market efficiency. This study is important because it will inform policy which aimed at improving agriculture marketing efficiency as well as estimates of adequate/acceptable payments that will encourage farmers to adopt road infrastructure and access to information improvement measures. This will ultimately improve market efficiency and help to alleviate rural poverty and improve food security.

1.7 Organisation of the study

The study is organised in seven chapters. Chapter one includes the general introduction and the background of the study, the problem statement, study objectives, questions and hypotheses. It also provides some background knowledge on price transmission and willingness to pay for agriculture services. Chapter two provides an historical background of agriculture marketing policy in Tanzania, government reforms and their impact in commodity marketing. Chapter three the literature reviews. The conceptual model and methods used to evaluate non market goods are discussed in this chapter. Empirical model and methods used to conduct the study are presented in chapter four. The chapter also include a description of the study area, questionnaire design, sampling and data collection. Data analysis, results and a discussion of the results are presented in chapter five. Finally chapter six provides summary of the study, recommendation and conclusions.

CHAPTER 2: BACKGROUND

2.1 Introduction

This chapter provides a short summary of sector and its contribution to Tanzania. It also provide a historical background of agriculture marketing policy in Tanzania, government policy reforms and their impact in commodity marketing especially grains where maize is a commodity of interest. The chapter also provides information regarding the current Agriculture Marketing Policy (AMP) of 2008, its implementation strategy (Agriculture Marketing Strategy –AMS) and the National Food Reserve Agency (NFRA) as supporting policy on grain marketing.

2.2 Status of Agriculture sector in Tanzania

Tanzanian economy is dominated by sector. In 1990s the sector generated 55 percent of Gross Domestic Product (GDP) and more than 80 percent of the total export. Also the sector being labour intensive it employed about 90 percent of the workforce. Country's Gross Domestic Product (GDP) has decreased to 6.4 percent the past two years when compared to 7 percent in 2010. The decrease in GDP was due to drought which affected different parts of the country as a consequence decrease in agriculture produces which the economy depend on (JMT 2012).
The sector is mainly subsistence with more than 4.4 million families engaged in cultivation of crops for food and cash earnings. The main subsistence crops account for 23.7 percent that the sector contributes to the country's Gross Domestic Product (GDP) and these include: maize, sorghum, millet, cassava, rice, plantains, wheat and pulses. The country has experienced decrease yields in recent years mainly caused by high rainfall variability, droughts, low input use and limited access and use of new technologies by farmers. Despite being a smallholder's production it accounts for most of the country's exports and over 80% of the value of marketed exports comes from cereals (maize, rice, sorghum and millet). In addition to cereals farmers also cultivate cash crops such as coffee, cotton, tobacco and cashew nuts (URT 2011).

The sector growth from 1980s has been modest although production levels are still far below potential. The annual growth rate has increased in recent years due to policy changes particularly market liberalization, the removal of foreign exchange controls and road improvements. The growth has also been experienced through an expansion in crop area. However, the productivity levels of most crops are significantly below those of the 1970s and environmental degradation is widespread in many rural areas due to inappropriate land use and a lack of appropriate technologies (URT 2010).

Agriculture despite being subsistence and unsustainable, it is a living to majority of developing countries communities such as Tanzania. Tanzanian farmers grow maize as their main leading crop for staple food and cash followed by rice. Maize is the most important commodity to Tanzanians as a source of carbohydrates and cash

earnings for the vast majority of the population. The availability of this commodity is of economic importance with respect to food security, social economic and political issues ranging from political instability in the form of protests due to increase the commodity price. Food security represents one of the central Millennium Development Goals (MDG) formulated United Nations due to decrease food production caused by drought in Sub Saharan Africa during the past three decades (UN 2008). It is also an important issue being implemented by programmes in the country such as Agriculture Sector Development Programme (ASDP), Agriculture first (Kilimo Kwanza - KK) initiative and National Strategy for Growth and Reduction of Poverty II (NSGRPII/MKUKUTA).

Maize production in Tanzania covers almost all regions where Arusha, Iringa, Rukwa, Mbeya, Ruvuma, Singida, Dodoma and Manyara in overall production are very potential due to their high production statistics compared to other regions. Maize prices, consumption and tradability differ according to location, income levels and population density. For example in urban areas such as Mwanza, Arusha, Kilimanjaro and Dar es Salaam where population densities are very high prices seem to be higher when compared to rural areas. Is either due to very low or no production of maize in the town centres while the commodity being highly consumed as it is important in the daily dietary basis of many Tanzanians (MAFC 2006). Furthermore, price in Tanzania vary from one location to another with regard to distance from production areas to the market or regional centre, terrain, road condition and season and it fluctuates in response to demand and supply forces (Pauw and Thurlow1992).

2.3 Agriculture marketing reforms and their impact on maize marketing

Tanzania due economic hardship and fiscal deficits in 1980 it has undertaken different policy reforms in agricultural commodity marketing to overcome problems associated with poor performance of state controlled marketing systems, subsidies in production and consumption. The state controlled market limited the role played by private sector such as maize traders and farmers in export by restricting their trade volumes and procurement rights at farm level (Peltzman 2000; Meyer 2004). The state owned institutions Cooperatives Unions (CU) and National Milling Cooperation (NMC) which had complete access to maize procurement throughout the year in areas where private traders were restricted and allowed to buy only a limited amount or volume of maize. Furthermore the government imposed price policy with regard to maize such as minimum prices at different stages of the marketing chain. All these policy interventions aimed at ensuring food security at controlled price level. Despite the reforms, agricultural commodity price and production remain very low which later

required further reforms and external assistance (Peltzman 2000; Suzuki and Bernard 2008).

In 1987 the Tanzanian government adopted the International Monetary Fund (IMF) and World Bank (WB) reform programme to restore macroeconomic balance and competence to the economy. These reform programmes raised the volume at which private trader could buy and allow them to buy maize from Cooperative Unions but restricted them to sell maize directly to the neighbouring countries such as Kenya, Malawi and Zambia (Kilima et al 2008). After the International Monetary Fund and the World Bank reforms major and comprehensive reforms were taken and implemented 1990s where all the restrictions regarding maize procurement were removed allowing traders to trade the commodity freely within the country. The aim was to improve marketing efficiency, price formation mechanisms, encourage increase in productivity and technological innovations (Barrett 2005).

Skarstein (2005) claims that reforms in Tanzania led to decrease in food crop productivity such as maize, rice and wheat 1990s as well as decline in labour productivity. This was particularly due to removal of agricultural subsidies at a time when farmers could not afford to buy inputs. In 1994 production statistics indicated a decline in crop yield which was a consequence of increased fertilizer prices which discouraged its use resulting reduced yields. Removal of fertilizer subsidy and privatization of input market headed to dramatic increase in input prices in the country. Price deregulation in 1990s induced decrease in producer price in maize, rice, beans and millet on the other hand maize and rice production increased 1990s but decrease prices and limited marketing opportunities meant that the commodities were produced for household own consumption (Skarstein 2005).

Although agriculture had lower growth rates in the 1990s than other sector such as industry and services but it's large contribution to GDP resulted to slight decrease in poverty in rural communities (Oliver 2007). However sustainable growth and marketing efficiency needs improved manufacturing industries and infrastructure development in which none of these has been achieved.

2.4 An Historical background of Agriculture Marketing Policy

Tanzania after independence agriculture sector institutionally was characterised by the Cooperatives Unions which were mainly for commodity marketing and price regulations. These cooperatives were not successful until 1970s when the shift was made parastatal to dominate marketing. Parastatals were not efficient either and in mid 1980s the shift to liberalization policies in agriculture were made and this encouraged emerging of private sector. The mid 1980s transformation were

fundamental to the economy as the roles of government and the private sector were all defined (Oliver 2007).

The policy transformation created new economic environment where production, processing and marketing were managed by private sector while regulatory and public support undertaken by government. The government control and the monopoly nature of marketing held by cooperatives and marketing board in agriculture input and output price were also eliminated (MITM 2008). However, with regard to agricultural commodity marketing the policies were not successful due to their fragmentation nature and risk associated with agricultural commodities. The policies did not put in place marketing system that could guarantee producers reliable and sustainable markets for their commodities in their localities (MITM 2008). Additionally, the number and capacity of agribusiness actors in agricultural inputs and outputs were constrained with their limited knowledge and skills, inadequate access to capital/finance, poor quality of infrastructure such as rural roads, the un-conducive nature of legal environment and inadequate competition. This was a wakeup call to government interventions to provide a proactive role in market failures and development of private sector participation in marketing by creating conducive environment (Oliver, 2007; Fredy et al 2008).

The existence of producer organisation such as Cooperatives played role in marketing but due to weak managerial skills lack of finance and credit access and corruption they were unable to meet their expectation to members. This again needed a government support in term of policy in short, medium and long term.
The government formulated number of policies in the sector including; Sustainable Industrial Development Policy (SIDP), 1996 – 2020; Agriculture and Livestock Policy (ALP), 1997; Cooperative Development Policy (CDP), 2002; Rural Development Policy (RDP); National Trade Policy 2003; Small and Medium Enterprises Development Policy (SMEDP), 2003; National Livestock Policy, 2006; and different programmes such as Agricultural Sector Development Strategy (ASDS) 2001 and Agricultural Sector Development Programme (ASDP) 2005 (MITM 2008). However, these policies and programmes did not address issues of agriculture marketing adequately due to number bottlenecks encountered which include; poor marketing infrastructure; inadequate and unreliable marketing information systems; limited capital and access to financial services; inadequate entrepreneurship skills; lack of appropriate value adding and packaging technologies and marketing skills. These challenges necessitated the formulation of the Agricultural Marketing Policy (AMP) of 2008 and its subsequent implementation strategy the Agricultural Marketing Strategy (AMS) of 2011 (MIT 2012).

2.5 Agricultural Marketing Policies and their implementation strategy

The policy was formulated by the Tanzanian government through the Ministry of Industry Trade and Marketing 2008 and its scope and focus is to address marketing issues in agriculture sector and its main sub sectors which include: crops; livestock; fisheries; forestry and beekeeping marketing.

The policy objective is to facilitate strategic marketing for agricultural produce in the country while ensuring fair returns to all stakeholders based on a competitive, efficient and equitable marketing system. Among other issues regarding agriculture marketing the policy also addresses legal reforms and regulatory framework, promoting investments in agricultural marketing infrastructure and agribusiness, facilitating efficient agricultural marketing information system, adoption and use of new technologies and innovation strategies in risk management (MITM 2008).

Facilitate effective policy implementation the Tanzanian government formulated Agriculture Marketing Strategy (AMS) of 2012 to speed up the progress of the implementation. The strategy objectives include:

(i) promotion of rural area investments in agricultural marketing infrastructure and agro-business;

(ii) stimulate and facilitate the development of efficient and effective agricultural marketing information system, research and intelligence systems in the existing marketing system and development of new agricultural markets;

(iii) reform the legal and regulatory framework and provide support to the formation and development of agriculture marketing institutions;

(iv) promote development, adoption and use of risk management strategies in agricultural marketing; and

(v) enhance access to agricultural marketing finance**.**

These are amongst issues of priorities in facilitating effective and efficient marketing systems in the country. Agricultural marketing infrastructure investments especially roads in the rural areas play an important part in reducing transportation costs and facilitating linkage between markets. It has been revealed that an improvement of feeder road in the rural area by upgrading from earth to gravel might increase farm gate price by decreasing the transport costs by 20% (Hine and TRL Limited 2001). A number of studies (such as Alderman 1993; Hine and TRL Limited 2001; Rashid

2004; Kilima 2006) indicate that transaction cost[4] especially transport costs account for over 50 percent of marketing costs and in areas with poor quality roads goes up to 70 percent. Smallholder farmers in developing countries share a small fraction of the final price of the commodities that they trade as a result of high transactions costs incurred during the marketing process. The transactions costs seem to be more worse where the marketing process involves marketing boards which are normally owned by the public (Baffes 2005). In addition to high transaction costs in trading, farmers have limited access to agricultural marketing information especially prices at the household level. Investments on agriculture information system in a country like Tanzania with legal and regulatory frameworks put in place can act as a catalyst to motivate farmers to increase their production activities as access to reliable information in time will facilitate decision making (Hine and Ellis 2001). Tanzanian smallholder farmers can only access agricultural marketing information once a week through newspapers or through a monthly magazine and radios in which most of the time the information is passed on, is out of date or is no longer accurate thus affecting their decision making on production and marketing activities.

2.6 The National Food Reserve Agency (NFRA) and its impact on maize prices

The National Food Reserve Agency (NFRA) was formed after the transformation of Strategic Grain Reserve (SGR) in the National Agriculture Policy of 2008. The National Food Reserve Agency adopted all the functions of Strategic Grain Reserve (SGR) which include procurement and storage of emergency food stock that should suffice addressing a food disaster for three month. The three month period has been regarded as time long enough to order and secure food imports from abroad reference (Kimani and Ouna 2011).

The transformation of grain storage industry organization was made due as a result of its poor performance which was largely affected by socialism policies enacted by the government from 1967 to 1984. During that period grain handling was dominated by statutory monopolies which resulted into policy failures particularly in pricing and lack of effective marketing arrangements. The Arusha Declaration in 1967 put an emphasis and encouragement of communal production and storage while discouraging individuals/private sector were through limiting political and institutional support. The institutional support, pricing and trade policies, wage and income policies and the currency exchange policy all affected grain production and storage.
After market liberalization in 1980s the government role was redefined to be regulatory only and encouraging more participation of private sector in grain

[4] Transaction costs means all costs associated with market transactions which include transfer costs (transport, storage, processing, retailing, and wholesaling costs) gathering information, identifying potential buyer/seller, bargaining and monitoring.

production, storage, trade and marketing. This led to collapse of state Parastatals, namely National Agriculture Product Board[5] (NAPB), National Milling Corporation[6] (NMC) and Regional Trading Companies[7] (RTCs) which controlled grain production, storage, trade and marketing.

Furthermore, the agricultural policy of 1983 emphasized the need to increase storage capacity especially in areas where transportation services were poor or difficult. The policy encouraged storage at the village level giving individual farmers and village government (primary cooperative societies) the responsibility to take care of food storage in their communities while building human capacity in terms of skills in improved storage. The policy successfully managed to construct storage facilities scattered all over the country with total carrier capacity of 400,000 million tonnes. These facilities are now under management and control of the National Food Reserve Agency (NFRA) and the Ministry of Agriculture, Food security and Cooperative entrusted with co-ordination role to minimize under-utilization of the created capacity and avoid unnecessary duplication of such facilities. However, challenges emerged which include distribution of surplus to deficit areas due to poor transportation channels. This led to the establishment of Inter-Ministerial Technical Advisory Committee on Agricultural Storage in 1987. The main task of the committee was to address issues of crop storage. A provisional policy on village level storage was developed which highlighted the need for household level storage, temporary storage for surplus produce and village stores (USAID 2011).

All these interventions on grain reserve aimed at price stabilization and regulation within the country which is never being achieved. Among the arguments raised against Strategic Grain Reserve is, it weakens domestic prices for producers, depresses private storage, and it is a fiscal burden to the government. It was also claimed that farmers should expect higher prices during the poor or off-seasons to compensate from lower prices received in the abundant seasons but the release of stock by the Strategic Grain Reserve usually reduces maize prices (market price). In this case the stabilization policy is observed to acts as indirect subsidy from maize producers to maize consumers (Nyange 2005). Furthermore, maize market liberalization in Tanzania involved removal of government regulation control but still

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5 National Agriculture Product Board (NAPB) was formed in 1962 with a mandate in controlling and marketing of agricultural products. The functions were limited to purchase from co-operatives unions or local co-operative societies and sales to licensed grain millers

6 The National Milling Cooperation (NMC) was formed in 1973 to replace the NAPB and it had authority in grain importation, processing, trading and marketing from national level to village level. The collapse of cooperatives due low farmer's confidence, corruption, periodical food shortage and consumer price fluctuations resulted to the total failure of the NMC.

7 Regional Trading companies (RTC) these were formed with a role to operate in regions and districts centres by distributing grain flour to consumers after being supplied by NMC

there are notable forms of government control such as the National Food Reserve Agency, restrictions on inter-district, inter-regional, and the cross-border trade with neighbouring countries such as Kenya, Zambia and Malawi. The government has quite often switched on and off this policy with an argument in favour of the policy that is to ensure local/domestic food security. However, these policy interventions have shown weaknesses in the current domestic marketing system as it has to future market orientation of smallholder farmers. The trade restrictions also are currently interfering with producer sovereignty due to the fact that the policies force them to sell their produce to local operators at uncompetitive prices (USAID 2011) .

Even though maize restriction policy intervention has been practiced in years and seasons where there threats in crop failure due to drought of flood but complaints raised by farmers have shown clear indications that private and social benefits do not match. Banning inter-regional, inter-district, and cross-border maize trade by the government to stabilize domestic price and recover seasonal price variability reduces chances of profitable market opportunities to farmers (Junior, D et al 2004). This also has played part as disincentives to small farmers and discourages their formal and legal market orientation. Additionally, since these bans are often imposed without warning, long term planning by farmers becomes difficult, which discourage investment in the grain sector especially maize sector (Nyange 2005).

CHAPTER 3: LITERATURE REVIEW

3.1 Introduction

This chapter provide discussion on relevant literature regarding this research. It begins with empirical literature about market integration followed by different approaches being used in market integration, empirical relationship between markets and a discussion about market integration being not always a good thing. It also provides discussion on Contingent Valuation (CV) and methods used to evaluate public goods.

3.2 Empirical Literature on Market Integration

Market integration or price transmission can be defined as a relationship of commodity price from one market to another. It is a degree at which one market can withstand price signals originating from another market or external market. The extent of price transmission between spatially separated markets or at different levels of supply chain can have considerable impact on market liberalization, risk reduction, producer and consumer's welfare and emerging markets. Price transmission is an important parameter in commodity market analysis. It provides information on the extent to which markets integrate within a country and regionally and it reflects market efficiency (Rashid 2004). It is an area of interest to economists in economic welfare analysis and to policy make when designing agricultural commodity price stabilization policies. Market integration has been explored many years ago in relation to the law of one price and information gathered has been used by governments, policymakers and development practitioners and it has proved to be significant. The Law of one Price holds when markets which are linked in terms of trade and arbitrage have common price and differences in price is equivalent to transaction costs. Such markets are said to be well integrated efficient and competitive with zero margin to arbitrage. Conforti (2004) revealed six factor which can cause incomplete price transmission or absence of market integration namely; transaction costs, border and domestic market policies, exchange rates, product homogeneity and differentiation, increased return to scale in production and market power.

Transaction costs: These are costs associated with transportation, access to marketing information and negotiation, monitoring and enforcement costs. These costs are considered as a bridge between markets, these costs needs to be covered by total price difference to allow arbitrage and integration to take place between markets. Stationary transaction costs which are proportional to quantity traded can be treated easily compared to when these costs are being fixed. Modelling price

transmission and integration requires non- linear model or linear models including thresholds when transaction between markets cannot be treated (Barrett and Li 2002).

Market power: Depending on the concentration of market agents it is likely for some agents in the production chain to dictate price of commodities and other agents becoming price taker. Such market power can be found in the price of inputs in which increase in price can be passed on to consumers while its decrease being captured by mark-up in the production (Goodwin and Holt 1999).

Increased return to scale in production: This is an origin of market power, an increase in returns to scale in the production chain has proved to have different effect in the vertical price transmission compared to that caused by market power (Goodwin 2001; McCorriston 2001).

Product homogeneity and differentiation: Agricultural commodities or products produced in different location the degree at which they can be substituted in consumption by consumers in relation to their preferences affect market integration and price transmission (Conforti 2004).

Exchange rates: Market integration depends on the value of currency and its stability. The degree to which changes in exchange rates are passed through on output prices depends on ability of firms to differentiate prices across locations in relation to different product, market structure and how the industry can adjust costs in production (Knetter 1993).

Border regulations and domestic policies: In most countries trade policies affect the extent to which prices are transmitted in different locations for similar goods while domestic policies such as price stabilization affecting price formation in both spatial and vertical transmission (Baffes and Ajwad 2001). Boarder measures such as export ban for some commodities, non-tariff barriers, can strongly affect price transmission especially when variable tariffs, prohibitive tariff and technical barrier are implemented in a country (Conforti 2004).

Existence of spatial markets each with its own demand and supply for commodities mark a starting point for market integration discussions. Each commodity has its own demand and supply thus providing a possibility to identify how areas with excess supply can transfer production to areas with excess demand through trade flow and price signals. It is also possible to identify price differences between markets for homogenous commodity. With free trade, difference in price between two markets in separate location account for transaction costs while an increase to transaction costs creates excess demand and supply to the markets depending on the trade flow.

Trade flows and the extent of price transmission provide sufficient information on market integration and efficiency especially in the case where markets are being connected through arbitrage process (Barrett and Li 2002). However, it has been indicated that where price differences between two separate locations are lower than transaction costs leads to rational trader to stop trading avoiding losses in trade. Additionally agricultural characteristics such as production, marketing and consumption, inadequate infrastructure, country barriers to trade, unreliable markets and inaccurate price information render the process of arbitrage leading to a risk activity for traders. Markets conditions such as demand and supply determine actual price for commodities resulting to independent price movement for commodities and this does not mean such markets are not integrated (Fafchamps et al Gardner 1994; 2003).

Economists generally use spatial price transmission as an indicator of overall market performance and welfare analysis in different country economies. Implementation of agricultural price stabilization policies in a country are claimed to have direct relationship with extent at which domestic markets are integrated (Alderman 1993). Countries with different ecological conditions have different commodity production patterns which lead to differences in price transmission for same commodity. It is common for spatial markets in developing countries in rural areas to convey inaccurate price information which mislead both producer and consumer in their decisions making resulting to inefficient product movement within and outside the country (Alderman and Shively1991).

Market liberalization reforms in 1980s to Tanzania have proved to have an impact to the country due to increase in market competition with various marketing agents such as small market participants, large traders and some trading enterprises within and outside the country (Fafchamps et al 2003). However, limited access to credit to both farmers and traders, cost of inputs, unreliable mechanisms for input supply, storage facilities, price volatility and limited access to agricultural marketing information are to be indicated as main obstacles to the success of market liberalization in developing countries (Alderman 1993; Fafchamps 1995 ; Conforti 2004).

Markets play important role in managing risks associated with supply and demand shock and this facilitate trade flow in different location resulting to reduction of price variation between producers and consumers over a period of time. Developing countries are characterised by persistent problems associated with poor communication infrastructure, lack or limited access to credit/finance, limited rule and regulations enforcement which limit markets from functioning efficiently. Empirical literature on various test of market integration considers commodity price

variability across space, time and season in developing countries as important and unclear predetermined arbitrage opportunities (Fackler and Goodwin 2002).

3.3 Approaches to Spatial Markets Integration

Different approaches have been developed over time to analyse degree of market integration between spatially separated markets. Most of the early approaches to market integration were associated with the idea of transfer of excess demand and supply from different market through trade and price signals. Another approaches was based on contestable markets where markets were considered to be integrated when there is no marginal profit to arbitrage which result to market efficiency (Barrett and Li 2002).

These approaches to market integration were not successful due to the fact that trade and markets with no marginal profit to arbitrage were not necessary condition to market integration. Commodity price between different locations can be transmitted as a result of institutional arrangement and market efficiency can be attained even if there is no trade between two locations (Abdulai 2000).

3.3.1 The Enke-Samuelson-Takayama-Judge Approach

Enke – Samuelson – Takayama – Judge studied market integration basing their ideas on spatial equilibrium between markets. They developed their model on price differentials between markets for an identical commodity in relation to the size of transaction costs.

The model was developed on assumption that, two markets *i* and *j* in a given time ***t***, their spatial price equilibrium can be given as;

$r_{it} = r_{jt} + y_{ijt}$, where r_{it} is the price of the commodity in location ***i*** in time ***t,*** y_{ijt} transaction cost from location ***j*** to location ***i*** in time ***t***.

In his model transaction costs are treated as an intermediary between the two markets and they represent costs of transporting the commodity, its storage and other costs like loading and unloading the commodity in the market.

Baulch (1997b) refers the Enke-Samuelson-Takayama-Judge model and use the ideas into three scenarios in the context of market integration.

The first one being the competitive equilibrium when $r_{it} = r_{jt} + y_{ijt}$. The non-trading equilibrium as the second occurrence where transfer costs are very high or low price given as $|r_{it} - r_{jt}| < y_{ijt}$ and the last one as a positive marginal return to inter market

trade as $|r_{it} - r_{jt}| > y_{ijt}$. The last occurrence was considered as predetermined arbitrage opportunities and markets are perfectly uncompetitive. The use of Enke-Samuelson-Takayama-Judge model in market analysis has a drawback in its application to markets in developing countries due to the fact that availability of reliable data on transport cost is a problem. The other disadvantage of using price transmission in market analyses with an assumption of fixed transfer cost such analyses cannot accommodate inter seasonal trade flow reversals (Fackler and Goodwin 2002; Kilima 2006).

3.3.2 Correlation analysis approach

Correlation analysis is another approach to market integration which was based on the behaviour of price movement for an identical commodity in two different markets. The analysis computes the degree at which prices of one market move in relation to price of another market with an assumption of instant price adjustment between markets. The advantage of correlation analysis is that correlations are simple and easier in computation but they too have a lot of weaknesses as factors like climatic patterns, population growth procurement policies and inflation which could affect prices across markets are not included. The assumption that prices adjust instantly is another problem associated with correlation analysis as such measures lead to underestimation of degree to which markets are integrated (Gardner 1994). The price adjustment process normally requires a period or several periods of time to occur. Market margins caused by transaction costs is another limitation of using correlation analysis to test spatial price linkage especially when markets are segmented with high transaction costs resulting to unprofitable trade (Lele 1971; Kilima 2006).

3.3.3 Threshold Model approach

The threshold models have been used to analyse market integration by testing the Law of one price. The threshold analysis is based on the existence of neutral band which represent transaction costs between two markets in spatial locations. The transaction cost in this case includes transport cost, time, identification of sellers and buyers, information and monitoring and they vary according to commodity seasons (Obstfeld and Taylor 1997). The models are based on two techniques, the Threshold autoregressive (TAR) together with Momentum Threshold autoregressive (MTAR) which are used to estimate neutral band and the speed at which prices between two markets converge (Abdulai 2000). Another technique is the use Non-parametric estimation which is used to estimate transaction cost without assumptions to any functional forms. This technique shows high results in prediction of degree at which markets are integrated compared to TAR (Teresa and Mancuso 2006). The Threshold models have an advantage that there is no need of transaction cost in

estimating the neutral band where the assumption of unidirectional trade flow and constant transaction costs are the main drawback to this model.

3.3.4 Regression approach/Ravallion's Method

Regression-based procedures developed by Ravallion in mid 1980s have been used to test for spatial price integration in term of short run and long run relationships between markets. Using Ordinary Least Square (OLS) estimator in regressions the price differences between markets are regressed with one market being a dominant or reference market. The approach include factors that affect demand and supply such as income and technology (Ravallion 1986). Regression analyses have a limitation in testing market integration as some price data are not stationary resulting to misleading results regarding to the degree at which price signals are transmitted. Additionally the regression approach takes single markets as reference markets ignoring the possibility of trade reversals and the transaction costs are assumed to be constant (Gardner and Brooks 1994).

3.4 Empirical Relationships between Markets

Econometric time series techniques are used to analyse commodity price movement between markets. Such techniques include Granger Causality (GC), Dynamic regression tests, Impulse Response Functions (IRFs), Vector Autoregressive (VAR) models, Error correction Models and cointegration analysis. The cointegration analysis, Vector autoregressive (VAR) models and Error correction model are currently regarded as standard tools for spatial market relationship analysis. These techniques are considered to be more accurate compared to earlier approaches such as correlation coefficient and regression analysis. However, these techniques have been criticised as they cannot incorporate price data, volume traded and transaction costs (Lütkepohl 1985; Baulch 1997b; Barrett and Li 2002). The Impulse response functions (IRFs) are normally computed in these models by exploring the relationship of variables in the system (Lütkepohl 1985).

3.4.1 The Granger causality

The Granger causality (GC) tests in time series analysis are conducted within the VAR models using the Granger approach (Granger 1969). The approach is based on regression analysis where market prices from one market are regressed in relation to lagged values of other markets. The lag and lead relationship between markets results to coefficients that can indicate how price signals from one market can cause a change in price in other markets. Granger causality tests can provide interpretations about the presence of statistically significant lead or lag relationship between prices from the markets in analysis. However, GC tests results can only

provide inference about the lead and lag relationship between markets for the period of analysis and not the actual nature of the relationship. It is important to supplement the GC results with other techniques that are used to test relationship between markets. Another limitation of GC approach is that the transaction costs are assumed to be constant which is similar to weaknesses of using correlation coefficients and standard regression approaches.

3.4.2 Cointegration analysis

Cointegration analyses are used to find out the nature of relationship between prices, the speed at which price adjusts. These tests are used to determine the long run equilibrium in a dynamic system when non-stationary pair of prices has linear combinations between them which are stationary. A stationary price difference is a necessary condition for cointegration. The number of cointegration relationships between pair of prices is regarded as the degree to which the markets are integrated. The cointegration analysis has a drawback of assuming constant transport costs. This assumption in analysis leads to mistreated transaction costs. Additionally the analysis is claimed to overlook the bidirectional trade which might prevent spatial arbitrage which prevent price transmission (Baulch 1997b; Goodwin and Piggott 2001).

3.5 Market integration is not always a good thing

Market integration studies in developing countries are currently gaining acceptance broadly due to their findings being of economic significance in development. The findings from these studies are directly linked to poverty reduction, response to demand and supply forces and agriculture price policies formulation (Badiane and Shively 1998). However, literature (see IFAD 2003; Meijerink and Roza 2007; Christophe and Laure 2012; Versailles 2012) have indicated that most of developing countries have put efforts in creating suitable environment for agricultural marketing that can facilitate market integration but most these efforts has been unsuccessful. The reasons behind the failure are based on existence of weak institutions such as governments, incomplete institutional organisation, policies, poor quality physical infrastructure and imperfect market competitions (Barrett and Mutambatsere 2005). In 1960s and 1970s some countries did undertake policy reforms to resolve market failures which gave way to market liberalization in 1980s. These policy reforms aimed at creating market oriented environment for right price to commodities currently known as getting institutions right. Despite the efforts put forward by different government and benefits of market integration there is strong debate and disagreement that markets openness can emphasize hidden dualistic nature of a modern and efficient marketing sector (IFAD 2003).

3.5.1 Restricted access to market

The extent to which markets are integrated domestically and regionally reflects market efficiency. Marketing reforms in developing countries are aimed at increasing market integration domestically and regionally. However limited access to land, finance, water, technology, information and security remain a challenge to improved market integration (Maijerink and Roza 2007). Market accessibility to these countries is limited to scale and capital this restrict traditional inefficient markets channels from entry. Additionally technological transfer in production holds out the promise of improved productivity leading to oversupply within limited markets. Developing countries are being challenged to attain market efficiency due to their differences in economic growth within and across countries and country endowment (Maijerink and Roza 2007). Change in consumer demand, product differentiation, quality, grades, standards, timely delivery with market structure concentrating in value added products provides limited opportunity to developing countries to gain share. Weak institution organisational structure, weak local and regional markets, limited knowledge and information on supply chain requirements, bargaining power and commercial production requirements also exclude the countries from penetrating markets.

3.5.2 Labour Market integration

Market liberalization in 1990s aimed at creating more opportunities for developing countries to participate in international trade in terms of goods and labour market instead it has resulted to decrease in economic potential of most rural sectors such as agriculture production, traditional goods and labour. Agriculture sector is no longer significant in economic growth due to production gap caused by labour market integration. Labour force movement from rural area to urban area searching for industrial jobs has left behind weak labour force such as old generation, women, children, sick and other dependents for agriculture production activities (Christophe and Laure 2012). Agriculture sector in rural areas is mainly subsistence where by smallholder farmers basically use traditional technologies which are labour intensive in production, removal of youth in production chain who can easily adjust to sophisticated technologies lead to reduction in production. Lack of skills, knowledge and the use of traditional technologies by farmers in production lead to failure in meeting market demand, product specification and timely delivery required by supermarkets and international market (Meijerink and Roza 2007). Technological advancement and its sophistication brought up challenge to farming communities in rural areas. Access and high illiteracy level make them lag behind in the whole process a consequence more vulnerability to poverty. Additionally, market integration has made large scale farmer better off especially in areas with good communication infrastructure and smallholder farmer worse off in the process as they cannot afford

market requirements. Communication infrastructure and access to information provide a wide opportunity to participate in trade. Poor or lack of quality communication infrastructure especially in rural area discourage production in terms of trade instead smallholder production concentrate on staple rural markets with low agro ecological potential. Physical access to market, market structure, lack of skills and knowledge, access to accurate information and institutional support add up another challenge to farmer participation in the whole process (IFAD 2003).

3.5.3 Response to consumer demand and standards

The rise of supermarkets in developing countries has resulted to change in consumer demand and product quality. Consumer demand and preference towards value added products has led markets to concentrate more on processed industrial goods than unprocessed agricultural commodities which are generally of low quality due to technological challenges in production. The on-going changes have led to increased demand for processing industries which have limited opportunities smallholder farmers. Lack of skills, knowledge, adequate information, access to credit and land security are the problems faced by farmers, this increase their dependency to traders and intermediaries who normally initiate marketing contracts, buy their produce, sell inputs and consumer goods (IFAD 2003). Product requirements such quality and standards, quantity and market sustainability exclude smallholder farmers to market penetration (Meijerink and Roza 2007).

The growth relationship between industries and farmers in developing countries aims at increasing assurance in commercial production. This has been beneficial to farmers however the monopoly structure of processing industry, credit availability, market intelligence and capacity of industries has led smallholder farmers to enter into contracts which are basically inequitable and not sustainable (IFAD 2003).

3.5.4 Market integration has its own costs

Market integration to developing countries enhances the opportunity of a country to participate in international trade on the other hand it increases the exposure of these countries to market risk and uncertainties. The exposure of a country to financial, labour and product market risks affect agriculture activities. Farmers find themselves at disadvantage position especially where agriculture activities are rain fed. However lack of knowledge, skills and marketing intelligence, adequate information on market condition, product quality and standards, formal or informal organisation that can give collective market power are the main challenges. These challenges result to failure of farmers to interact on equal basis with other market participants such as strong traders and intermediaries (Barrett 2005). Such market conditions farmers become passive than active player in the market process leading to farmer's

exploitation and failing to realize value of their production. Limited access to agriculture services create a lot of challenges to smallholder farmers as their production activities and access to market depends on them in terms of product quality and standards (Panagiotis 2008). The ignorance level and use of modern technologies to these farmers is very minimal which leads to difficulties to participating fully in the process. Furthermore, these technologies come up with hidden costs that farmers has to incur as the marketing environment force them to undertake training, pay for access to agriculture information and extension services at their own costs. Growth and wide spread of communications technologies such as radios, television and more recently mobile phones and internet play an important role in reducing informational asymmetries but an access to and to own these facilities is still limited (Barrett and Mutambatsere 2005).

3.5.5 Environmental deteriorations

Market integration aims at increased marketing efficiency but to developing countries this is not the case due to its effects on environment. Increased natural resources deterioration, climate change, loss of biodiversity, wide spread of deforestation and desertification and global warming as a result of diminishing ozone layer are good example of effects of market integration (Simone and Alessandro 2003). Agriculture depends on natural resources base, increased production in commercial farming to meet industrial requirement has led to increased natural resources deterioration and increased environmental pollution due to carbon dioxide emissions from industries. Furthermore increased investments on agriculture such as the use of green house that cause increased carbon dioxide in air, use of machinery in production that affect biodiversity, increased land exploitation resulting to deforestation, desertification and land value deterioration resulting to climate change such as unpredictable weather, prolonged drought conditions and decrease in natural resource availability such as water (Dornbusch 1992; Knetter 1993).

3.6 The Contingent Valuation (CV) method.

The Contingent valuation Method (CVM) is defined as a methods that have been developed and used by economists to estimate values that individuals places on public goods. The method uses survey questionnaires with hypothetical scenarios to approach people and report the amount that they are willing to pay (Willingness to Pay WTP) to obtain a certain good or the amount that they are willing to give up (Willingness to Accept WTA) to avoid certain condition to occur. The use of hypothetical scenarios without actual transaction makes the approach successful and a promising approach in determining public willingness to pay to public goods. The approach is currently used by researchers, policymakers to elicit people's preferences for public goods by finding out the amount or value that they would be

willing to pay to a specified improvement in a good or service (Mitchell and Carson 1989).

3.6.1 Soliciting farmer's (WTP) using contingent valuation Method

Currently economists have been using stated preference methods to assess value of goods and services that cannot be obtained from observed or revealed behaviour of people in convectional market by using people's stated behaviour in hypothetical market setting. In comparison to previous approaches where economist use actual market behaviour to value good or products directly or indirectly observed or revealed as evidence. Value of goods and services that cannot be obtained from revealed/observed behaviour of people in convectional markets is of economic importance for a country. The contingent valuation method (CVM) and Choice Modelling (CM) are the two approaches which have been used to values such goods using individuals' stated preference to hypothetical situations (Portney 1994). The two approaches uses discrete choice model to estimate average or marginal values of WTP/WTA for goods and their attributes. The two approaches have a disadvantage that only limited numbers of discrete choices are observed from WTP or WTA and consequently market demand and supply can be estimated (Lust and Hudson 2004).

3.6.2 Contingent Valuation Method

CV method involves the use of survey questionnaire with hypothetical market to elicit individuals WTP for stated changes in quantity/quality of public goods or the amount that they would be willing to accept (WTA) in compensation for well specified degradation in public goods provision and generate the absent market (Hanemann 1998; Bateman et al 2002).

CV approach circumvent the missing market for public goods and services by using hypothetical markets and present them to consumers with choice environment to give them opportunity to buy or sell goods and services in question. CV approach scenarios are presented or demonstrated to public after private market or political referendum for awareness. The approach is named contingent valuation because the elicited values are contingent upon the particular scenario described to surveyed respondents (Mitchell and Carson 1989).

The approach is currently used by researchers, governments agencies, world bank and policymakers to evaluate values of different development investments (Navrud 1992). Different studies using the approach have been conducted in different countries in various areas which include transportation, water sanitation, health, arts, education and environment (Mitchell and Carson 1989). Notable examples of survey

studies that were used to elicit individuals' willingness to pay include; Randall, Ives and Eastman (1974) on improved air quality Southwest; Bishop and Heberlein (1979) the value of duck hunting permits; Brookshire et al (1982) on air pollution in Southern California and Mitchell and Carson (1993) on national water quality benefits from the Clean Water Act.

Despite its extensive use in different parts of the word the CV approach faces a substantial critique about whether it sufficiently measures individuals' willingness to pay for public goods quality. The reason behind the critique is that the estimates obtained from CV can still be question in terms of their validity and reliability and stated preferences obtained from CV approach deviate from the standard assumptions of economic theory (see Diamond and Hausman 1994; Henemann 1994; Vatn 2005a). Authors like Diamond et al (1993), Diamond and Hausman (1994) and Hanemann (1994) believe that the problem is not only the measurements but also that people are not familiar with assigning money values on public goods and services just because they don't have experience with them in the market. However public goods including environmental commodities are complex and they perform multi-functions in such a way that individuals presented with valuing them may not have satisfactory foundation to state their true value (Vatn 2005a).

CV literature have extensively discussed about measurement error and potential bias sources in their surveys. Mitchell and Carson (1989) provide a general overview of CV potential biases and they includes: starting point biases; eliciting biases; question order biases; sample selection biases; information biases; interviewer and respondent. Some authors (List and Shogren 1998; List and Gallet 2001; Murphy et al 2003), have stated biases regarding on the hypothetical scenarios however its presence is still on debate and challenged by different authors (such as Sinden 1988; Smith and Mansfield 1998). The reliability of CV approach studies can be improved by addressing the biases through the use of advanced methods that touches all aspects of the CV survey which includes sampling, instrument development, formulation of valuation scenarios, questionnaire design and structure and data analysis (Mitchell and Carson 1989).

Though the CV approach is quite popular in valuing public goods only few studies have employed this approach to estimate values that the beneficiaries/farmers are willing to pay improve agricultural services such as quality of road infrastructure and access to agricultural information. In the context of this study CV method will be employed to estimate farmers' WTP for improved quality of road infrastructure and access to information using mobile phone and internet. It will also determine factors that influence farmers WTP in Tanzania. WTP has been preferred in this study to estimate the value that farmers are willing to pay for agriculture services

improvement in Tanzania than WTA due to the fact that road infrastructure and access to agriculture information are typical example of public good meaning that these good are non-congestible, non rival and non excludable.

3.6.3 Institutions in economic framework

Institutions have been defined by different people in different ways. In a broadest sense, institutions are defined as: “a set of formal rules of conduct (laws, contracts, political systems, organizations, markets, etc.) and informal rules of conduct (norms, traditions, customs, value systems, religions, sociological trends, etc.) that facilitate coordination or govern relationships between individuals or groups”(Jari and Fraser 2009). Institutions are of economic importance as the pave a way on how individuals or groups plan, implement and evaluate their development programs. It is believed that without institution, individuals or groups are likely to fail on their plans and on the other hand institutions are believed to contribute to a failure if not well structured.
There are different viewpoints about the importance of institutions on preference formation. Neoclassical economic theory describes individuals as self-centred, has stable or given preferences, and rational choices characterized by aim of individual utility maximization (Becker 1976; Eggertsson 1990). Preference and rationality of individual are considered to be independent of external factors or institutions or social context. Institutions are seen as external constraints to utility maximizing individuals as they don’t give them thought and do not matter.

Institutional economics unlike neoclassical economics takes a different view. The need arises due to increased demand to society protection from increased free riding and costs of punishing defectors being high in relation to their increase in number. The institution in this view was created in order to reduce uncertainties in human exchange. Institutions together with technology employed play role to determine marketing transaction costs and they are responsible in structuring and regulating interactions between marketing actors (North 1991). Market efficiency can only be obtained when transaction costs are zero when institutions don’t matter.

Institutions have a role to define information and incentives structure within which economic outcomes are determined. A rational, wealth maximizing individuals collaborate with other actors in an institutional framework to reduce transaction costs in economic investments (North 1991; Vatn 2005a; 2005b). Thus, rationality of individuals is influenced by the institutional context in which they live and make decisions. Therefore institutions both social and economic influence behaviours and outcome of individual preference (Bowles 1998; Vatn 2005a; 2005b). The individual preferences do not only determine economic outcome only but also the economic situation, social factors, legal environment, and cultural structure of society affects preferences.

WTP is a measure reflecting the choice and preference of individual to non-market goods and serviced in monetary value. The monetary values are obtained on such non-market goods and services through the expression of stated preferences of individuals. What can be deduced from the relationship between institutions and preferences is the importance of the institutional context on preferences and value expressions (e.g. WTA/WTP) (Bowles 1998) and hence on price determination (Tool 1995). If preferences are based on context, then the institutional setting under which preferences are made may itself have implications for the preferences that are expressed (Vatn 2005a).

Institutions can also be broadly seen as being the sphere of resource use and management (Vatn 2005b). The motivation underlying sustainable resources use and production management practices by farmers is defined by the mechanisms of institutions of collective action[8]and property rights under which they operate (Meinzen -Dick 2004).

Both property rights and collective action are therefore crucial for the management of public goods and services, the benefits of which will serve many people. For this reason, the connections between property rights, collective action, and natural resource management have vital implications for the adoption of technologies and environmental protection for sustainable use and for the preferences of resource users and managers.

3.7 Gaps in the literature

From the literature reviewed, it is quite clear that considerable amount of studies have been conducted on price transmission and commodity market integration in developing countries. But a lot of these studies have tended to concentrate on price transmission and degree to which domestic markets are integrated with only few considering on the ways to improve agriculture services especially rural roads and access to agriculture market information which are the main obstacle to market efficiency and welfare distribution within the country. In particular, Kilima (2006) and Van Campenhout (2008) have assessed the effect price transmission in local market integration, transaction costs especially transport costs and its effect in agriculture production and policy intervention measures needed to improve market efficiency. Rashid (2009) employed time series analysis to Ugandan maize market to examine the extent at which the domestic markets are integration, causality between

[8] Collective action in this case means behaviour or actions of individuals or groups of people working together toward a common goal. When individual engage in collective action, the strength of the group's resources, knowledge and efforts is combined to reach a goal shared by all parties.

spatial location and its importance in price formation. Furthermore, Shively (1998) explored role of spatial market integration and transport cost to explain commodity price change in Ghana and Baulch (1997a) used the information regarding transfer costs in Philippine's rice markets to assess the efficiency of spatial arbitrage. Even though much has been done all these studies would have been of more economic significant if they had included role played by agriculture service in market efficiency. Regardless of the numbers none of these studies has attempted to assess farmer's willingness to pay to improve agriculture service in developing countries such as quality of rural road infrastructure and access to agriculture information especially price. It is also of economic important exploring factors that affect farmer's WTP in agriculture service as these services are believed to obstruct market integration in developing countries. It is thus imperative that the study of price transmission and market integration including farmer's willingness to pay to improve agriculture service to be employed in the literature to account for the fact that improved agriculture service will facilitates price transmission as a result marketing efficiency.

CHAPTER 4: METHODOLOGY

4.1 Introduction

This chapter provide relevant information regarding the selected research area, the survey questionnaire design, the pre-survey work and pilot survey done. It also provide information on how the research was conducted, criterion put forward for study area selected, how the respondents were selected. The chapter provide necessary information on the precautions taken so that the respondent could provide only required information for the research to avoid unnecessary information being collected. It also provides the analytical part on how the data will be analyse and models estimation for Contingent Valuation (CV) and the time series data obtained from Ministry of Industry and Trade (Maize price data).

4.2 Research Area

The research was undertaken in the United Republic of Tanzania. It is a relatively large country located in East Africa, with total area of 945,087 square kilometres. The total area includes the Tanzania mainland and the islands of Mafia, Pemba, and Unguja (Zanzibar). With a coastline that cross 1,424 kilometres, the eastern part of Tanzania borders the Indian Ocean, while to the north lies Kenya, to the northeast Uganda, Rwanda, and Burundi, to the west Zaire, to the southwest Zambia and to the south, Malawi and Mozambique. Based on rainfall and vegetation Tanzania has a tropical climate with two major rainfall regions. The unimodal rainfall (December - April) and the bimodal rainfall (October -December and March - May). The former is experienced in southern, south-west, central and western parts of the country, and the latter is found to the north and northern coast. In the bimodal regime the March - May rains are referred to as the long rains season whereas the October - December rains are generally known as short rains season.

Tanzania is divided into five agro ecological zones namely Central Zone, Eastern Zone, Western zone, Lake Zone, and Southern highlands. The study will concentrate into three regions of the country mainland where maize are potentially grown namely; Arusha which is composed of six districts from Northern zone; Dodoma six districts in central zone and Iringa seven districts in southern highland zone[9].

[9] The study retain the districts selected and treat them as districts due to government reform in 2011 which transformed Njombe to a region.

4.3 Survey questionnaire design

Through literature search information gathered was used to design one - to - one survey questionnaire. The first part of the questionnaire described road infrastructure quality that was valued and it was presents in hypothetical scenario. The hypothesis included importance of good road quality such as minimization of travel time, transport costs and environment conservation. The second part described access to agriculture information through internet with its hypothetical scenario. The CV portion of the survey questionnaire followed in each part and here respondents were presented with WTP ladder, with options ('definitely yes', 'probably yes', 'don't know', etc.) to choose from. Questions regarding perception and awareness to quality of road infrastructure and access to agriculture information were also presented to respondents with options to choose from ('strongly agree', 'agree', 'neither agree/disagree', etc.). The purpose of these questions was to enable the researcher to assess respondents' understanding about road quality and accessibility to agriculture information. Specific questions such as the kind of road transport, distance from market, travel time and frequency of visiting market place were included and the relative importance of good road quality and access to reliable information. In order to assess the influence of institutional arrangement on WTP questions were presented to respondent in terms of voluntary and compulsory payment scheme including questions on the institutional support. Information on individual household socio economic characteristics and agriculture services in addition to other important information were included in the questionnaire.

4.3.1 Description of goods

The first part of this section gave a brief explanation of poor quality of road infrastructure, the cause and its impact on price, farm income and the environment. The fact these impacts can be address by farmer's willingness to pay for improvements in terms of monthly payments or contribution of their labour force. Description of marketing information centre, its cause and impacts on price, income and time was also provide as its impacts can be addressed by the small amount that farmers can pay for an access. Pictures were also included in this section to make easy understanding of the good.

4.4 Selection of study Area (Regions, districts and villages)

The study was carried out in three regions (Arusha, Iringa and Dodoma) of Tanzania. The survey was conducted in one district from each region namely: Arusha district in Arusha region, Njombe district in Iringa region and Kongwa district in Dodoma region. These regions and their districts were selected with respect to their productivity and their potential to maize market in Tanzania.

Selection of villages within districts was not entirely random consideration was made on availability of marketing centre and road infrastructure connecting the village and other villages to that market. Ten communities/villages were selected from each district making a total of thirty (30) communities/villages. It was important that the survey was undertaken in areas where there is market place and road infrastructure to ensure that farmers/respondent understands or had an experience about agriculture services that they are valuing. The villages/communities were chosen with the help of regional, district and village agriculture extension officers from MAFC taking an account of accessibility to the community/village as important criteria.

4.5 Selection of respondents (sampling)

Maize farmers were selected for this survey despite that they also grow other crops. Individuals in the community were separated into farmers and both farmer and a trader, from each group five respondent were purposively sampled. An effort was made to include different categories such as male and female, youth and old and small and large farmers etc so as the information obtained to be a representative of all categories. In each village a number of ten respondents were interviewed except for few villages where farmers were not willing to participate. The respondents were randomly selected with assistance from the extension officer in that area. In all at least one hundred respondents were to be interviewed in each district to make total survey sample size to three hundred households. However, the numbers of respondents interviewed in a community/village were lower or higher than ten depending upon the size of the community, accessibility and willingness of respondents to participate in the survey. At the end of survey the total sample was 291 in which Arusha had 103 respondents, Njombe 100 and Kongwa 88.

4.6 Data collection

This study used both qualitative and quantitative data. The qualitative part involved data collection in which field survey was conducted to collect data from households as the basic unit of decision making in agriculture. The field work survey for data collection was conducted October, 2011 to March, 2012. The second part which is quantitative involved secondary data of Maize Price obtained from Ministry of Industry and Trade (MIT) for a period covering January, 1998- December, 2011. However, additional information was obtained from Ministry of Industry and Trade, Ministry of Agriculture, Food security and Cooperatives (MAFC) and other stakeholders. Discussions were made with Director of Marketing and Trade Promotion in MIT and Director of Crop Production in MAFC under consideration that they are responsible in policy making in terms of production and marketing of the commodity in Tanzania.

4.6.1 Maize price data

The study involved time series disaggregated monthly prices of maize data from Ministry of Industry and Trade database. The Ministry of Industry and Trade database is part of FAOSTAT which was established by FAO in collaboration with the Ministry to facilitate price data collection, storage and dissemination. The price data covers Dodoma, Iringa, Arusha and Dar es Salaam regions in Tanzania. The price data covers a period of January, 1998 – December, 2011. However, this period was chosen because it has a complete data set in the database covering the regions selected. The data has being used to analyse price transmission and cointegration analysis from the selected regions.

4.6.2 CV survey – focus group discussion

In order to obtain useful information mainly qualitative that cannot be obtained from standardized questionnaire and face-to-face interviews and to make sure that right information relating agriculture services are collected for further development of the survey questionnaire, focus group sessions were held. Three discussions were held in three communities/villages, one in every district (Arusha, Njombe and Kongwa) all held in November 2011. The groups ranged from a manageable group size of ten to fifteen individuals. Conscious efforts were made to include all categories of respondents such as male and female, different age groups and maize traders in the group. This exercise was done in order to obtain information that was reasonably representative of the farmer population. Because household heads are mainly male in the study areas, each of the groups included about 70% male participants.

The participants involved were agriculture extension staff recruited by Ministry of Agriculture, Food security and cooperatives in Tanzania who have been working with farmers on regular basis in the communities/villages. The extension staff also acted as interpreter at the group discussion while the researcher acted as a moderator. The focus group sessions started with introductions, after which, participants were all informed the aim of the meeting and the expected outcome. Participants were all encouraged to freely contribute to the discussion. Using the semi-structured checklist developed earlier to help the researcher to restrict the discussions as much as possible to relevant topic, farmers' knowledge and awareness about the agriculture services valued was sought. The session began with discussion on road infrastructure quality in their communities, their causes and solutions (i.e. farmers' contribution to improvement awareness) followed by access to agriculture information were discussed. Important considerations in adoption of proposed ways of improvement technologies as far as farmers were concerned were sought for. The appropriate improvements ways were obtained based on consensus and agreed upon. Other information obtained from the groups included their perception on road

quality and access to agriculture information especially price, important constraints to agriculture service investments and benefits of improvements. The discussions lasted from 2- 2.5 hours. Information obtained from these sessions was used to make relevant adjustments to the survey questionnaire before individual pre- test interviews. A total of 35 participants were present at the three focus group discussions 10 in Dodoma, 10 in Iringa 15 in Arusha districts.

Two other meetings were held in January 2011 one with officers from MAFC and another one in MIT where director of crop production from MAFC and director of Marketing and Trade promotion were part of the meetings respectively. Each meeting included 10 participants and they were conducted in respective ministries. A checklist was employed by the researcher as a guide in the meetings to make sure all topics regarding road quality and access to agriculture information were pursued. All these meetings were led by the researcher.

4.6.3 Questionnaire pre-test and pilot survey

The questionnaire was pre-tested on volunteering farmers in one community from each district visited in February 2010 after group discussion. In all fifteen individual interviews were conducted. Survey assistants were used to assist the researcher in order to save time. Before the pre-test the researcher discussed the questionnaire with the assistants in a day earlier, explaining the questionnaire to them and how the questions were to be explained and asked, with particular emphasis on road quality and access to agriculture information for respondents to understand clearly. During the interview the researcher asked the question and the assistants assisted the researcher to record farmer's response. The road quality improvement took time most, an average of an hour and a half to complete the interview. The duration of time depended on how farmers understood the questions. It was realized that explaining the attributes of good quality road with pictures helped the farmers to understand. The information gathered from the pre-test and the problems encountered were used to further modify and structure the questionnaire for a pilot survey.

In March 2010, the survey questionnaire was piloted in Arusha district. This survey was undertaken to mimic the final survey procedures upon which final modification to the questionnaire may be necessary before the actual survey. A total of 18 respondents were involved six from each communities participated in the pilot study. Because the questionnaire had been pre tested earlier the information obtained was used to make final modification to the instrument and make it ready for final face to face or one – to – one interview.

4.6.4 CV survey individual one-to-one interview

The data collection process was individual one – to– one interview using the standardised structured questionnaire designed. The interview was conducted by the researcher together with enumerators who were trained by the researcher. It was expected that problems associated with CV studies in developing countries such as poor administration and execution of the surveys particularly where individual cannot read and write. The hypothetical scenario and questions were interpreted to them to make the respondents conceptualise the scenario correctly. Also communication tools such as drawings and pictures were used to minimize the effect of this problem. The survey made it clear to the respondent that the hypothetical scenarios are just hypothetical and constantly maintain it throughout the interviews.

4.7 Analytical Methods

4.7.1 Maize Price data

The maize price data obtained from MITM was used in this analysis from four regions namely Iringa, Arusha and Dodoma as dependant variables of maize prices in Dar es Salaam. The Dar es Salaam prices were treated as proxies to international maize prices and were used as independent variable in the regression analysis.
The basic analyses which were carried out to explore the time series properties of the data include:-

Pair-wise plots for the three regions in relation to Dar es Salaam. Since Dar es Salaam in this study was indicated as main market maize in Tanzania, the plots to compare prices movements and fluctuations from Iringa, Arusha, and Dodoma in relation to Dar es Salaam were plotted.

4.7.2 Unit root test

This was used to test if the data series are stationary or non-stationary; this was the first step in analysis after the Least Square estimator (LS) which determine the dynamic properties of the price data series. This step provided an understanding of the price pairs if they were integrated in the same order. Furthermore the unit root test help to avoid spurious regressions in the analysis caused by one to one relationship between the number of stationary variable and number of cointegration relationships. The test results also indicate whether variables contain unit root or not to avoid false results (Hill, Griffiths et al. 2001 : 343-345; Harris and Sollis 2003 : 42-77; Rashid 2004).

The study used the augmented Dickey-Fuller approach for unit root test, order of integration and optimum lag length determination will be based on the Akaike Information Criterion (AIC) (Harris and Sollis 2003 : 42-77; Conforti 2004; Rashid 2004).

4.7.3 Cointegration Analysis

This was used to analyse the time series property of the variables. This analysis was used to find out if the price series can be linked to form an equilibrium relationship spanning the long run. The cointegration concept mimics the existence of a long run equilibrium to which the economic system converges over time (Engle 1987; Granger 1988; Harris and Sollis 2003 : 42-77).

This study used both Engle –Granger Approach and Johansen's cointegration test approach.

4.7.4 Engle –Granger Approach

This involved testing each series individually for their order of integration. The first step involved the use augmented Dickey-Fuller test to test for the presence of a unit-root for whether the price series are stationary or not. If the individual time series are integrated of different orders then it was concluded with certainty that they are not cointegrated (Harris 1995 : 78-79). It was believed that the cointegrating relationship only exist if variables are integrated in the same order. The second step involved estimation of the long-run equilibrium relationship between the time series. If (y_t) and (z_t) are both *I*(1) processes then the long-run relationship takes the form:-

$$y_t = \beta_0 + \beta_1 Z_t + e_t$$

If the variables are in fact cointegrated then OLS regression yields “super consistent” estimates of the cointegrating parameters β_0 and β_1.The augmented Dickey-Fuller test will be used to determine the stationarity property of the residual series (e_t).

Where cointegration exists either unidirectional or bidirectional Granger Causality must exist in at least the *I* (0) variables. The Granger causality test will be carried with an appropriate error correction term derived from the long run cointegration relationship. The inferences derived from this test will be taken on *I*(0) variables (Heytens 1986; Harris 1995 : 77-80).

4.7.5 Johansen's cointegration tests

Johansen's approach is another technique used to estimate time series models. This technique helps to avoid spurious regressions resulting from the presence of non-stationary variable in the cointegration test. The Johansen procedure followed the Engle –Granger (EG) procedure. It is the commonly used procedure as it helps the user to avoid problems associated with EG such as:

i. Testing the order of integration of each variable that enter the multivariate model

ii. Setting the appropriate lag length of the Vector autoregressive (VAR) model in order to ensure Gaussian error terms in Vector error –correction (VECM) and determining whether the system should be conditioned on any predetermined *I*(0) variable including dummies

iii. Testing for reduced rank including *I* (2) rather than *I* (1) system

iv. Trend identification in data, testing for weak exogeneity, testing for linear hypothesis in cointegration and unique cointegration vectors (Heytens 1986; Charemaza and Deadman1992 : 92- 99; Harris 1995 : 77-80; Harris and Sollis 2003 :110-114).

The Johansen procedure is a maximum likelihood estimator for multivariate autoregressive models that avoids the use of a two-step estimator. In doing so it escapes the drawbacks faced by Engle and Granger. Instead, the Johansen (1988) procedure relies heavily on the relationship between the rank of a matrix and its root characteristics. It is also known as multivariate generalisation of the Dickey-Fuller test.

Johansen's procedure took its starting point in the vector auto regression (VAR) of order *p* given by:

$$y_t = A_1 y_{t-1} + \cdots + A_p y_{t-p} + \mu \quad \text{where} \quad \mu \sim IN(0,\sigma^2) \qquad (1)$$

$\boldsymbol{y_t}$ is an *n*x1 and each A_1 is an (*n x n*) vector of variables that will be integrated of order one which are commonly denoted by *I*(1) and μ is an *n*x1 which is the influence of other variables excluded from the model. The system will be a reduced form with each variable y_t regressed on only lagged value of both itself and all other variable in the system (Harris 1995).

The VAR in (1) will be reformulated into Vector error- correction (VECM) form as

$$\Delta y = \Gamma_1 \Delta y_{t-1} + \cdots \Gamma_{p-1} \Delta y_{t-j} + \Pi y_{t-1} + \mu \qquad (2)$$

$$\Delta y = \mu + \Pi y_{t-1} + \sum_{i-1}^{p} \Gamma_t \Delta y_{t-i}$$

Where

$$\Pi = \sum_{t-i}^{p} \mathrm{A}_i - I$$

and

$$\Gamma_i = - \sum_{j=i+1}^{p} \mathrm{A}_j$$

$\boldsymbol{\Gamma_i} = -(\mathbf{I} - \mathbf{A}_1 - \ldots - \mathbf{A}_i)$, ($i$=1,..., j-1), and $\boldsymbol{\Pi} = -(\mathbf{I} - \mathbf{A}_1 - \ldots - \mathbf{A}_k)$. In which the information on both the short run and long run adjustment to change in $\mathbf{y}_t$ will be contained in the system through the estimates of $\boldsymbol{\Gamma_i}$ and $\boldsymbol{\Pi}$ respectively.

The coefficient matrix $\boldsymbol{\Pi}$ will have reduced rank $r<n$, and existence of n x r matrices of $\boldsymbol{\alpha}$ and $\boldsymbol{\beta}$ each with rank r such that $\boldsymbol{\Pi} = \boldsymbol{\alpha\beta'}$ and $\boldsymbol{\beta' y}$ is stationary, r will be the number of cointegrating relationships, the elements of $\boldsymbol{\alpha}$ are the adjustment parameters in the vector error correction model and each column of $\boldsymbol{\beta}$ will be a cointegrating vector. This will be shown as for a given r, the maximum likelihood estimator of $\boldsymbol{\beta}$ defines the combination of $\mathbf{y}_{t-1}$ that yields the r largest canonical correlations of $\Delta\mathbf{y}_t$ with $\mathbf{y}_{t-1}$ after correction of lagged differences and deterministic variables when present. The two proposed likelihood ratio tests in Johansen approach was the significance of canonical correlations and the reduced rank of the $\boldsymbol{\Pi}$ matrix (Harris 1995 : 77-80; Harris and Sollis 2003). The trace test and maximum Eigen value test will be estimated as shown in equations below:

$$I_{trace} = -T \sum_{i=r+1}^{n} \ln(1 - \hat{\lambda}_i$$

$$I_{max} = -T ln(\hat{\lambda}_{r-1})$$

Where T was the sample size and $\hat{\lambda}$ the ith largest canonical correlation. The trace test for the null hypothesis of r cointegrating vectors against the alternative hypothesis of n cointegrating vectors. The maximum Eigen value test, on the other hand tests the null hypothesis of r cointegrating vectors against the alternative hypothesis of r +1 cointegrating vectors. Neither of these test statistics follows a chi square distribution in general; asymptotic critical values was found in Johansen and

Juselius (1990). The critical values used for the maximum Eigen value and trace test statistics were based on a pure unit-root assumption.

The assumption of pure unit root makes the approach very flexible and it is of disadvantage as it makes the method not robust to near integrated variables since they may fall into neither of these two classifications (Johansen 1990).

4.7.6 Model Specification and estimation techniques

The initial form of the test involves estimation of the simple first order autoregressive model AR (1) by means of Ordinary Least Square (OLS).

$$\chi_t = \beta\chi_{t-1} + \varepsilon_t \qquad (1)$$

Where the value of the variable in a given period (χ_t) equals to its value in the previous period (χ_{t-1}) plus a disturbance ε_t. Equation 1 is modified to equation 2 obtained after (χ_{t-1}) is subtracted from both sides:

$\Delta\chi_t = \lambda\chi_{t-1} + \varepsilon_t$, where $\lambda = \beta - 1$ (2)

The null and alternative hypothesis took the following forms.

H_0: $\beta = 1$ or $\lambda = 0$

H0: $|\beta| < 1$ or $|\lambda| < 0$

The value of coefficient (β) or (λ) determined the nature of the series. When (β) equals one or $\lambda = 0$ the series contain a unit root. If it is less than one or $\lambda < 0$ then the series is stationary.

Testing for unit root by means of equation 1 and 2 imply the assumptions that both mean and first observation equals to zero and no trend in the underlying data generating process (dgp) (Harris 1995 : 27-34; Harris and Sollis 2003 :41-45). This was highly rigid approach and contrary to the common rule that regression model used for testing should contain more deterministic components than the hypothesised dgp. The model was extended so that it could covers both hypotheses; the equation 2 included an intercept (α) and the time trend (T) (Harris and Sollis 2003 : 41-45):

$\Delta\chi_t = \alpha + \gamma T + \lambda\chi_{t-1} + \varepsilon_t$ (3)

On the basis of the properties, the unit root test was applied to the residual of the regression between each pair of prices to test for cointegration. Where cointegration

arises the set of Auto Regressive Distributed lag (ARDL) model was estimated as follows:

$$\Delta \chi_{mt} = \alpha_0 + \lambda T + \sum_{i=1}^{I} \alpha_i \chi_{mt-i} + \sum_{j=0}^{J} \alpha_j \chi_{0t-j} + \varepsilon_t \qquad (4)$$

Where $\Delta\chi_{mt}$ are the maize prices for the other three regions in time *T*, χ_0 is the maize price for Dar es Salaam which proxies the international price, α_0 is an intercept, T is a time trend and ε is the error term and *t* is the period index.

This estimation identify the correct number of lag to be included in regression as over and under parameterization create problem of misspecification and unnecessary reduction in the degree of freedom. The relevant *i* and *j* was chosen through minimization of Akaike information criterion.

The t-test for null hypothesis of non stationarity was based on non DF distribution (Harris and Sollis, 2003: 15).

4.7.7 WTP estimation and Model specification

The CV responses are statistically discrete dependent variables as they measured in nominal or ordinal scale with assumed finite number of values which are indexed by *j* = 1,…,*M*. For the *i*th observed response, the probability that it takes a particular value can be expressed as some function such as:

$$\Pr(\text{response}_{i} = j) = H_j(Ai; z_i; \gamma) \quad (1)$$

where A_i is value/bid on the occasion, z_i representing covariates describing the item being valued and γ being a vector parameter to be estimated from the data. For the probabilities to be well defined the right hand side (RHS) in equation (1) above must return a value between zero and one and it must sum to unit over all possible outcomes *j*=1,… *M* according to Hanemann and Kanninen (1998). Hanemann and Kanninen (1998) also explained in binary response models where there are only two possible outcomes “yes” and “no” the equation (1) is reduced to

$$\Pr(\text{response is “yes”}) = H(A; z; \gamma)$$
$$\Pr(\text{response is “no”}) = 1 - H(A; z; \gamma)$$

The composition of two functions can be written as:

$$H(A; z; \gamma) \equiv 1 - F[T(A; z; \gamma)] \qquad (2)$$

This permits the statistical model to be casted in the form

Response = “yes” if T (A; z; γ) - $\eta \geq 0$ and Response = “no” otherwise, (3) where T is some function of A and Z and η is some random variable with cumulative distribution function (cdf) and γ represents both coefficients associated with T and parameters of cdf. This composition ensures the RHS of (1) returns a value within the range [0,1] (Hanemann and Kanninen 1998). This statistical perspective will be complemented with economic perspective so that the survey responses to become economically meaningful in the sense that they constitute a utility maximizing to the survey question. To satisfy both the economic model of utility maximization can be formulated as follows;

With an individual consumer with utility function defined over both market commodities denoted by ***x*** and some non-market item which is to be valued noted by ***q*** and ***s*** other attributes that make the individual to shift her preferences for ***x*** and ***q*.** The direct utility function will depend on the price of the market good ***p*** and individual income ***y*** and her characteristics ***s*** and non-market good ***q***. With an assumption that the individual knows her preferences with certain and does not consider them stochastic, they contain some components which are unobservable and can be treated as random (Hanemann 1984b). The unobservable can be characteristics of the individual or attributes of the item and they can stand for both variation in preferences among members of the population and measurement error denoted by ε and it is unspecified whether is scalar or vector and the indirect utility function is ***v*** (***p***, ***q***, ***y***, ***s***, ε).

The focus of the valuation will be of a single program using the single bounded approach that the individual is confronted with the possibility of securing a change from $\boldsymbol{q^0}$ to $\boldsymbol{q^1} > \boldsymbol{q^0}$. This is regarded as an improvement so that ***v*** (***p***, $\boldsymbol{q^1}$, ***y***, ***s***, ε) $\geq$ ***v*** (***p***, $\boldsymbol{q^0}$, ***y***, ***s***, ε). And this will cost the individual ***A*** and is then asked whether she would be willing to pay that price (Hanemann and Kanninen 1998).

With the logic of utility maximization this individual answers “yes” if ***v*** (***p***, $\boldsymbol{q^1}$, ***y-A***, ***s***, ε) $\geq$ ***v*** (***p***, $\boldsymbol{q^0}$, ***y***, ***s***, ε) and no otherwise. Hence

Pr (response is “yes”) = Pr [***v*** (***p***, $\boldsymbol{q^1}$, ***y-A***, ***s***, ε) $\geq$ ***v*** (***p***, $\boldsymbol{q^0}$, ***y***, ***s***, ε)]. (4)

This outcome can be expressed by using compensating variation measure denoted by ***C*** as

v (***p***, $\boldsymbol{q^1}$, ***y-C***, ***s***, ε) = ***v*** (***p***, $\boldsymbol{q^0}$, ***y***, ***s***, ε) (5)

Thus, C = ***C*** (***p***, $\boldsymbol{q^0}$,$\boldsymbol{q^1}$, ***y***, ***s***, ε) is the maximum WTP for the change from $\boldsymbol{q^0}$ to $\boldsymbol{q^1}$. It follows that the response is “yes” and if the stated price is less than this WTP, and “no” otherwise (Hanemann and Kanninen 1998)

CHAPTER 5: DESCRIPTIVE RESULTS

5.1 Introduction

This chapter represents the initial results obtained from the study. It begins with description of the data used, the sample used in CV survey, definitions of the explanatory variables used in the model to analyse the time series data and the determinants of WTP. The detailed results of time series analysis and WTP will be presented and discussed in details later in this chapter when the analysis and estimations are completed.

5.2 The maize price data for time series analysis

The monthly maize price data obtained from Ministry of Industry and Trade Tanzania has been used in this study and it is the same data set when obtained from FAOSTAT. Maize has been selected as it is the main staple food and source of income in the selected regions. The data set contained wholesale maize price in US dollars (US$) per 100kg from four region in Tanzania covering period of January 1998 to December 2011. The data descriptive statistics are presented in US dollars (US$ per 100Kg and the results are as follows; mean of 20.81 for Dar es Salaam; 19.14 Arusha; 19.33 Dodoma and 16.77 for Iringa. The Standard Deviations are 6.66, 6.77, 7.93 and 5.84 for Dar es Salaam, Dodoma, Arusha and Iringa respectively and details are as shown in *Table 1* below:

Table 1: Data statistics

Statistical Descriptive	D'salaam (US$/100kg)	Arusha (US$/100kg)	Dodoma (US$/100kg)	Iringa (US$/100kg)
Mean	20.81	19.14	19.33	16.77
Standard Error	0.51	0.52	0.61	0.45
Median	18.96	16.89	15.88	15.76
Minimum	10.31	8.13	7.96	7.79
Maximum	36.07	33.26	41.19	31.27
Standard Deviation	6.66	6.77	7.93	5.84
Sample Variance	44.41	45.86	62.89	34.06
Kurtosis	-1.01	-1.03	-0.90	-0.87
Skewness	0.43	0.41	0.55	0.51
Range	25.76	25.13	33.23	23.48
Sum	3496.06	3215.82	3247.59	2816.98
Observations	168	168	168	168
Confidence Level (95.0%)	1.02	1.03	1.21	0.89

5.2.1 Correlation

The analysis of price relation between Dar es Salaam and other markets was undertaken and Dar es Salaam being considered as a larger consumption market and other markets being main source of supplies to Dar es Salaam.

The correlation results matrix for the four markets are as presented in Table 2 below and it shows that all the four markets have strong price correlation meaning that there is strong relationship in the price series.

Table 2: Correlation matrix

	Arusha	**Dodoma**	**D'salaam**	**Iringa**
Arusha	1			
Dodoma	0.95	1		
D'salaam	0.91	0.90	1	
Iringa	0.85	0.89	0.90	1

5.2.2 Pair wise plots

To explore the time series properties of the data pair wise plot for each of the markets of Dodoma, Arusha and Iringa with Dar es Salaam has been plotted and Dar es Salaam is taken as the dominant consumer market. The plots were mainly to check the time series properties and price relationships between Dar es Salaam and the three markets (Dodoma, Arusha and Iringa) and a plot of all the four markets together. The results of the plots are shown in figure 1, 2, 3, and 4.

The plot shows some short run fluctuations in prices and the three markets of Arusha, Iringa and Dodoma have common trend with Dar es Salaam. The Dar es Salaam market price seems to be high in comparison with Iringa and Arusha except for Dodoma in a period covering 2004 to 2010 where prices in Dodoma seem to be higher than Dar es Salaam. The launch of Kibaigwa International maize Market in Dodoma region 2000 contributed to increased maize production in terms of area and yield from 59.15 hectares in 2000/2001 to 180.1 hectares in 2001/2002 and 94,640 tonnes in 2000/2001 to 307,800 tonnes in 2001/2002 respectively. The market created opportunity to traders in the region and other regions including Dar es Salaam which resulted to increased competition in market players (MAFC 2006)
The plots indicate clearly that the markets exhibit co-movements in prices between them.

Figure 1: Plot of Dar es Salaam and Dodoma

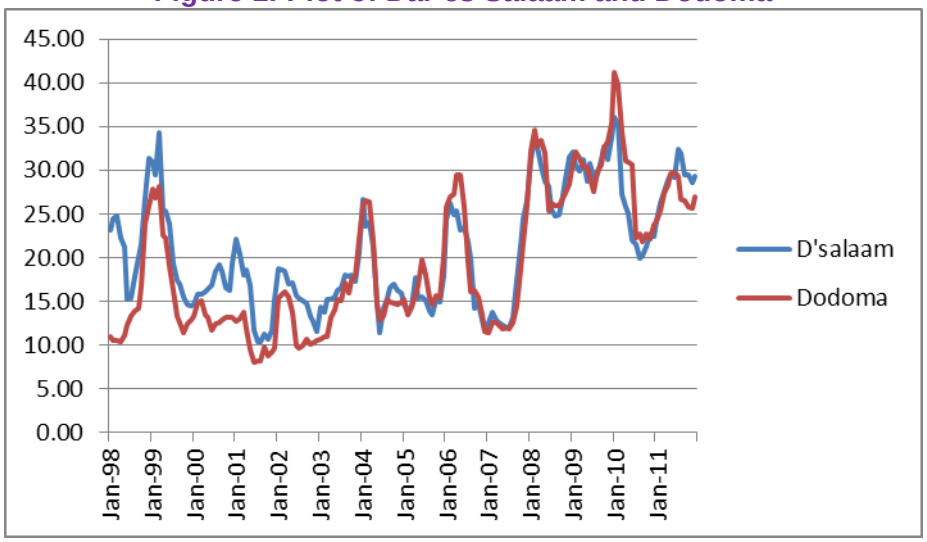


Figure 2: Plot of Dar es Salaam and Arusha

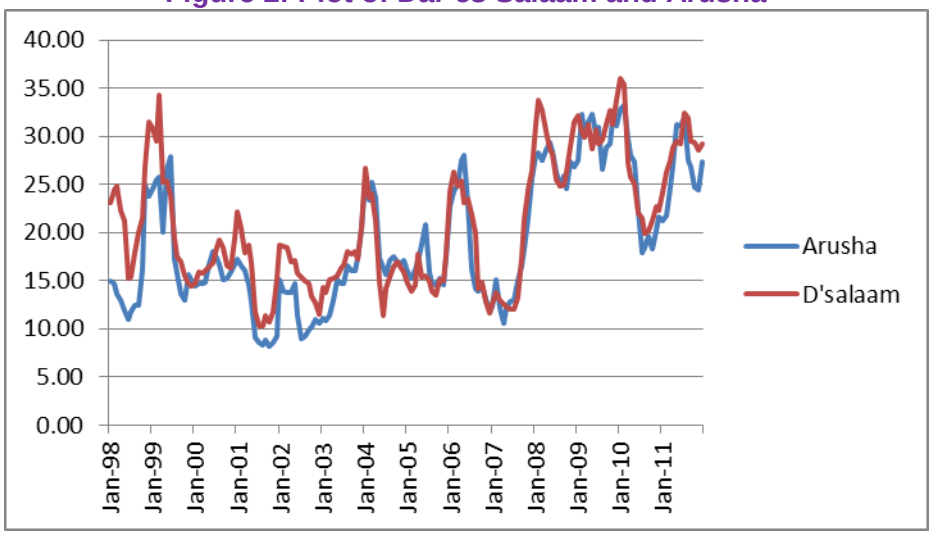


Figure 3: Plot of Dar es Salaam and Iringa

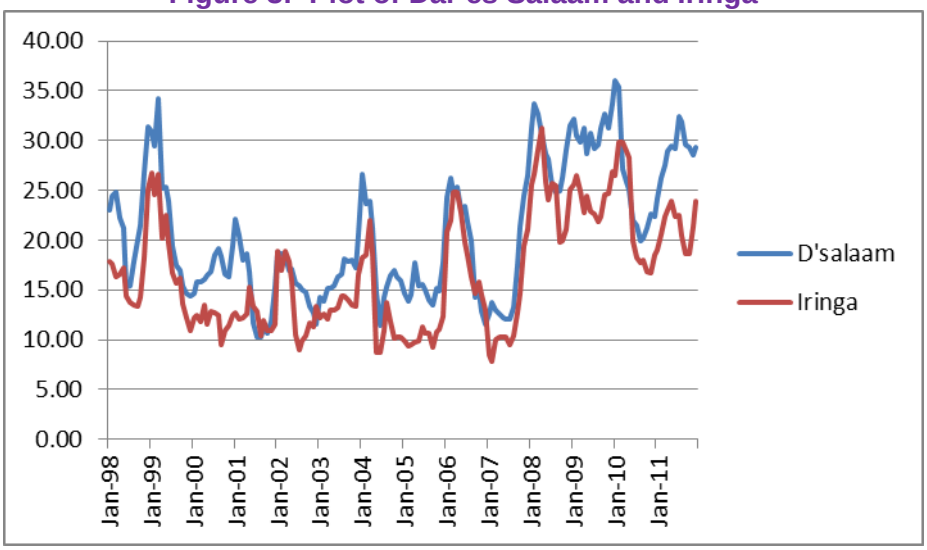
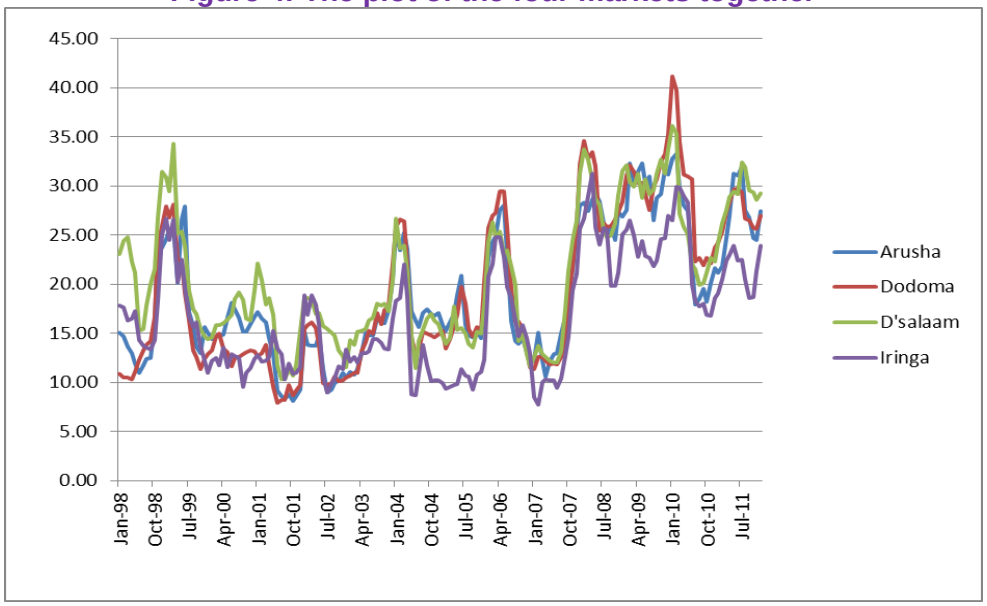


Figure 4: The plot of the four markets together



5.3 The unit root test results

The price data series were subjected to Least square estimator in simple regression model to find out if the series results are spurious or not. The results indicated that the series are non- stationary and the goodness of fit (R-squared) is greater than the Durbin-Watson statistic clearly and give a conclusion that they are spurious. The results are as shown in Table 2 below.

Table: 3 Summary of Least Square estimator results

	The Least Square Estimator Price series		
	DSM & ARUSHA	**DSM &IRINGA**	**DSM &DODOMA**
Variable	**C** **ARUSHA**	**C** **IRINGA**	**C** **DODOMA**
Coefficient	(3.742614) (0.891626)	(3.592841) (1.026799)	(6.224103) (0.754533)
Std. Error	(0.656236) (0.032331)	(0.688367) (0.038784)	(0.599810) (0.028719)
t-statistic	(5.70315) (27.57827)	(5.219365) (26.47458)	(10.3768) (26.27282)
Probabilities	(0.0000) (0.0000)	(0.0000) (0.0000)	(0.0000) (0.0000)
R-squared	0.820843	0.808514	0.806134
Durbin -Watson statistics	0.554935	0.584669	0.390874

The Least Square estimate provides us reasonable reasons to undertake stationarity tests for the series such as unit root tests.

5.3.1 The unit root tests and level integration selection

The variables (the four regional markets Iringa, Arusha, Dodoma and Dar es Salaam) were subjected to unit root test to test whether the series are stationary or non-stationary following the Least Square estimation results. The test helps to avoid series behaviour and properties that can influence the final results. It also helps to determine the level of integration which means the order at which the series need to be differenced to attain stationarity (Harris 1995). The unit root test also helps to avoid spurious regression when two variables are trending over time and regression models with non stationary variable will not follow the standard assumption for asymptotic analysis therefore the *t*-ratios will not follow *t*-distribution, so we cannot validly undertake hypothesis tests about the regression parameters.

5.3.2 The unit root test results

The unit root test results indicate that all regions are first order difference *I* (1) as indicated in the test results for both raw data and differenced data. The Augmented Dickey Fuller t- statistics (*tau)* results are -3. 344848 for Dar es Salaam, -2.658060 for Arusha, -3.26915 for Iringa and -2.204995 for Dodoma for undifferenced data and -7.001886, - 6.599978, -10.77306 and -6.714962 respective values for differenced data which are significantly more negative more than the critical values at 1% for all regions. These results for both series allow us to reject the null hypothesis of unit root for both undifferenced and the differenced data when only intercept (constant) is used.

When both trend and intercept is used the unit root test results indicate that all regions are first order difference *I* (1) as indicated in the test results for both raw data and differenced data.

The Augmented Dickey Fuller t- statistics (*tau)* results are -4.103446 for Dar es Salaam, -4.007818 for Arusha, -3.940224 for Iringa and -3.335446 for Dodoma for undifferenced data and -6.967037, -6.57947, -10.75280 and -6.69268 respective values for differenced data which are significantly more negative more than the critical values at 1% for all regions. These results for both series allow us to reject the null hypothesis of unit root for both undifferenced and the differenced data.

5.3.3 Lag length selection

The automatic Akaike information Criterion (AIC) at maximum lag length of 12 shows lag length of 3 Dar es Salaam, 1 Arusha, 2 Iringa and 5 for Dodoma for undifferenced data and for differenced data lag length of 4 Dar es Salaam, 4 Arusha, 0 Iringa and 4 for Dodoma results are based on when only intercept is used. When

both intercept and trend are used lag length are 3 Dar es Salaam, 3 Arusha, 2 Iringa and 5 for Dodoma for undifferenced data and for differenced data lag length of 4 Dar es Salaam, 4 Arusha, 1Iringa and 4 for Dodoma. Detailed results are as shown in Table 4 and 5 below:

Table 4: Unit root results summary the raw data

	Price series			
	Dar es Salaam (DSM)	**Arusha (AR01)**	**Iringa (IR)**	**Dodoma(DM)**
A when only intercept is used				
Null Hypothesis	Has unit root	Has unit root	Has unit root	Has unit root
Exogenous	constant	constant	constant	constant
Lag length	3	1	2	5
Augmented Dickey-Fuller test statistic	(-3.344848) 0.0145*	(-2.658060) 0.0836*	(-3.26915) 0.0179*	(-2.204995) 0.2054*
Test critical values:				
1% level	(-3.470427) NR	(-3.469933) NR	(-3.470179) NR	(-3.470934) NR
5% level	(-2.879045) R	(-2.878829) R	(-2.878937) R	(-2.879267) R
10% level	(-2.576182) R	(-2.576067) R	(-2.576124) R	(-2.576301) R
R-squared	0.127942	0.068319	0.090000	0.247691
B: When both trend and intercept are used				
Null Hypothesis	has a unit root	has a unit root	has a unit root	has a unit root
Exogenous	Constant, Linear Trend	Constant, Linear Trend	Constant, Linear Trend	Constant, Linear Trend
Lag length	3	3	2	5
Augmented Dickey-Fuller test statistic	(-4.10346) 0.0076*	(-4.007818) 0.0102*	(-3.940224) 0.0125*	(-3.335446) 0.0643*
Test critical values:				
1% level	(-4.014986) NR	(-4.014986) NR	(-4.014635) NR	(-4.015700) NR
5% level	(-3.437458) R	(-3.437458) R	(-3.437289) R	(-3.437801) R
10% level	(-3.142936) R	(-3.142936) R	(-3.142837) R	(-3.143138) R
R- squared	0.157219	0.129722	0.116015	0.276423

The test statistic is based on Augmented Dickey Fuller test

The lag length is Automatic based on Akaike Information Criterion (AIC)

Values in parentheses represent the t-statistic critical values

*Indicate the probabilities based on MacKinnon (1996) one –sided p-values.

NR - Null Hypothesis for unit root not rejected

R - Null hypothesis for unit root being rejected

Table 5: Unit root results summary the raw data for the differenced data

	Price series			
	Dar es Salaam (DSM)	**Arusha (AR01)**	**Iringa (IR)**	**Dodoma (DM)**
A when only intercept is used				
Null Hypothesis	Has unit root	Has unit root	Has unit root	Has unit root
Exogenous	constant	constant	constant	constant
Lag length	4	4	0	4
Augmented Dickey-Fuller test statistic	(-7.001886) 0.0000*	(-6.599978) 0.0000*	(-10.77306) 0.0000*	(-6.714962) 0.0000*
Test critical values:				
1% level	(-3.470934) NR	(-3.470934) NR	(-3.469933) NR	(-3.470934) NR
5% level	(-2.879267) NR	(-2.879267) NR	(-2.878829) NR	(-2.879267) NR
10% level	(-2.576301) NR	(-2.576301) NR	(-2.576067) NR	(-2.576301) NR
R-square	0.436668	0.446140	0.414409	0.348075
B: When both trend and intercept are used				
Null Hypothesis	has a unit root	has a unit root	has a unit root	has a unit root
Exogenous	Constant, Linear Trend	Constant, Linear Trend	Constant, Linear Trend	Constant, Linear Trend
Lag length	4	4	1	4
Augmented Dickey-Fuller test statistic	(-6.967037) 0.0000*	(-6.57947) 0.0000*	(-10.75280) 0.0000*	(-6.69268) 0.0000*
Test critical values:				
1% level	(-4.015700) NR	(-4.015700) NR	(-4.014288) NR	(-4.015700) NR
5% level	(-3.437801) NR	(-3.437801) NR	(-3.437122) NR	(-3.437801) NR
10% level	(-3.143138) NR	(-3.143138) NR	(-3.142739) NR	(-3.143138) NR
R-square	0.436849	0.446175	0.415015	0.348124

The test statistic is based on Augmented Dickey Fuller test
The lag length is Automatic based on Akaike Information Criterion (AIC)
Values in parentheses represent the t-statistic critical values
*Indicate the probabilities based on MacKinnon (1996) one –sided p-values.
NR - Null Hypothesis for unit root not rejected
R - Null hypothesis for unit root being rejected

5.3.4 The cointegration test

The cointegration tests performed following the Engle and Granger tests procedure. The test results indicate lag length of 0 for Dar es Salaam and Arusha series, 1for Dar es Salaam and Iringa series and 0 for Dar es Salaam and Arusha series when constant was used and both constant and trend. The lag lengths were selected based on automatic Akaike information Criterion.

5.3.5 Engle and Granger test results

i. Dar es salaam and Arusha

The Augmented Dickey Fuller test for the residuals (e) for Dar es Salaam and Arusha series is -5.438364 when only constant was used and -5. 444801 when both constant and trend are used. The values negatively greater than the critical values of -3.469691 and -4.013946 respectively at 1% allowing us to reject null hypothesis of unit root in (e) providing evidence that the two series are cointegrated.

ii. Dar es Salaam and Iringa

The Augmented Dickey Fuller test for the residuals (e) for Dar es Salaam and Iringa series is -5.671874 when only constant was used and -5. 737185 when both constant and trend are used. The values negatively greater than the critical values of -3.469933 and -4.014288 respectively at 1% allowing us to reject null hypothesis of unit root in (e) providing evidence that the two series are cointegrated.

iii. Dar es Salaam and Dodoma

The Augmented Dickey Fuller test for the residuals (e) for Dar es Salaam and Dodoma series is -4.811737 when only constant was used and -4. 770886 when both constant and trend are used. The values negatively greater than the critical values of -3.469691 and -4.013946 respectively at 1% allowing us to reject null hypothesis of unit root in (e) providing evidence that the two series are cointegrated. The detailed results are as shown in table 6 below;

Table 6: Summary of Engle and Granger Test results

	Price series		
	DSM & ARUSHA	**DSM &IRINGA**	**DSM &DODOMA**
A: When only constant is used			
Null Hypothesis	e has unit root	e has unit root	e has unit root
Exogenous	constant	constant	constant
Lag length	0	1	0
Augmented Dickey-Fuller test statistic	(-5.438364) 0.000*	(-5.671874) 0.0000*	(-4.811737) 0.001*

Price series			
	DSM & ARUSHA	**DSM &IRINGA**	**DSM &DODOMA**
Test critical values:			
1% level	(-3.469691) R	(-3.469933) R	(-3.469691) R
5% level	(-2.878723) R	(-2.878829) R	(-2.878723) R
10% level	(-2.576010) R	(-2.576067) R	(-2.576010) R
R-squared	0.152001	0.165447	0.123053
B: When trend and intercept is used			
Null Hypothesis	e has unit root	e has unit root	e has unit root
Exogenous	Constant, Linear Trend	Constant, Linear Trend	Constant, Linear Trend
Lag length	0	1	0
Augmented Dickey-Fuller test statistic	(-5.444801) 0.0001*	(-5.737185) 0.0000*	(-4.770886) 0.0008*
Test critical values:			
1% level	(-4.013946) R	(-4.014288) R	(-4.013946) R
5% level	(-3.436957) R	(-3.437122) R	(-3.436957) R
10% level	(-3.142642) R	(-3.142739) R	(-3.142642) R
R-square	0.125516	0.16977	0.154125

e-stands for Residuals
The test statistic is based on Augmented Dickey Fuller test
The lag length is Automatic based on Akaike Information Criterion (AIC)
Values in parentheses represent the t-statistic critical values
*Indicate the probabilities based on MacKinnon (1996) one –sided p-values.
NR - Null Hypothesis for unit root not rejected
R - Null hypothesis for unit root being rejected

5.3.6 The Johansen cointegration tests

The test involved trend assumption of linear deterministic trend and linear deterministic trend restricted and the lag interval 1 to 4. The test results for trace indicates 4 cointegration equations while the Maximum Eigenvalue statistic indicates 1 cointegration equation relationships. The Log likelihood is -1235.855, -1226.876 and -1221.591 for cointegration equation 1, 2, and 3 respectively. The probability values are for both trace and Eigenvalue are less than the critical values at 5% which indicates rejection of the null hypothesis for cointegration and give us confidence to conclude that price series have long run relationship which means they are cointegrated. Detailed results are as shown in table 7 below

Table 7: Summary of Johansein cointegration test results

Price series	**(DSM, ARUSHA, IRINGA AND DODOMA**				
Observation 163 after adjustment, trend assumption linear deterministic trend lag interval (in first difference) 1to 4					
Unrestricted Cointegration Rank test (Trace)	Hypothesized No of CE(s)	Eigenvalue	Trace statistics	0.05 Critical Value	Prob**
	None *	0.199455	73.75426	47.85613	0.0000
	At most 1 *	0.104317	37.49280	29.79707	0.0054
	At most 2 *	0.062790	19.53527	15.49471	0.0116
	At most 3 *	0.053515	8.965111	3.841466	0.0028
Trace test indicate 4 cointegration equations at the 0.05 level					
Unrestricted Cointegration Rank test (Max Eigenvalue)	Hypothesized No of CE(s)	Eigenvalue	Max-Eigen statistics	0.05 Critical Value	Prob**
	None *	0.199455	36.26146	27.58434	0.0030
	At most 1	0.104317	17.95753	21.13162	0.1314
	At most 2	0.062790	10.57016	14.26460	0.1771
	At most 3 *	0.053515	8.965111	3.841466	0.0028
Maximum - eigenvalue test indicate 1 cointegration equation at the 0.05 level					

*Indicates rejection of the hypothesis at 0.05 level

**Indicates MacKinnon-Haug-Michelis (1999) probability values

5.3.6 The Granger Causality Test

(i) Based on the Probability values reported in the table 8 below, the hypothesis that Arusha does not Granger Cause Dar es Salaam cannot be rejected, but the hypothesis that Dar es Salaam does not Granger Cause Arusha can be rejected. Therefore, it appears that Granger causality runs one way, from Dar es Salaam to Arusha but not from Arusha to Dar es Salaam.

(ii) Based on the Probability values reported in the table 8 below, the hypothesis that Dodoma does not Granger Cause Dar es Salaam can be rejected, while the hypothesis that Dar es Salaam does not Granger cause Dodoma cannot be rejected. Therefore we can conclude that the Granger causality runs one way, from Dodoma *to* Dar es Salaam and not Dar es Salaam to Dodoma.

(iii) Based on the Probability values reported in the Table 8 below, the hypothesis that Iringa does not Granger Cause Dar es Salaam cannot be rejected, but the hypothesis that Dar es Salam does not Granger cause

Iringa can be rejected. Therefore, the Granger causality runs one way from Dar es Salaam to Iringa and not from Iringa to Dar es Salaam.

(iv) Based on the Probability values reported in the Table 8 below, the hypothesis that Dodoma does not Granger Cause Arusha can be rejected, but the hypothesis that Arusha does not Granger Cause Dodoma cannot be rejected. Therefore, the Granger causality runs one way from Dodoma to Arusha and not from Arusha to Dodoma.

(v) Based on the Probability values reported in the Table 8 below, the hypothesis that Iringa does not Granger Cause Arusha cannot be rejected, but the hypothesis that Arusha does not Granger Cause Iringa can be rejected. Therefore, the Granger causality runs one way from Arusha to Iringa and not from Iringa to Arusha.

(vi) Based on the Probability values reported in the table 8 below, the hypothesis that Iringa does not Granger Cause Dodoma cannot be rejected, but the hypothesis that Dodoma does not Granger Cause Iringa can be rejected. Therefore, the Granger causality runs one way from Dodoma to Iringa and not from Iringa to Dodoma.

Table: 8 Granger Causality Test results

Pairwise Granger Causality Tests **Lags: 1**			
Null Hypothesis:	**Observations**	**F-Statistic**	**Probabilities.**
ARUSHA does not Granger Cause DSM	167	1.96881	0.1625
DSM does not Granger Cause ARUSHA		7.55007	0.0067
DODOMA does not Granger Cause DSM	167	2.99679	0.0853
DSM does not Granger Cause DODOMA		2.58135	0.1101
IRINGA does not Granger Cause DSM	167	2.61039	0.1081
DSM does not Granger Cause IRINGA		31.5599	8.E-08
DODOMA does not Granger Cause ARUSHA	167	14.6663	0.0002
ARUSHA does not Granger Cause DODOMA		0.02886	0.8653
IRINGA does not Granger Cause ARUSHA	167	0.26619	0.6066
ARUSHA does not Granger Cause IRINGA		7.34964	0.0074
IRINGA does not Granger Cause DODOMA	167	1.95455	0.1640
DODOMA does not Granger Cause IRINGA		21.0745	9.E-06

5.4 The survey Data

5.4.1 The CV sample description

The sample contained total of 291 respondents selected from three districts of Arusha (103), Njombe (100) and Kongwa (88) from Tanzania mainland. Table 9 below show sample descriptive statistics from the survey conducted.

Table 9: Sample descriptive statistics

	N	Minimum	Maximum	Mean	Std. Deviation
District	291	1.00	3.00	1.9485	.80991
Gender	291	1.00	2.00	1.3952	.48973
Household members	291	1.00	22.00	5.8385	2.44202
Respondent level of education	291	1.00	6.00	2.7113	1.00645
Respondent age	291	18.00	80.00	41.6186	10.59158
Valid N (list wise)	291				

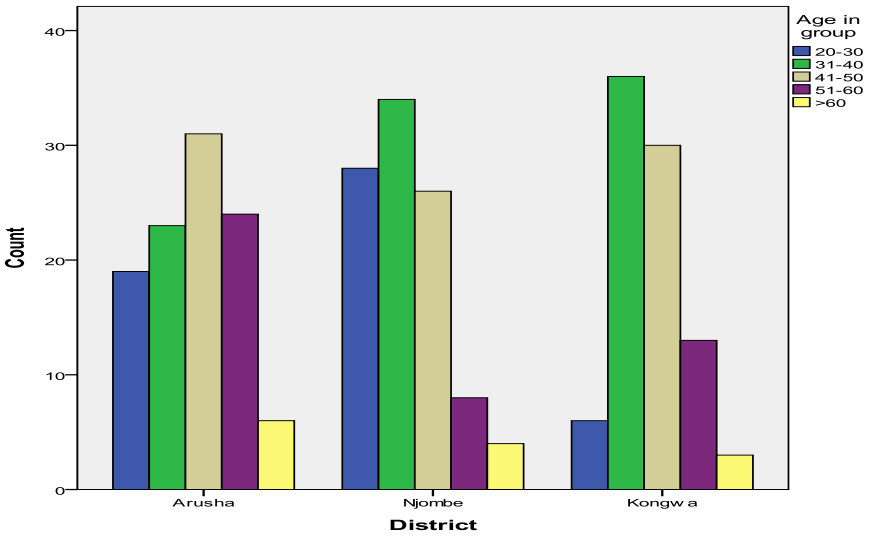
The table 10 represent descriptive statistics of selected socio-economic and demographic characteristics of respondents and institutional characteristics for the sample surveyed. Out of the total 291 respondents surveyed approximately 61% were male and 39% female. The dominance of male respondents in survey sample conforms to studies conducted in Tanzania such (Randal 1974; Brookshire, D. S et al 1982; Amanda Ellis et al 2007) that the proportion of male headed households in rural area is much higher than female headed households despite that female participate more in agriculture activities than male.

From the surveyed sample majority of respondent's age lied between 31-50 years. This is an indication that there both youth and elderly participate in agriculture. It has been noted that the household involved in the survey their age group was different from each district. In Arusha district both youth, middle age and elderly have almost equal proportion in their participation to agriculture activities compared to Njombe where more youth and middle age group being engaged to agriculture activities and in Kongwa middle age and elderly participate more in agriculture activities. The differences in age between the districts is either caused by other economic activities present in the area such as Kongwa where youth mainly involve themselves in trading activities, mining and pastoralist activities in Arusha whereas in Njombe forestry activities dominates.

Table 10: Farmers social economic characteristics

Sample characteristics	Districts			Total sample
	Arusha (%) (n= 103)	Njombe (%) (n= 100)	Kongwa (%) (n= 88)	Freq. (%) (n= 291)
Household composition				
Male Female	60 (58.25) 43 (41.25)	59 (59) 41 (41)	57 (64.77) 31 (35.23)	176 (60.48) 115 (39.52)
Marital status				
Not married Married Separated Widowed Divorced	7 (6.80) 90 (87.38) 2 (1.94) 3 (2.91) 1 (0.97)	10 (10.00) 88 (88.00) 0 1 (1.00) 1 (1.00)	9 (10.23) 69 (78.41) 8 (9.09) 2 (2.27) 0	26 (8.94) 247(84.88) 10 (3.44) 6 (2.06) 2 (0.69)
Household size (group in numbers)				
1 – 4 5 – 8 9 – 12 13 – 16 17 – 20 21 – 24	22 (21.36) 68 (66.02) 10 (9.71) 1 (0.97) 1 (0.97) 1 (0.97)	47 (47.00) 50 (50.00) 03 (03.00) 0 0 0	25 (28.41) 50 (56.82) 11 (12.50) 2 (2. 27) 0 0	94 (32.31) 168 (57.73) 24 (8.25) 3 (1.03) 1 (0.34) 1 (0.34)
Age group (years)				
20 –30 31 – 40 41 – 50 51 – 60 Over 60	19 (18.45) 23 (22.33) 31 (30.10) 24 (23.30) 6 (5.83)	28 (28.00) 34 (34.00) 26 (26.00) 8 (8.00) 4 (4.00)	6 (6.82) 36 (40.91) 30 (34.09) 13 (14.77) 3(3.41)	53 (18.21) 93 (31.96) 87 (29.90) 45 (15.46) 13 (4.47)
Level of education of respondent				
No formal education Primary Education Completed secondary School Not completed secondary education University/College Other (Adult education)	9 (8.74) 46 (44.66) 39 (37.87) 1 (0.97) 3 (2.91) 5 (4.850	1 (1) 44 (44) 29 (29) 16 (16) 6 (6) 4 (4)	0 43 (48.48) 40 (45.46) 3 (3.41) 2 (2.27) 0	10 (3.44) 133 (45.71) 108 (37.11) 20 (6.87) 11 (3.78) 9 (3.09)
Respondent employment status				
Government employee Private sector Self employed Unemployed	4 (3.88) 13 (12.62) 86 (83.50) 0	7 (7.00) 20 (20.00) 72 (72.00) 1 (1.00)	8 (9.09) 20 (22.73) 52 (59.09) 8 (9.09)	19 (6.53) 53 (18.21) 210 (72.17) 9 (3.09)
A place where respondent lives				
Rural Urban	89 (86.41) 14 (13.59)	62 (62.00) 38 (38.00)	74 (84.09) 14 (15.91)	225 (77.32) 66 (22.68)

Figure 5: Age distribution across districts surveyed

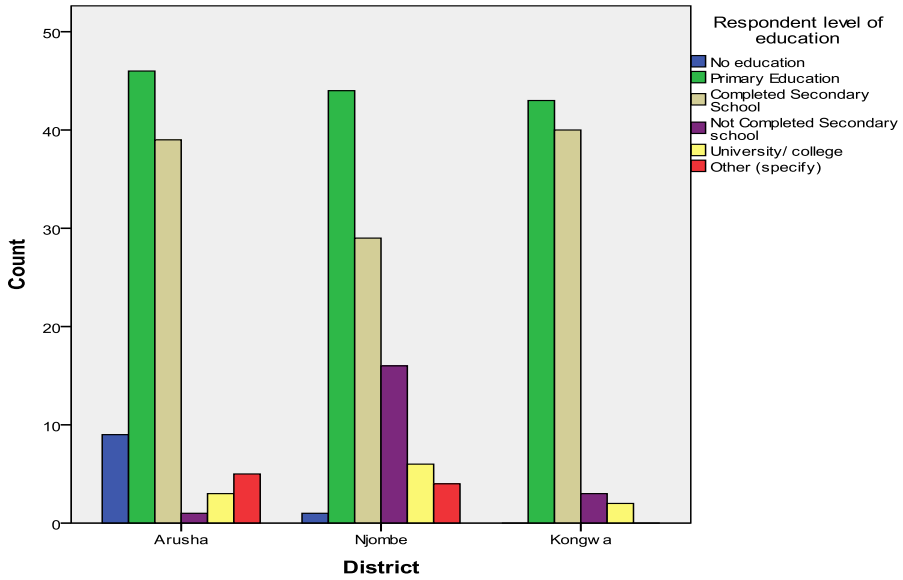


Age is an important factor to consider in the rural areas when planning for development activities especially when it involves new innovation such as modern technologies. The elderly group are less innovative than youth and this provides a good reason why some development innovation adoption in agriculture becomes very low in areas where more elderly people are involved compared to youth. Area where more youth are involved in development activities are more likely to be adopted as youth are more innovative and are much more willing to spend time and labour required in such activities (Mwaseba 2006). There are more youth involved in agriculture in Njombe than Arusha and Kongwa and this can be a good reason for the district being more productive. Generally in areas where activities such as mining, transportation, trading and forestry deviate youth from agriculture living the elderly group behind which are less productive and innovative. It has been noted that due to risks associated in agriculture, the poor quality of transportation system in rural areas, lack of reliable information regarding agricultural commodity marketing makes the youth to consider agriculture as a risk business to undertake.

Family size contributes to the family working force in the rural areas and it is the main source of labour in development activities such as agriculture. Majority of survey of respondent's had household members ranging 4-8 members which it's good indication of low labour force for agriculture activities especially in the rural farming areas where agriculture is substance and labour intensive seasonally. Lwechungura (2000) indicated that interaction between household size and proportion of labour force in rural area are closely associated with level of poverty in the families. Families with large number of households indicate that they have enough labour force and less poverty.

In the survey conducted results indicates that majority of respondents have very low level of education such as 46% primary school education and 37% have completed secondary school this implies that farmers are either illiterate or have very low level of education to enable them to make decision in adopting and use agricultural innovations. It has been report that Tanzanian farmer due to their low level of education they rely greatly on their traditional farming practices and poor technology as a result a limiting factor to innovation (Kapange 2010). The survey statistics indicates that very few respondents had attained higher education level such as the post-secondary education which was mainly the extension staff or teachers living in the rural areas. Some of the highly educated respondents were recorded to be living in urban areas (district town centre) and most of them were government employee this also indicate how difficult it is for the households to share knowledge and skills at rural areas. Details are as shown in *Table 10* and *Figure 6* below.

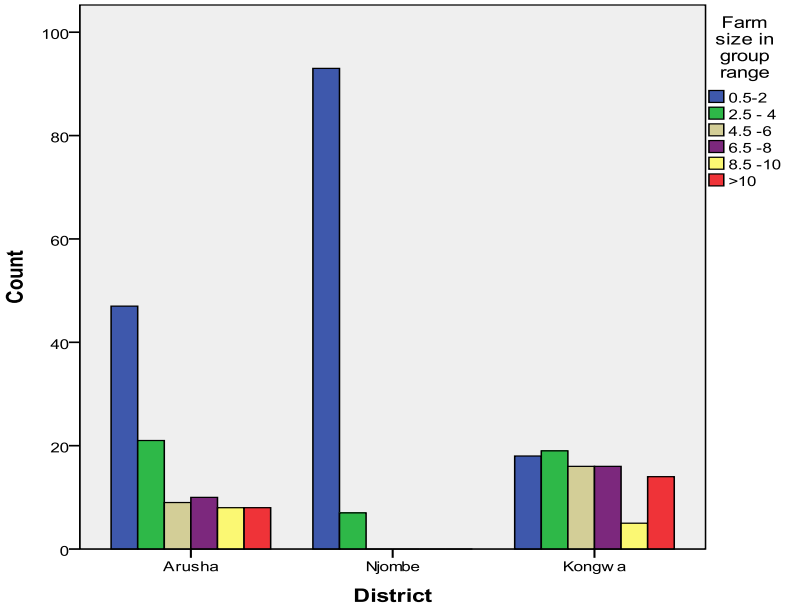
Figure 6: Respondents level of education across district surveyed



Respondents land ownership generally are very small plots with an average range of farm 0.2 hectares at minimum and maximum 24 hectares. The farm size being small it's clear that these households have low income as their production per area being low. This is another reason behind their willingness to pay for agriculture services with regard to their use furthermore it is an indication of household's income from what they earn from farming activities (Hine 2001). The three districts show that the farm size of 0.5 – 2 hectare is dominant and very high in Njombe compared to Arusha and Kongwa. The land ownership, increased population and forestry activities made the land value to be high in Njombe is such a way that smallholder farmers cannot afford to own a large plots for agriculture population. Furthermore the transportation service and distance to market discourage commercial farming in Njombe compared to Arusha and Kongwa where some smallholder farmers are now

trying to engage themselves in commercial farming and own large plots land. The availability of market infrastructure such as Kibaigwa market in Kongwa has positive impact in production and marketing activities especially in Kongwa where it has changed smallholder farmers. The proportion of farmers owning more than 10 hectare in Kongwa is much higher compared to Arusha and Njombe. Details are as seen in *Figure 7* below:

Figure 7: Households farm size across districts



In terms of agriculture service and institutional support majority of farmers approximately 86% responded that agriculture services are the main problem in their area. 71% of farmers claimed that they are not satisfied with the agriculture service provided because it's not available when needed, its expensive and no enough expert. The respondents believe that any improvement in the quality of road infrastructure it will of economic benefit to them as they will save time and costs associated on commodity transport, transportation of commodity will be easier, commodity price will improve and other development services will also improve.

Farmers travel a distance of 0.5 – 10 Kilometres to the nearest market. They normally use animals (donkey and cattle), bicycle, tractors, pick up/small track, Lorries and Mkokoteni (the local wheel barrow). Approximately 67% of surveyed farmers use transport system (animal, tractor and bicycle) that consume a lot of time such as 1- 3 hours where they could spend 25 – 30 minutes when tracks are used for transportation to the market centre. Farmers such as 87% spend 1000 TShs and more than 1000 TShs as transportation costs when vehicles are being used to carry the commodity to the market. The higher the transportations costs and time spent to reach the market provide a clear indication poor quality of road infrastructure in the rural area. Hine and Ellis (2001) on their study on agricultures marketing and

transport services found out that transportation costs are very high where road quality are very poor and it varies with distance travelled and the season. The impact of transport costs on the final market price varies depending on commodity type, the kind of transport and the numbers of marketing actors. Therefore an improvement of road quality has a positive impact on the price of commodities. Details are as shown in Figure 8, 9 and 10 and Table 11 below.

Table 11: Farmer's responses on specific question regarding their access to market

Sample characteristics	Arusha (%) (n= 103)	Njombe (%) (n= 100)	Kongwa (%) (n= 88)	Freq. (%) (n= 291)
If agriculture service is problem				
Yes	96 (93.20)	87 (87.00)	66 (75.00)	249 (85.57)
No	5 (4.86)	5 (5.00)	12 (13.64)	22 (7.56)
Not sure	2 (1.94)	8 (8.00)	10 (11.36)	20 (6.87)
Kind of road transport that they mostly use to take maize to the market				
Animals	44 (42.72)	2 (2.00)	34 (38.64)	80 (27.49)
Tractors	36 (34.95)	4 (4.00)	47 (53.41)	87 (29.90)
Pick up/small trucks	13 (12.62)	56 (56.00)	5 (5.68)	74 (25.43)
Lorries	4 (3.88)	14 (14.00)	1 (1.14)	19 (6.53)
Bicycle	4 (3.88)	24 (24.00)	1 (1.14)	29 (9.97)
Mkokoteni	2 (1.94)	0	0	2 (0.69)
Farmers distance from farm/home to the nearest market (Km).				
0.5 – 4	14(13.59)	9 (9.00)	17 (19.32)	40 (13.75)
5 – 8	42 (40.78)	26 (26.00)	12 (13.64)	80 (27.49)
9 – 12	14 (13.59)	4 (4.00)	10 (11.36)	28 (9.62)
13 – 16	8 (7. 77)	12 (12.00)	13 (14.77)	33 (11.34)
17 – 20	12 (11.65)	9 (9.00)	14 (15.91)	35 (12.03)
22 – 26	7 (6.80)	12 (12.00)	16 (18.18)	35 (12.03)
28 – 36	6 (5.83)	18 (18.00)	6 (6.82)	30 (10.31)
40 – 50	0	7 (7.00)	0	7 (2.41)
60 – 80	0	3 (3.00)	0	3 (1.03
The time that farmer takes from home/farm to reach the nearest market (hours).				
0.5 – 1	26 (25.24)	24 (24.00)	22 (25.00)	72 (24.74)
1.2 – 2	4 (3.88)	10 (10.00)	11 (12.5)	25 (8.59)
2 – 2.5	45 (43.69)	34 (34.00)	28 (31.81)	107 (36.77)
3 – 3.5	24 (23.30)	22 (22.00)	22 (25.00)	68 (23.37)
4 – 5	4 |(3.88)	9 (9.00)	4 (4.55)	17 (5.84)
6	0	1 (1.00)	1 (1.14)	2 (0.69)
How many times (frequency) in a month that a farmer need to go to the market				
1 – 2	81(78.64)	78 (78.00)	70 (79.55)	229 (78.69)
3 – 4	22 (21.36)	19 (19.00)	16 (18.18)	57 (19.59)
5 – 6	0	2 (2.00)	2 (2.27)	4 (1.38)
7 – 8	0	0	0	0
9 – 10	0	1 (1.00)	0	1 (0.34)

Sample characteristics	Arusha (%) (n= 103)	Njombe (%) (n= 100)	Kongwa (%) (n= 88)	Freq. (%) (n= 291)
If farmers think that they will benefit or lose out when road are improved				
Will benefit Will lose out	103 (100.00 0	99 (99.00 1 (1.00)	87 (98.86) 1(1.14)	289 (99.31) 2 (0.69)
Reason behind farmers response on road improvements				
Will save time and money Easy transport Better price Better services in development	78 (75.73) 23 (22.33) 1 (0.97) 1 (0.97)	37 (37.00) 55 (55.00) 5 (5.00) 3 (3.00)	38 (43.18) 32 (36.36) 9 (10.23) 9 (10.23)	153 (52.58) 110 (37.80) 15 (5.15) 13 (4.47)
Use of vehicle				
Yes No	101 (98.06) 2 (1.94)	100(100.00) 0	88 (100.00) 0	289 (99.31) 2 (0.69)
Transport costs when using vehicle (TShs/100kg bag				
Not use vehicle 600 700 800 900 1000 >1000	2 (1.94) 0 2 (1.94) 7 (6.80) 2 (1.94) 43 (41.75) 47 (45.63)	0 3 (3.00) 1 (1.00) 9 (9.00) 6 (6.00) 26 (26.00) 55 (55.00)	0 3 (3.41) 0 1 (1.41) 2 (2.27) 28 (31.82) 54 (61.36)	2 (0.69) 6 (2.06) 3 (1.03) 17 (5.84) 10 (3.44) 97 (33.33) 156 (53.61)
Farmers satisfaction on agriculture services				
Very satisfied Satisfied Not satisfied Not sure	0 27 (26.21) 75 (72.82) 1 (0.97)	5 (5.00) 13 (13.00) 75 (75.00) 7 (7.00)	14 (15.91) 14 (15.91) 57 (64.77) 3 (3.41)	19 (6.53) 54 (18.56) 207 (71.13) 11 (3.78)
Reason out of agriculture service satisfaction				
Not available when needed It's expensive No enough expert	49 (47.57) 47 (45.63) 7 (6.80)	45 (45.00) 41 (41.00) 14 (14.00)	41 (46.59) 30 (34.09) 17 (19.32)	135 (46.39) 118 (40.55) 38 (13.06)

Figure 8: Average distance travelled to the nearest market

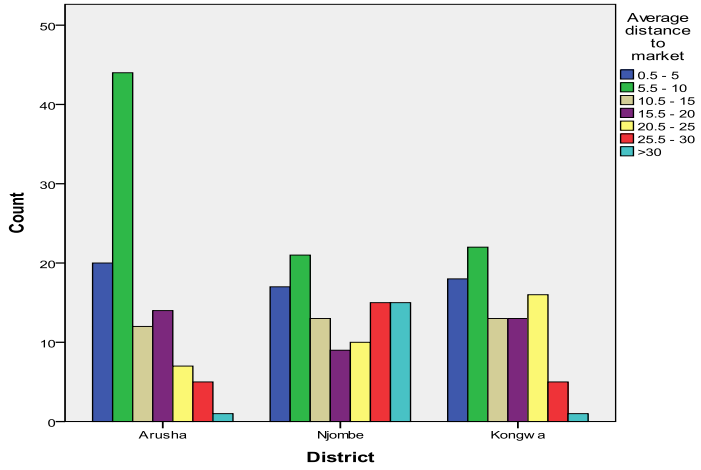


Figure 9: Kind of transport used across districts

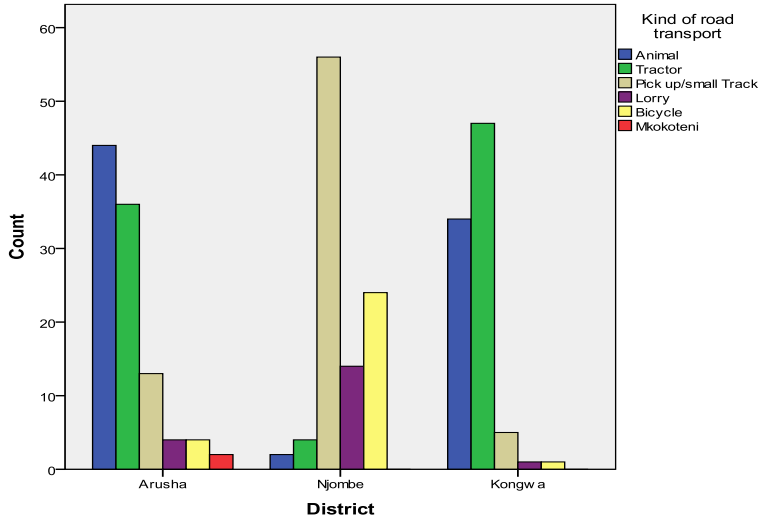
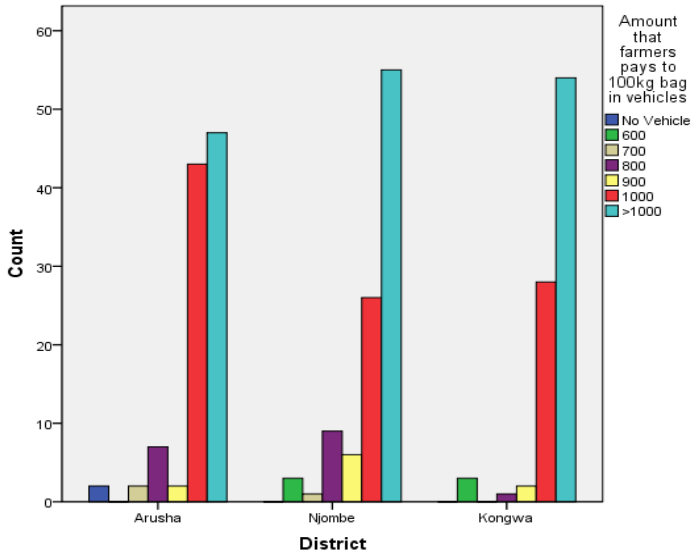
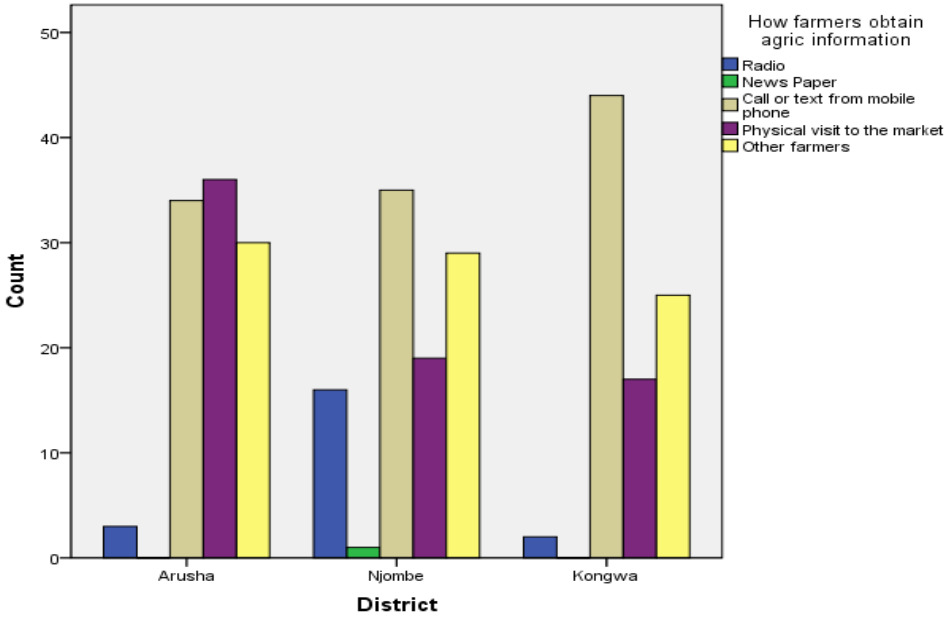


Figure 10: Transport costs across districts



Access to agriculture information is a problem in rural areas as approximately 95% respondents from the survey reported yes it is a problem. The reasoning behind their response were as follow; 53.27% no enough expert; 26.80% it's expensive and 19.93% it's not available. This is provide a good indication that rural communities in Tanzania lack communication infrastructure and farmers depends highly on agricultural extension staff (extension officers) which are not available in every village. Farmers mainly obtain agricultural information especially price from unreliable sources such as physically visit to the market, their fellow farmers by either call or text from their mobile phone or visiting their fellow farmers in their homes. In the surveyed sample ways that are used to find out agriculture marketing information were as follow; 7.22% Radio, 0.32% Newspapers, 38.83% call or text from mobile phone, 24.7% physical visit to the market and 28.9% other farmers as shown in Table 12 and in Figure 11 below. The survey results provide a proof that an investment to marketing centre in the rural area is worth undertaking as it will provide farmers an access to reliable agriculture marketing information, it will also serve as technology innovation learning centre. (Kapange 2010) on his study regarding Information and Communication Technologies (ICTs) and National Agriculture Research system indicated that due to lack of extension staff there is a need of Zonal Communication Centres (ZCC) equipped with vans, video and audio systems, computing facilities it will serve as an array of research and technical innovation and easy distribution to farmers. Furthermore (Kapange 2010) motioned that community based telecentres will not only provide an access to price, markets, technology and weather information but have the potential to empower rural communities and facilitate socio-economic development in agriculture.

Figure 11: Ways that farmers use to obtain agriculture Information.



Mobile phones are used by farmers either by text or call to other farmers. Approximately 93% use mobile phone to found out price information from other farmers while 7% of the sample surveyed does not use mobile phone. The frequency of mobile use were as follows 6.87% Not use, 21.65% Three times for text, 51.20% Two times for call and 20.27% Three times both call and text and the costs being 400 Tshs , 500 Tshs and more than 500Tshs for calls or texts. This shows that farmers spend lots of time and costs to find out price information before they make decision to take their commodity to the market or sale it traders who normally visit their home detail are in *Table 12 below:*

Table 12: Farmers response regarding their access to agricultural information

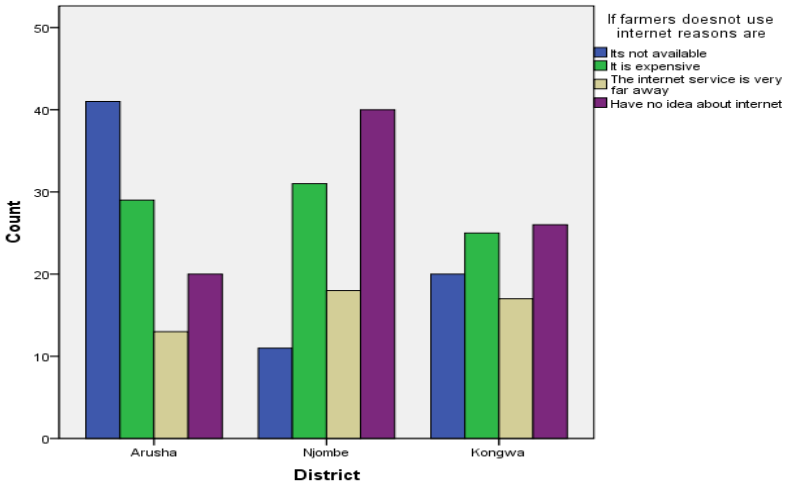
Sample characteristics	**Arusha (%) (n= 103)**	**Njombe (%) (n= 100)**	**Kongwa (%) (n= 88)**	**Freq. (%) (n= 291)**
If agriculture information is problem				
Yes	98 (95.15)	94 (94.00)	84 (95.46)	276 (94.85)
No	0	1 (1.00)	0	1 (0.34)
Not sure	5 (4.85)	5 (5.00)	4 (4.54)	14 (4.81)
Reason for agriculture service satisfaction				
No enough expert	66 (64.08)	49 (49.00)	40 (45.45)	155 (53.27)
It's expensive	21 (20.39)	32 (32.00)	25 (28.41)	78 (26.80)
Not available	16 (15.53)	19 (19.00)	23 (26.14)	58 (19.93)
The ways that farmer use to obtain agriculture information				
Radio	3 (2.91)	16 (16.00)	2 (2.27)	21 (7.22)
Newspaper	0	1 (1.00)	0	1 (0.32)
Call or text from mobile phone	34 (33.01)	35 (35.00)	44 (50.00)	113 (38.83)
Physical visit to the market	36 (34.95)	19 (19.00)	17 (19.32)	72 (24.74)
Other farmers	30 (29.13)	29 (29.00)	25 (28.41)	84 (28.87)
Farmers use of mobile phone				
Yes	96 (93.200	89 (89.00)	86 (97.73)	271 (93.13)
No	7 (6.80)	11 (11.00)	2 (2.27)	20 (6.87)
How many times (frequency) that farmer use Mobile to find out about price				
Not use	7 (6.80)	11 (11.00)	2 (2.27)	20 (6.87)
Three times for text	34 (33.01)	5 (5.00)	24 (27.27)	63 (21.65)
Two times for a call	48 (46.60)	65 (65.00)	36 (40.91)	149 (51.20)
Three times both call and text	14 (13.59)	19 (19.00)	26 (29.55)	59 (20.27)
The amount that farmer spend on mobile phone (mobile costs) in Tanzanian shillings – (TShs)				
0	7 (6.80)	11 (11.00)	2 (2.27)	20 (6.87)
100	4 (3.88)	1 (1.00)	2 (2.27)	7 (2.41)
200	10 (9.71)	6 (6.00)	6 (6.82)	22 (7.56)
300	16 (15.53)	10 (10.00)	6 (6.82)	32 (11.00)
400	23 (22.33)	18 (18.00)	8 (9.09)	49 (16.84)
500	29(28.16)	38 (38.00)	33 (37.5)	100 (34.36)
>500	14 (13.59)	16 (16.00)	31 (35.23)	61 (20.96)
If farmers use Internet or not				
Yes	55 (53.40)	47 (47.00)	35 (33.77)	137 (47.08)
No	48 (46.60)	53 (53.00)	53 (60.23)	154 (52.92)
The frequency of Internet use per week				

Sample characteristics	Arusha (%) (n= 103)	Njombe (%) (n= 100)	Kongwa (%) (n= 88)	Freq. (%) (n= 291)
Do not use at all	48 (46.60)	53 (53.00)	53 (60.23)	154 (52.92)
Two times for 30min session	38 (36.89)	8 (8.00)	13 (14.77)	59 (20.28)
Three times for 30min session	17 (16.51)	39 (39.00)	22 (25.00)	78 (26.80)
The internet costs when used (TShs)				
Do not use at all	48 (46.60)	53 (53.00)	53 (60.23)	154 (52.92)
300/30min	27 (26.21)	3 (3.00)	4 (4.55)	34 (11.68)
400/30min	25 (24.27)	36 (36.00)	24 (27.27)	85 (29.21)
500/30min	3 (2.92)	8 (8.00)	7 (7.95)	18 (6.19)
The reasons behind why farmers do not use internet				
It's not available	41 (39.81)	11 (11.00)	20 (22.73)	72 (24.74)
It's expensive	29 (28.16)	31 (31.00)	25 (28.41)	85 (29.21)
Its far away from where I live	13 (12.62)	18 (18.00)	17 (19.32)	48 (16.50)
No idea about internet	20 (19.42)	40 (40.00)	26 (29.55)	86 (29.55)
If farmer use different ways to find price information				
Yes	98 (95.15)	93 (93.00)	84 (95.45)	275 (94.50)
No	5 (4.85)	7 (7.00)	4 (4.55)	16 (5.500
Different ways that are used to find out price information				
Do not use any other way	5 (4.85)	7 (7.00)	4 (4.55)	16 (5.50)
Physical visit to the market	69 (66.99)	36 (36.00)	42 (47.73)	147 (50.51)
Ask other farmers	29 (28.16)	57.(57.00)	42 (47.73)	128 (43.99)

Approximately 53% of the respondent does not use the internet service to find out price information and the reasons behind were as follows 24.74% It's not available, 29.21% It's expensive, 16.50% it's far away from where farmer lives and 29.55% no idea about the internet. Either farmers frequency of internet use is twice or thrice a week with a cost of 300Tshs and 400Tshs per 30min which indicates that the internet is rarely used due to its costs and time involved visiting the internet service provider which is mainly located in village town centres. It is also claimed that the level of education of majority of farmers is a constraint to technology use such as internet. The internet use also differ across the districts surveyed as shown in Figure 12 below that farmers in Arusha do not use internet as its not available and also its expensive and far away, in Njombe district majority of farmers have no idea about internet and those who have idea complained its expensive while Kongwa the farmers indicated almost same proportion in the main reasons provided details in Figure 12 below.

Despite that farmers use mobile phone and internet service to access agriculture information in the rural areas but the use of these facilities are being challenged by power shortage to charge their mobile phones, poor network connectivity and has result to the use of so called *Mkulilima shushushu* (farmers market spy) by forming group which is also costly (Lightfoot et al 2008).

Figure 12: Reasons behind farmers use of internet



Generally farmers do receive institutional support with regard to agriculture services. Approximately 97% of the sample responded *yes* that they do receive agricultural service support from different institutions such as Ministry of Agriculture, Food Security and Cooperatives (MAFC), Non-Governmental organisations (NGOs), Development agencies and their fellow farmers. The main support that farmers receive is training on agriculture practices mostly being provided by extension staff from MAFC once a year or once in a very three month details are as shown in Table 12 above and Figure 13 and 14 below.

Figure 13: Kind of institutional support

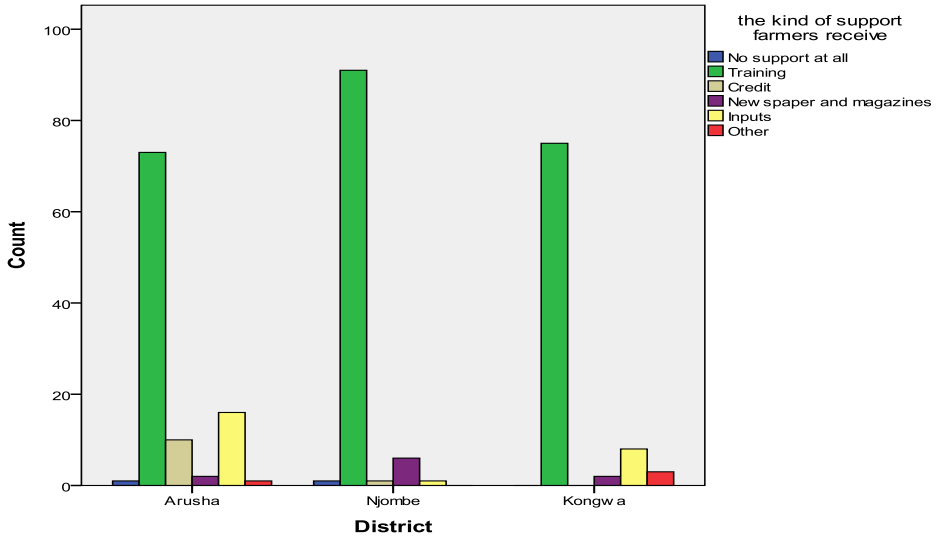
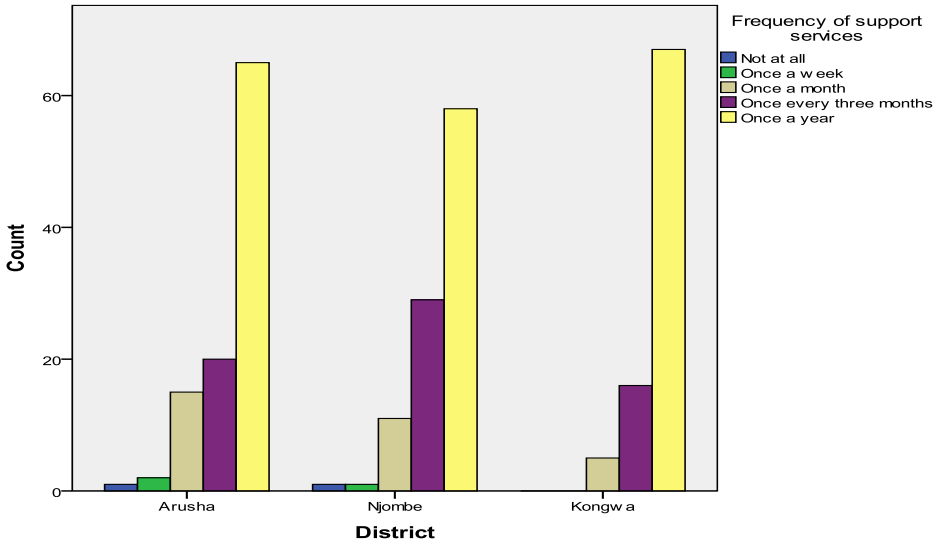


Figure 14: The frequency of Institutional support



Access to credit or financial service seems to be a constraint to farmers as majority of respondents responded that access to credit is very difficult followed with some farmers responding somewhat difficult and somewhat easy. Despite that the credit or financial services are available farmers find it hard to obtain credit due to their ignorance on how credit works. The conditions attached to the credit especially the interest rate which is very high such as 15 – 20 % which discourages farmers. Either the high risks associated with agriculture especially draught, flooding, dependency on rainfall and poor farming systems makes lending facilities such as credit agency to hesitate disburse loan to farmers as a result most of farmers are not credit worth (Alderman 1993). From the survey majority of responded that they obtain credit from Farmers Associations (SACCOS) approximately 42% and 23% Credit agencies, 16% from other farmers and 15% from banks. The credit access has been reported by 51% of respondents that it is very difficult to get credit from financial institution, 25% responded it's somewhat difficult and 14% reporting somewhat easy the details are in Table 13 and Figure 15 below.

Table 13: Production Institutional support and access to credit

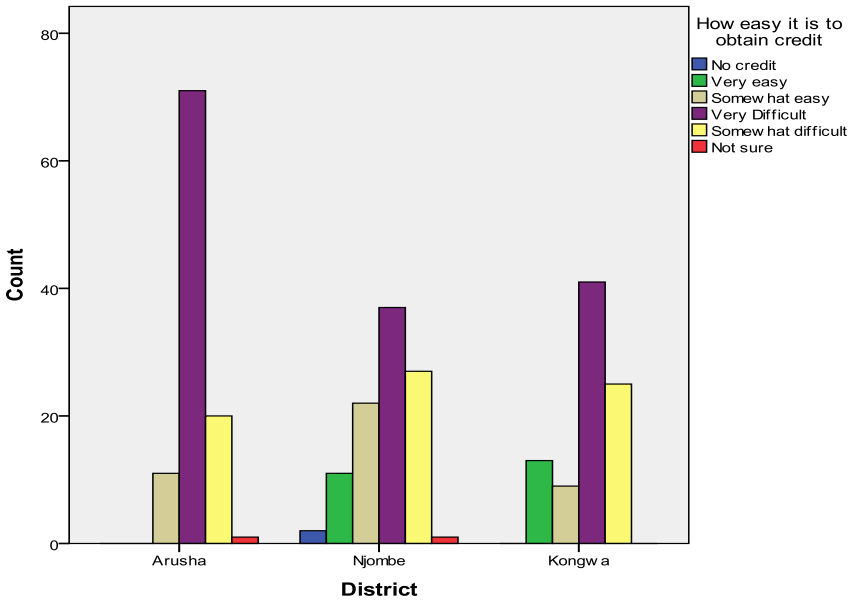
Sample characteristics	Districts			Total sample
	Arusha (%) (n= 103)	Njombe (%) (n= 100)	Kongwa (%) (n= 88)	Freq. (%) (n= 291)
Farm size in hectares				
0.5 – 1	21 (20.39)	29 (29.00)	1(1.14)	51 (17.53)
1.5 – 2	25 (24.27)	64 (64.00)	13 (14.77)	102 (35.05)
2.5 – 3	16 (15.53)	5 (5.00)	7 (7.95)	28 (9.62)
3.5 – 4	10 (9.71)	2 (2.00)	15 (17.05)	27 (9.28)
4.5 -6	5 (4.85)	0	20 (22.73)	25 (8.59)
6.5 – 8	9 (8.74)	0	13 (14.77)	22 (7.56)
8.5 – 10	9 (8.74)	0	6 (6.82)	15 (5.15)
12	8 (7.00)	0	10 (11.36)	18 (6.19)

Sample characteristics	Districts			Total sample
	Arusha (%) (n= 103)	Njombe (%) (n= 100)	Kongwa (%) (n= 88)	Freq. (%) (n= 291)
20	0	0	2 (2.27)	2 (0.69)
24	0	0	1 (1.14)	1 (0.32)
Yield in 100kg bags per hectare				
10 – 14	3 (2.91)	0	1 (1.14)	4 (1.37)
15 – 18	19 (18.45)	4 (4.00)	4 (4.55)	27 (9.28)
20 – 22	40 (38.83)	21 (21.00)	22 (25.00)	83 (28.52)
22 – 24	9 (8.74)	1 (1.00)	12 (13.65)	22 (7.56)
25 – 28	24 (23.30)	55 (55.00)	43 (48.86)	122 (41.92)
29 – 30	8 (7.77)	18 (18.00)	6 (6.82)	32 (11.00)
35	0	1(1.00)	0	1 (0.34)
Production costs (Tshs/ha)				
200,000 – 300,000	74 (71.85)	22 (22.00)	21 (23.86)	117 (40.21)
400,000 – 500,000	27 (26.21)	70 (70.00)	42 (47.73)	139 (47.77)
500,000 – 600,000	0	6 (6.00)	13 (14.77)	19 (6.53)
700,000 – 800,000	1 (0.97)	2 (2.00)	0	3 (1.03)
<200,000	1 (0.97)	0	12 (13.64)	13 (4.47)
Average household income per year from maize sales in Tshs.				
200000 – 400000	7 (6.80)	3 (3.00)	0	10 (3.44)
450000 – 700000	17 (16.50)	2 (2.00)	0	19 (6.53)
750000 – 1000000	11(10.68)	1 (1.00)	0	12 (4.12)
1500000 – 2000000	6 (5.83)	3 (3.00)	5 (5.68)	14 (4.81)
2100000 – 3500000	15(14.56)	4 (4.00)	7 (7.95)	26 (8.93)
3600000 – 6500000	17(16.50)	31 (31.00)	24 (27.27)	72 (24.74)
6600000 – 8000000	14(13.59)	17 (17.00)	7 (7.95)	38 (13.06)
8500000 – 9000000	7(6.80)	11 (11.00)	12 (13.64)	30 (10.31)
9500000 – 12000000	8(7.77)	19 (19.00)	20 (22.73)	47 (16.15)
12500000 – 14000000	0	7 (7.00)	8 (9.09)	15 (5.15)
14500000 – 21000000	1(0.97)	2 (2.00)	5 (5.68)	8 (2.75)
Farmers sources of income				
Maize sales	48 (33.98)	62 (62.00)	61(69.32)	158 (54.30)
Livestock sales	6 (5.83)	0	1 (1.14)	7 (2.40)
Farm labourer	7 (6.80)	2 (2.00)	2 (2.27)	11 (3.78)
Credit agency	1 (0.97)	1 (1.00)	0	2 (0.69)
Off farm activities	7 (6.80)	16 (16.00)	7 (7.96)	30 (10.30)
Both livestock and Maize sales	38 (36.89)	18 (18.00)	17 (19.32)	73 (25.09)
Other	9 (8.73)	1 (1.00)	0	10 (3.43)
Farmers monthly household income in total from farming activities (TShs)				
200,000 – 300,000	48 (46.60)	36 (36.00)	26 (29.55)	110 (37.80)
400,000 – 500,000	33 (32.04)	47 (47.00)	38 (43.18)	118 (40.55)
500,000 – 600,000	2 (1.94)	7 (7.00)	9 (10.23)	18 (6.19)
700,000 – 800,000	0	3 (3.00)	2 (2.27)	5 (1.72)
900,000 – 1,000,000	0	2 (2.00)	2 (2.27)	4 (1.37)
<200,000	20 (19.42)	5 (5.00)	11 (12.50)	36 (12.37)
Farmers income from off farm activities (TShs)				
200,000 – 300,000	42 (40.78)	51 (51.00)	46 (52.27)	139 (47.77)

Sample characteristics	Districts			Total sample
	Arusha (%) (n= 103)	Njombe (%) (n= 100)	Kongwa (%) (n= 88)	Freq. (%) (n= 291)
400,000 – 500,000	17 (16.51)	22 (22.00)	12 (13.63)	51 (17.53)
500,000 – 600,000	1 (0.97)	7 (7.00)	4 (4.55)	12 (4.12)
700,000 – 800,000	0	1 (1.00)	1 (1.14)	2 (0.69)
900,000 – 1,000,000	1 (0.97)	2 (2.00)	0	3 (1.03)
Not at all	42 (40.78)	17 (17.00)	9 (10.23)	68 (23.36)
<200,000	0	0	16 (18.18)	16 (5.50)
If farmer receive any support in agriculture services				
Yes	101 (98.06)	98 (98.00)	88 (100)	287 (98.62)
No	2 (1.94)	2 (2.00)	0	4 (1.38)
Where farmer get agriculture support				
Not receive any support	1 (0.97)	1 (1.00)	0	2 (0.69)
Extension staff from MAFC	84 (81.55)	57 (57.00)	52 (59.09)	193 (66.32)
NGO's	11 (10.68)	35 (35.00)	3 (3.41)	49 (16.84)
Development Agencies	3 (2.92)	3 (3.00)	25 (28.41)	31 (10.65)
Other farmers	4 (3.88)	4 (4.00)	8 (9.09)	16 (5.50)
Kind of Agriculture Support				
Not receive any support	1 (0.97)	1 (1.00)	0	2 (0.69)
Training	73 (70.87)	91 (91.00)	75 (85.23)	139 (82.13)
Credit	10 (9.71)	1 (1.00)	0	11 (3.78)
Newspaper and magazine	2 (1.94)	6 (6.00)	2 (2.27)	10 (3.44)
Inputs	16 (15.53)	1 (1.00)	8 (9.09)	25 (8.59)
Other	1 (0.97)	0	3 (3.41)	4 (1.37)
Frequency of agriculture support				
Not at all	1 (0.97)	1 (1.00)	0	2 (0.69)
Once a week	2 (1.94)	1 (1.00)	0	3 (1.03)
Once a month	15 (14.56)	11(11.00)	5 (5.68)	31 (10.65)
Once in every three month	20 (19.42)	29 (29.00)	16 (18.18)	65 (22.34)
Once a year	65 (63.11)	58 (58.00)	67 (76.14)	190 (65.29)
Where do farmers get an access to credit/financial support				
No credit at all	0	3 (3.00)	0	3 (1.03)
Bank	13 (12.62)	22 (22.00)	8 (9.09)	43 (14.78)
NGO's	0	7 (7.00)	2 (2.27)	9 (3.09)
Credit agencies	19 (18.45)	33 (33.00)	15 (17.05)	67 (23.02)
Farmers associations (SACCOS)	64 (62.14)	26 (26.00)	32 (36.36)	122 (41.92)
From other farmers	6 (5.83)	8 (8.00)	31 (35.23)	45 (15.46)
Other ways	1 (0.97)	1 (1.00)	0	2 (0.69)
How easy it is for household members to get an access to credit for farming activities				
No credit	0	2 (2.00)	0	2 (0.69)
Very easy	0	11 (11.00)	13 (14.77)	24 (8.25)
Somewhat easy	11 (10.68)	22 (22.00)	9 (10.23)	42 (14.43)

Sample characteristics	Districts			Total sample
	Arusha (%) (n= 103)	Njombe (%) (n= 100)	Kongwa (%) (n= 88)	Freq. (%) (n= 291)
Very difficult	71 (68.93)	37 (37.00)	41 (46.59)	149 (51.20)
Somewhat difficult	20 (19.42)	27 (27.00)	25 (28.41)	72 (24.74)
Not sure	1 (0.97)	1 (1.00)	0	2 (0.69)

Figure 15: Farmers access to credit or Finance.



5.4.2 The debriefing questions

The survey respondents were asked questions to capture information that can provide some insight into the reliability of the response provided by the respondents. The questions were different from each scenario such that nine questions from road improvement and maintenance scenario and five question from price information improvement. The questions required respondents to rate their understanding and usefulness of certain aspects of road improvements and price information improvement described in the survey questionnaire. The responses are in *table 14* and *15*. Looking on the tables the responses reveal that the questions were acceptable as true and it is reasonably safe to conclude that the respondents understood well the scenarios presented to them and responses given by the respondents are their actual answers.

Table 14: Farmer's responses on their perception regarding roads improvement

Sample characteristics	Districts			Total sample
	Arusha (%) (n= 103)	Njombe (%) (n= 100)	Kongwa (%) (n= 88)	Freq. (%) (n= 291)
I am very concerned about costs and travel time that I spend to transport maize to the market				
Strongly agree	94 (91.26)	66 (66.00)	76 (86.36)	236 (81.10)
Agree	8 (7.77)	29 (29.00)	9 (10.23)	46 (15.81)
Neither agree or disagree	0	0	1 (1.14)	1 (0.34)
Disagree	0	5 (5.00)	1 (1.14)	6 (2.06)
Strongly disagree	1 (0.97)	0	1 (1.14)	2 (0.69)
It is good that the roads are so bad at this prevents too much outside competition in the market.				
Strongly agree	1 (0.97)	2 (2.00)	2 (2.27)	5 (1.72)
Agree	7 (6. 80)	3 (3.00)	0	10 (3.44)
Neither agree or disagree	3 (2.91)	11 (11.00)	8 (9.09)	22 (7.56)
Disagree	19 (18.45)	37 (37.00)	33 (37.50)	89 (30.58)
Strongly disagree	73 (70.87)	47 (47.00)	45 (51.14)	165 (56.70)
It is good to have some isolation from other villages otherwise farmers and trader will come and dominate everything.				
Strongly agree	4 (3.88)	1 (1.00)	3 (3.41)	8 (2.75)
Agree	1 (0.97)	1 (1.00)	0	2 (0.69)
Neither agree or disagree	3 (2.91)	2 (2.00)	4 (4. 55)	9 (3.09)
Disagree	19 (18.45)	33 (33.00)	37 (42.05)	89 (30.58)
Strongly disagree	76 (73.79)	63 (63.00)	44 (50.00)	183 (62.89)
A road with gravel, pot holes cleared and levelled will minimize travel time and transportation costs that I spend to transport good to the markets.				
Strongly agree	91 (88.35)	78 (78.00)	68 (77.27)	237 (81.44)
Agree	10 (9.71)	19 (19.00)	17 (19.32)	46 (15.81)
Neither agree or disagree	0	2 (2.00)	0	2 (0.69)
Disagree	0	0	3 (3.41)	3 (1.03)
Strongly disagree	2 (1.94)	1(1.00)	0	3 (1.03)
I will increase the area of my farm for production when transportation services (road) are good.				
Strongly agree	82 (79.61)	83 (83.00)	74 (84.09)	239 (82.13)
Agree	20 (19.42)	17 (17.00)	14 (15.91)	51 (17.53)
Neither agree or disagree	0	0	0	0
Disagree	1 (0.97)	0	0	1 (0.34)
Strongly disagree	0	0	0	0
Road improvement will increase number of sellers and buyers in the market (increased market competition).				
Strongly agree	90 (87.38)	75 (75.00)	75 (85.23)	240 (82.47)
Agree	13 (12.62)	25 (25.00)	13 (14.77)	51 (17.53)
Neither agree or disagree	0	0	0	0
Disagree	0	0	0	0
Strongly disagree	0	0	0	0
Improved transport service especially roads will improve price of inputs, produce, income and food security				
Strongly agree	85 (82.52)	78 (78.00)	65 (73.86)	228 (78.35)
Agree	17 (16.51)	22 (22.00)	21 (23.86)	60 (20.62)
Neither agree or disagree	1 (0.97)	0	1 (1.14)	2 (0.69)
Disagree	0	0	1 (1.14)	1 (0.34)
Strongly disagree	0	0	0	0

Sample characteristics	Districts			Total sample
	Arusha (%) (n= 103)	Njombe (%) (n= 100)	Kongwa (%) (n= 88)	Freq. (%) (n= 291)
Animals used to transport your maize to the market destroy the environment by digging gullies in farms and creating unwanted paths in farms				
Strongly agree	87 (84.47)	68 (68.00)	77 (87.50)	232 (79.73)
Agree	16 (15.53)	25 (25.00)	11 (12.50)	52 (17.87)
Neither agree or disagree	0	3 (3.00)	0	3 (1.03)
Disagree	0	4 (4.00)	0	4 (1.37)
Strongly disagree	0	0	0	0
With good quality road the environment and climate will be protected and there will be no unwanted animal paths in the farms.				
Strongly agree	92 (89.32)	73 (73.00)	78 (88.64)	243 (83.51)
Agree	11 (10.68)	26 (26.00)	10 (11.36)	47 (16.15)
Neither agree or disagree	0	1 (1.00)	0	1 (0.34)
Disagree	0	0	0	0
Strongly disagree	0	0	0	0

Table 15: Farmer's responses on their perception on access to agricultural information

Sample characteristics	Districts			Total sample
	Arusha (%) (n= 103)	Njombe (%) (n= 100)	Kongwa (%) (n= 88)	Freq. (%) (n= 291)
I am concerned about time and costs that I spend finding out about maize price information.				
Strongly agree	83 (80.58)	58 (58.00)	67 (76.14)	208 (71.48)
Agree	20 (19.42)	39 (39.00)	21 (23.86)	80 (27.49)
Neither agree or disagree	0	0	0	0
Disagree	0	3 (3.00)	0	3 (1.03)
Strongly disagree	0	0	0	0
Marketing Information Centres in the village where farmers can have access to Agriculture Information will minimize time and costs spent to obtain this information.				
Strongly agree	92 (89.32)	71 (71.00)	71 (80.68)	234 (80.41)
Agree	11 (10.68)	28 (28.00)	17 (19.32)	56 (19.24)
Neither agree or disagree	0	1 (1.00)	0	1 (0.35)
Disagree	0	0	0	0
Strongly disagree	0	0	0	0
Marketing Information Centres in the village will provide an Internet access opportunity that will provide information such as price of inputs, markets access, technology development and transfer and it is also a means of communication.				
Strongly agree	77 (74.76)	77 (77.00)	76 (86.36)	230 (79.04)
Agree	25 (24.27)	23 (23.00)	12 (13.64)	60 (20.62)
Neither agree or disagree	0	0	0	0
Disagree	1 (0.97)	0	0	1 (0.34)
Strongly disagree	0	0	0	0
Getting information about maize price will assist in decision making such land use, production quantity for maize and other crops, time for selling and buying.				
Strongly agree	83 (80.58)	91 (91.00)	72 (81.82)	246 (84.54)
Agree	20 (19.42)	9 (9.00)	14 (15.90)	43 (14.78)
Neither agree or disagree	0	0	0	0
Disagree	0	0	1 (1.14)	1 (0.34)
Strongly disagree	0	0	1 (1.14)	1 (0.34)

Sample characteristics	Districts			Total sample
	Arusha (%) (n= 103)	Njombe (%) (n= 100)	Kongwa (%) (n= 88)	Freq. (%) (n= 291)
Timely access to maize price information can help improve income generation and food security.				
Strongly agree	89 (86.41)	78 (78.00)	76 (86.36)	243 (83.51)
Agree	14 (13.59)	21 (21.00)	12 (13.64)	47 (16.15)
Neither agree or disagree	0	1 (1.00)	0	1 (0.34)
Disagree	0	0	0	0
Strongly disagree	0	0	0	0

The initial results for farmers WTP for quality of road infrastructure and the reasons behind the amount stated are as shown in table 16, 17, 18 and 19 below. Majority of farmers indicate the highest values from Tsh 600 to Tshs1000 with reasoning that the amounts are afforded, every farmer can manage to pay, and reasonable meaning that it will not affect their activities. The results were for both voluntary and compulsory payments. Other amounts apart from the amounts mentioned in question was Tsh 1450 – 1600 when it's compulsory and Tsh 1700- 2000 when its voluntary.

Table 16: Farmer's willingness to pay for road infrastructure when it's compulsory

Sample characteristics	Districts			Total sample
	Arusha (%)	Njombe (%)	Kongwa (%)	Freq. (%)
	(n= 103)	(n= 100)	(n= 88)	(n= 291)
100				
Definitely Yes	1(0.97)	4(4.00)	1(1.14)	6(2.06)
Probably Yes	0	3(3.00)	2 (2.27)	5 (1.72)
Don't know	0	0	0	0
Probably No	2(1.94)	1(1.00)	4(4.55)	7 (2.41)
Definitely No	100 (97.09)	92 (92.00)	81 (92.05)	273 (93.81)
400				
Definitely yes	4 (3.88)	5 (5.00)	2 (2.27)	11 (3.78)
Probably Yes	5(4.85)	9 (9.00)	9 (10.23)	23(7.90)
Don't know	0	1 (1.00)	4 (4.55)	5 (1.72)
Probably No	22 (21.36)	32 (32.00)	1 (1.14)	55 (18.90)
Definitely No	72 (69.90	53 (53.00)	72 (81.82)	197 (67.70)
500				
Definitely yes	22 (21.36)	10 (10.00)	11 (12.50)	43 (14.78)
Probably Yes	21 (20.39)	18 (18.00)	6 (6.82)	45 (15.46)
Don't know	1 (0.97)	7 (7.00)	37 (42.05)	45 (15.46)
Probably No	44 (42.72)	49(49.00)	33 (37.50)	126 (43.30)
Definitely No	15 (14.56)	16 (16.00)	1 (1.14)	32 (11.00)
600				
Definitely yes	6 (5.83)	5 (5.00)	1 (1.14)	12 (4.12)
Probably Yes	67 (65.05)	31 (31.00)	17 (19.32)	115 (39.52)
Don't know	3 (2.91)	32(32.00)	21 (23.86)	56 (19.24)
Probably No	19 (18.45)	31 (31.00)	49 (55.68)	99 (34.02)
Definitely No	8 (7.77)	1 (1.00)	0	9 (3.09)
700				

Sample characteristics	Districts			Total sample
	Arusha (%) (n= 103)	Njombe (%) (n= 100)	Kongwa (%) (n= 88)	Freq. (%) (n= 291)
Definitely yes	5 (4.85)	4 (4.00)	4 (4.55)	13 (4.47)
Probably Yes	87 (84.47)	73 (73.00)	72 (81.82)	232 (79.73)
Don't know	1 (0.97)	6 (6.00)	7 (7.95)	14 (4.81)
Probably No	4 (3.88)	16 (16.00)	5 (5.68)	25 (8.59)
Definitely No	6 (5.83)	1 (1.00)	0	7(2.41)
800				
Definitely yes	13 (12.62)	4 (4.00)	7 (7.95)	24 (8.25)
Probably Yes	73 (70.87)	78(78.00)	67 (76.14)	218 (74.91)
Don't know	2 (1.94)	0	11 (12.50)	13 (4.47)
Probably No	13 (12.62)	15 (15.00)	3 (3.41)	31 (10.65)
Definitely No	2(1.94)	3 (3.00)	0	5 (1.72)
900				
Definitely yes	7 (6.80)	3 (3.00)	7 (7.95)	17 (5.84)
Probably Yes	64 (62.14)	69 (69.00)	65 (73.86)	198 (68.04)
Don't know	0	0	1(1.14)	1 (0.34)
Probably No	29 (28.16)	21(21.00)	14 (15.91)	64 (21.99)
Definitely No	3 (2.91)	7 (7.00)	1 (1.14)	11 (3.78)
1000				
Definitely Yes	47 (45.63)	66 (66.00)	56 (63.64)	169 (58.08)
Probably Yes	9 (8.74)	3 (3.00)	12 (13.640	24 (8.25)
Don't know	0	0	0	0
Probably No	11 (10.68)	10 (10.00)	9 (10.23)	30 (10.31)
Definitely No	36 (34.95)	21 (21.00)	11 (12.50)	68 (23.37)
The reasons behind farmers amount they are willing to pay				
Affordable	84(81.55)	67 (67.00)	54 (61.36)	205 (70.45)
will not affect other activities	15 (14.56)	6 (6.00)	9 (10.23)	30 (10.31)
all can afford	3(2.91)	23(23.00)	20 (22.73)	46 (15.81)
Reasonable	1(0.97)	4 (4.00)	5 (5.68)	10 (3.44)

Table 17: Amount that farmers would be willing to pay apart from those in questions when it's compulsory

Sample characteristics	Districts			Total sample
	Arusha (%) (n= 103)	Njombe (%) (n= 100)	Kongwa (%) (n= 88)	Freq. (%) (n= 291)
The amount that farmers are willing to pay apart the amount mentioned from the questions				
200 – 500	9(8.74)	0	0	9(3.09)
500 – 1000	4(3.88)	0	0	4 (1.37)
1100 – 1400	11(10.68)	18 (18.00)	5 (5.68)	34(11.68)
1450 –1600	35 (33.98)	47 (47.00)	35 (39.77)	117 (40.21)
1700 –2000	36 (34.95)	23(23.00)	29 (32.95)	88 (30.24)
2500 – 3000	2 (1.94)	2 (2.00)	8 (9.09)	12(4.12)
5000 – 6000	4 (3.88)	10 (10.00)	11 (12.50)	25(8.59)
7000 – 10000	2 (1.94)	0	0	2 (0.69)

Table 18: Amount that farmers are willing to pay when it's voluntary

Sample characteristics	Districts			Total sample
	Arusha (%)	Njombe (%)	Kongwa (%)	Freq. (%)
	(n= 103)	(n= 100)	(n= 88)	(n= 291)
100				
Definitely Yes	2 (1.94)	5 (5.00)	0	7 (2.41)
Probably Yes	0	1 (1.00)	3 (3.41)	4 (1.37)
Don't know	0	0	0	0
Probably No	4(3.88)	0	2 (2.27)	6 (2.06)
Definitely No	97 (94.17)	94 (94.00)	83(94.32)	274 (94.16)
400				
Definitely Yes	3(2.91)	2 (2.00)	2 (2.27)	7(2.41)
Probably Yes	1(0.97)	5 (5.00)	6(6.82)	12 (4.12)
Don't know	1(0.97)	0	5(5.68)	6(2.06)
Probably No	25(24.27)	31 (31.00)	3(3.41)	59 (20.27)
Definitely No	73(70.87)	62 (62.00)	72(81.82)	207(71.13)
500				
Definitely Yes	12(11.65)	6 (6.00)	10 (11.36)	28 (9.62)
Probably Yes	21(20.39)	12 (12.00)	6 (6.82)	39 (13.40)
Don't know	1(0.97)	6(6.00)	36 (40.91)	43(14.78)
Probably No	51(49.51)	63 (63.00)	34 (38.64)	148 (50.86)
Definitely No	18(17.48)	13 (13.00)	2 (2.27)	33(11.34)
600				
Definitely Yes	4(3.88)	4(4.00)	2(2.27)	10(3.44)
Probably Yes	64(62.14)	21(21.00)	18(20.45)	103(35.40)
Don't know	4(3.88)	41(41.00)	17(19.32)	62(21.31)
Probably No	23(22.33)	34(34.00)	50(56.82)	107(36.77)
Definitely No	8(7.77)	0	1(1.14)	9(3.09)
700				
Definitely Yes	5 (4.85)	3 (3.00)	4 (4.55)	12 (4.12)
Probably Yes	84 (81.55)	78 (78.00)	69 (78.41)	231 (79.38)
Don't know	1 (0.97)	4 (4.00)	10 (11.36)	15 (5.15)
Probably No	7 (6.80)	13 (13.00)	5 (5.68)	25 (8.59)
Definitely No	6 (5.83)	2 (2.00)	0	8 (2.75)
800				
Definitely Yes	14 (13.59)	3 (3.00)	6 (6.82)	23 (7.90)
Probably Yes	77 (74.76)	84 (84.00)	67 (76.14)	228 (78.35)
Don't know	3 (2.91)	0	7 (7.95)	10 (3.44)
Probably No	6 (5.83)	9 (9.00)	8 (9.09)	23 (7.90)
Definitely No	3(2.91)	4 (4.00)	0	7 (2.41)
900				
Definitely Yes	7 (6.80)	3 (3.00)	5 (5.68)	15 (5.15)
Probably Yes	69 (66.99)	78 (78.00)	68 (77.27)	215 (73.88)

Sample characteristics	Districts			Total sample
	Arusha (%)	Njombe (%)	Kongwa (%)	Freq. (%)
	(n= 103)	(n= 100)	(n= 88)	(n= 291)
Don't know	3 (2.91)	0	1 (1.14)	4 (1.37)
Probably No	21 (20.39)	13(13.00)	13 (14.77)	47 (16.150
Definitely No	3 (2.91)	6(6.00)	1 (1.14)	10 (3.44)
1000				
Definitely Yes	59 (57.28)	75 (75.00)	62 (70.45)	196 (67.35)
Probably Yes	7 (6.80)	4 (4.00)	8 (9.09)	19 (6.53)
Don't know	0	0	0	0
Probably No	12 (11.65)	3 (3.00)	7 (7.95)	22 (7.56)
Definitely No	25 (24.27)	18 (18.00)	11 (12.50)	54 (18.56)
The reasons behind farmers amount they are willing to pay				
Affordable	83 (80.58)	66 (66.00)	54 (61.36)	203 (69.76)
will not affect other activities	14(13.59)	10 (10.00)	8 (9.09)	32 (11.00)
all can afford	5 (4.85)	20 (20.00)	21 (23.86)	46 (15.81)
Reasonable	1 (0.97)	4 (4.00)	5 (5.68)	10 (3.44)

Table 19: Amount that farmers would be willing to pay apart from those in questions when it's voluntary

Sample characteristics	Districts			Total sample
	Arusha (%) (n= 103)	Njombe (%) (n= 100)	Kongwa (%) (n= 88)	Freq. (%) (n= 291)
The amount that farmers are willing to pay apart the amount mentioned from the questions				
200-500	7 (6.80)	0	0	7(2.41)
500-1000	2(1.94)	0	0	2 (0.69)
1100- 1400	3(2.91)	7 (7.00)	3(3.41)	13(4.47)
1450 - 1600	24(23.30)	26 (26.00)	16 (18.18)	66(22.68)
1700-2000	40 (38.83)	34 (34.00)	36(40.91)	110(37.80)
2500- 3000	11 (10.68)	18 (18.00)	19(21.59)	48(16.49)
3500 -5000	12 (11.65)	12(12.00)	11(12.50)	35(12.03)
6000-8000	2 (1.94)	1(1.00)	1(1.14)	4(1.37)
8500-10000	2(1.94)	2 (2.00)	2(2.27)	6(2.06)

The initial results for farmers WTP for farmers access to agriculture information and the reasoning behind the amount stated are as shown in table 20, 21, 22 and 23 below. Majority of farmers indicate that the amount between Tsh 200 to Tshs 500 with reasoning that the amounts are afforded, every farmer can manage to pay, and reasonable meaning that it will not affect their activities. The results were for both voluntary and compulsory payments. An amount other than amounts mentioned in question was Tsh 800 – 1000 for both compulsory and voluntary payments.

Table 20: Farmer's willingness to pay for access to information when it's compulsory

Sample characteristics	Districts			Total sample
	Arusha (%)	Njombe (%)	Kongwa (%)	Freq. (%)
	(n= 103)	(n= 100)	(n= 88)	(n= 291)
100				
Definitely yes	3(2.91)	8(8.00)	0	11 (3.78)
Probably Yes	3(2.91)	1(1.00)	3(3.41)	7(2.41)
Don't know	0	0	3(3.41)	3(1.03)
Probably No	6(5.83)	1(1.00)	4(4.55)	11 (3.78)
Definitely No	91(88.35)	90 (90.00)	78 (88.64)	259 (89.00)
200				
Definitely yes	7(6.80)	5 (5.00)	9 (10.23)	21 (7.22)
Probably Yes	31(30.10)	23 (23.00)	8 (9.09)	62 (21.31)
Don't know	6(5.83)	21 (21.00)	39 (44.32)	66 (22.68)
Probably No	45(43.69)	40 (40.00)	30 (34.09)	115 (39.52)
Definitely No	14 (13.59)	11 (11.00)	2 (2.27)	27 (9.28)
300				
Definitely yes	8 (7.77)	3 (3.00)	4 (4.55)	15 (5.15)
Probably Yes	6 (5.83)	12 (12.00)	9 (10.23)	27 (9.28)
Don't know	2 (1.94)	0	6 (6.82)	8 (2.75)
Probably No	28 (27.18)	29 (29.00)	9 (10.23)	66 (22.68)
Definitely No	59 (57.28)	56 (56.00)	60 (68.18)	175 (60.14)
350				
Definitely yes	5 (4.85)	2 (2.00)	4 (4.55)	11 (3.78)
Probably Yes	71 (68.93)	55 (55.00)	28 (31.82)	154 (52.92)
Don't know	4 (3.88)	11 (11.00)	22 (25.00)	37(12.71)
Probably No	17 (16.50)	29 (29.00)	33 (37.50)	79 (27.15)
Definitely No	6 (5.83)	3 (3.00)	1 (1.14)	10 (3.44)
400				
Definitely yes	17 (16.50)	10 (10.00)	6 (6.82)	33 (11.34)
Probably Yes	75 (72.82)	76 (76.00)	70 (79.55)	221 (75.95)
Don't know	0	1 (1.00)	10 (11.36)	11 (3.78)
Probably No	8 (7.77)	10 (10.00)	2 (2.27)	20 (6.87)
Definitely No	3 (2.91)	3 (3.00)	0	6 (2.06)
450				
Definitely yes	1 (0.97)	2 (2.00)	4(5.55)	7(2.41)
Probably Yes	78 (75.73)	80 (80.00)	68 (77.27)	226 (77.66)
Don't know	0	0	2 (2.27)	2 (0.69)
Probably No	16 (15.53)	14 (14.00)	14(15.91)	44 (15.12)
Definitely No	8 (7.77)	4 (4.00)	0	12 (4.12)
500				
Definitely yes	61 (59.22)	70 (70.00)	62 (70.45)	193 (66.32)
Probably Yes	8(7.77)	8 (8.00)	8 (9.09)	24(8.25)
Don't know	0	0	1 (1.14)	1 (0.34)

Sample characteristics	Districts			Total sample
	Arusha (%)	Njombe (%)	Kongwa (%)	Freq. (%)
	(n= 103)	(n= 100)	(n= 88)	(n= 291)
Probably No	12 (11.65)	9 (9.00)	6 (6.82)	27 (9.28)
Definitely No	22 (21.36)	13 (13.00)	11 (12.50)	46 (15.81)
The reasons behind farmers amount they are willing to pay				
Affordable	88 (85.44)	67 (67.00)	55 (62.50)	210 (72.16)
will not affect other activities	11 (10.68)	7 (7.00)	8 (9.09)	26 (8.93)
all can afford	4 (3.88)	24 (24.00)	21 (23.86)	49 (16.84)
Reasonable	0	2 (2.00)	4 (4.55)	6 (2.06)

Table 21: Amount that farmers would be willing to pay apart from those in questions when it's compulsory

Sample characteristics	Districts			Total sample
	Arusha (%)	Njombe (%)	Kongwa (%)	Freq. (%)
	(n= 103)	(n= 100)	(n= 88)	(n= 291)
The amount that farmers are willing to pay apart the amount mentioned from the questions				
250-500	8 (7.77)	0	0	8 (2.75)
550-700	25 (24.27)	14 (14.00)	17 (19.32)	56 (19.24)
800 - 1000	60 (58.25)	72 (72.00)	53 (60.23)	185 (63.57)
1200 - 1400	1 (0.97)	0	2 (2.27)	3 (1.03)
1500 -2000	8 (7.77)	11 (11.00)	12 (13.64)	31 (10.65)
2500-3000	0	3 (3.00)	2 (2.27)	5 (1.72)
3500- 5000	1 (0.97)	0	2 (2.27)	3 (1.03)

Table 22: Farmer's willingness to pay for access to information when it's voluntary

Sample characteristics	Districts			Total sample
	Arusha (%)	Njombe (%)	Kongwa (%)	Freq. (%)
	(n= 103)	(n= 100)	(n= 88)	(n= 291)
100				
Definitely yes	4 (3.88)	5 (5.00)	0	9 (3.09)
Probably Yes	5 (4.85)	3 (3.00)	3(3.41)	11 (3.78)
Don't know	0	0	2 (2.27)	2 (0.69)
Probably No	3 (2.91)	0	2 (2.27)	5 (1.72)
Definitely No	91 (88.35)	92 (92.00)	81 (92.05)	264 (90.72)
200				
Definitely yes	7 (6.80)	2 (2.00)	5 (5.68)	14 (4.81)
Probably Yes	10 (9.71)	7 (7.00)	5 (5.68)	22 (7.56)
Don't know	0	0	10 (11.36)	10 (3.44)
Probably No	21 (20.39)	33 (33.00)	5 (5.68)	59 (20.27)
Definitely No	65 (63.11)	58 (58.00)	63 (71.59)	186 (63.92)
300				
Definitely yes	7 (6.80)	3 (3.00)	7 (7.95)	17 (5.84)
Probably Yes	26 (25.24)	17 (17.00)	8 (9.09)	51 (17.53)
Don't know	8 (7.77)	19 (19.00)	38 (43.18)	65 (22.34)
Probably No	50 (48.54)	51 (51.00)	33 (37.50)	134(46.05)
Definitely No	12 (11.65)	10 (10.00)	2 (2.27)	24 (8.25)

Sample characteristics	Districts			Total sample
	Arusha (%)	Njombe (%)	Kongwa (%)	Freq. (%)
	(n= 103)	(n= 100)	(n= 88)	(n= 291)
350				
Definitely yes	2 (1.94)	1 (1.00)	1 (1.14)	4 (1.37)
Probably Yes	71 (68.93)	53 (53.00)	28 (31.82)	152 (52.23)
Don't know	5 (4.85)	16 (16.00)	21 (23.86)	42 (14.43)
Probably No	21 (20.39)	29 (29.00)	38 (43.18)	88 (30.240
Definitely No	4 (3.88)	1 (1.00)	0	5 (1.72)
400				
Definitely yes	11 (10.68)	5 (5.00)	6 (6.82)	22 (7.56)
Probably Yes	80 (77.67)	86 (86.00)	71 (80.68)	237 (81.44)
Don't know	0	0	9 (10.23)	9 (3.09)
Probably No	7 (6.80)	6 (6.00)	2 (2.27)	15 (5.15)
Definitely No	5 (4.85)	3 (3.00)	0	8 (2.75)
450				
Definitely yes	1 (0.97)	2 (2.00)	3 (3.14)	6 (2.06)
Probably Yes	81 (78.64)	87 (87.00)	72 (81.82)	240 (82.47)
Don't know	0	0	2 (2.27)	2 (0.69)
Probably No	13 (12.62)	7 (7.00)	11 (12.50)	31 (10.65)
Definitely No	8 (7.77)	4 (4.00)	0	12 (4.12)
500				
Definitely yes	73 (70.87)	81 (81.00)	67 (76.14)	221 (75.95)
Probably Yes	7 (6.80)	5 (5.00)	5 (5.68)	17 (5.84)
Don't know	0	1 (1.00)	1 (1.14)	2 (0.69)
Probably No	7 (6.80)	6 (6.00)	3 (3.41)	16 (5.50)
Definitely No	16 (15.53)	7 (7.00)	12 (13.64)	35 (12.03)
The reasons behind farmers amount they are willing to pay				
Affordable	90 (87.38)	70 (70.00)	56 (63.64)	216 (74.23)
will not affect other activities	8 (7.77)	6 (6.00)	9 (10.23)	23 (7.90)
all can afford	5 (4.85)	22 (22.00)	19 (21.59)	46 (15.81)
Reasonable	0	2 (2.00)	4 (4.55)	6 (2.06)

Table 23: Amount that farmers would be willing to pay apart from those in questions when it's voluntary

Sample characteristics	Districts			Total sample
	Arusha (%) (n= 103)	Njombe (%) (n= 100)	Kongwa (%) (n= 88)	Freq. (%) (n= 291)
The amount that farmers are willing to pay apart the amount mentioned from the questions				
250-500	6 (5.83)	0	0	6 (2.06)
550 - 700	6 (5.83)	4 (4.00)	7 (7.95)	17 (5.84)
800 - 1000	65 (63.11)	62 (62.00)	43 (48.86)	170 (58.42)
1200 - 1400	1 (0.97)	5 (5.00)	0	6(2.06)
1500 - 2000	21 (20.39)	23 (23.00)	28 (31.82)	72 (24.74)
2500 - 3000	0	6 (6.00)	5 (5.68)	11 (3.78)
3500 - 5000	4 (3.88)	0	5 (5.68)	9 (3.09)

5.5 Policy Implication from the pre results

It is generally argued that competitive tradable markets are crucial to the process of economic development and policies at macro-level; rely on markets to transmit price signals affects lower level decision making such as producers. However, price signals as Moser et al (2006) noted, cannot be transmitted or are transmitted unevenly across space and time. Either when markets are not competitively integrated with possibilities for trade particularly agriculture markets in developing countries such as Tanzania, these markets may be segmented or integrated, competitive or non-competitive to a varying degrees at different spatial scales with trade flowing in different directions over the course of a year. However, there is limited information and little research done on market integration for maize markets in Tanzania, the available analyses do not take an account on the impact of price transmission in farmer's production, selling and buying activities. These needed further investigation in order to gain a wide understanding of the maize market. Furthermore there was limited research on the impact of factors such as physical barrier, infrastructural gap, together with remoteness and access to agriculture information to farmers. A study on complexity of integration across space taking an account of farmers WTP to improve quality of road infrastructure and access to price information is of economic value.

Institutions help to choose an appropriate behaviour or preferences in a given situation. Farmers who are take decisions on the production and marketing practices do operate in an institutional environment, formal and informal. However, earlier research to estimate preferences (WTP/WTA) of farmers using non-market valuation methods has ignored the relevance of institutions. This work fills that gap by examining how farmers' WTP for improved road infrastructure and access to information differ with the institutional environment in Tanzania. The knowledge gained from this study as well as the findings provide policymakers, Tanzanian government and interesting donor agencies with a guide to decision making and policy formulation such as:

- The four markets are integrated with long run relationship in relation to Dar es Salaam. The difference in price with Dar es Salaam is mainly associated with transportation costs and distance travelled thus there in a need to improve the transport infrastructure.

- There is a need for the government to reorganise and invest in agriculture services to improve market efficiency.

- Farmers are willing to pay for agriculture services provided that the information provided that information about fund management will be available to them.

- Factors like age, education, and access to credit affect farmers WTP that there is a need to invest in education and credit institutions

- Time spent to access information, distance to market, costs associated with transport and access to information influence farmers WTP

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