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Urban Agriculture and the Use of ICTS in Accessing and Disseminating Livestock Husbandry Information in Urban Areas of Tanzania. A Review of Related Literature.

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ABSTRACT

This review summarizes relevant research on the relevance of urban agriculture and how best various Information and Communication Technologies (ICTs) can be used in accessing and disseminating livestock husbandry information, in order to improve livestock husbandry practices in urban areas. Specifically, it reviews studies that have been conducted in relation to urban agricultural practices, the challenges of keeping livestock in urban areas and the solutions to overcome the challenges of urban livestock keeping. The review also discusses the extent of ICT integration in agriculture from a global perspective and specifically in Africa and Tanzania. The review focuses on the information needs of urban livestock keepers and the challenges encountered in using various ICTs in accessing livestock husbandry information. This review reveals gaps in the literature and recommends on possible ways forward that relevant stakeholders may take to address these gaps.

***Keywords:** Urban agriculture; ICTs; Livestock husbandry; Livestock information; Urban areas; Literature review*

1.0 INTRODUCTION

Livestock production is one of the major agricultural activities in Tanzania. The sub sector contributes to national food supply, converts rangelands resources into products suitable for human consumption and is a source of income both to the farmers and to the country. It provides about 30 per cent of the Agricultural Gross Domestic Product (GDP). Out of the sub sector's contribution to GDP, about 40 percent originates from beef production, 30 percent from Milk production and another 30 percent from poultry and small stock (URT, 2007). Approximately 99 percent of the livestock in Tanzania belongs to small scale livestock keepers with big ranches and dairy farms constituting the remaining one percent. In Dar-es-Salaam urban farming is the second largest employer after petty trade and labor, and 74 percent of urban farmers keep livestock. Urban livestock keeping in Tanzania is regulated in practice and is commonly practiced as zero-grazing, as required by the by-laws of urban livestock keeping (Jacobi et al, 2005). Development of the livestock sector, therefore, could contribute to reducing poverty level substantially. The governmental development strategy to increase livestock production and productivity sector falls into the broader National Strategy for

Agricultural Development. The main objective is the promotion of a market-driven livestock sector able to support the income levels of the poor livestock keepers (URT, 2005).

FAO (1998a) defines an urban livestock system as a form of livestock keeping that is concentrated in and around cities, as opposed to rural livestock keeping that is concentrated in rural areas. In this study, the term 'urban' has been defined as a geographical location found in a city or town. The term 'peri-urban' has been defined as an area that immediately surrounds the city or town. 'Urban livestock keeping' in the context of this study is defined as the keeping of livestock in and around cities and towns (refer section 1.7 in this thesis). Since 'peri-urban' is an area that immediately surrounds an 'urban' area, then the definition of 'urban livestock keeping' comprises the definitions of both urban and peri-urban areas. According to FAO (2007), an urban livestock system is therefore characterized by a large variation of livestock systems that occur in and around densely populated areas and that strongly interact with the surrounding wealthy as well as poor human communities in different ways, at several levels of system-hierarchy and with nearby and distant rural areas.

In nearly all developing countries, urban livestock keeping is becoming increasingly important, as urban demand for animal products rises. The demand for information on livestock production is also growing, both in the sense of demands expressed by the producers themselves, and in the more general sense of a growing potential for increasing production through the delivery of information (Morton and Matthewman, 1996). An effective and profitable livestock production cannot be achieved if information is neither available nor accessible to the livestock keepers. Information is very important because it will enable the livestock keepers to domesticate their animals in the most profitable way. This is emphasized by Brodnig and Mayer-Schönberger (2000) who reports that accurate and reliable information is a key element for sustainable development. Livestock keepers need information on livestock diseases, nutrition, treatment and control of diseases, breeding techniques and markets for their products, among many other information needs. These information needs may be grouped into five headings: agricultural inputs; extension education; agricultural technology; agricultural credit; and marketing (Ozowa, 1995). All this information has to be made available, accessed and used by the livestock keepers in order to increase productivity and hence improve their livelihoods. There are various ICTs that can be used by urban livestock keepers in accessing information as opposed to rural livestock keepers. Examples of these technologies include; telephones/mobile phones, television, radio and the Internet. These technologies can be very useful in providing various types of information to the livestock keepers depending on their information needs.

Research has shown that lack of access to information is one of the serious obstacles to development, including agricultural development. Livestock husbandry faces lack of research and services provision: information access and adoption of improved technologies is limited for small scale urban livestock keepers. This is made worse by the fact that existing services are not tailored towards their needs and circumstances (CIRAD, 2009). One of the coping strategies of this problem is the organization and networking among small scale urban livestock keepers to improve access to information and other services: urban livestock keepers should become more aware of the potential benefits of organization and networking as a means to access information and services and improve marketing strategies (Guendel, 2002). According to Munyua (2008), emerging technologies and new materials are key success factors in addressing the challenges of small-scale farmers. Information and knowledge are considered prime productive resources and play a key role in ensuring food security and sustainable development. Ramkumar (2005) reported that, dissemination of knowledge through appropriate delivery methods is important. Although modern telecommunication systems have made rapid progress, the benefits have yet to penetrate to small scale livestock owners. Kapange (2002) has reported that, ICTs are crucial in facilitating communication and access to agricultural information. Since agriculture is the national priority sector, it is one of the potentially beneficial areas for the application of ICTs for economic transformation. Development of networks and use of low-cost ICTs enhance timely access to accurate and reliable information. It therefore calls for investment of part of the country's limited resources for ICT development.

2.0 LITERATURE REVIEW

2.1 Introduction

The literature review gives an overview of urban and peri-urban agriculture with emphasis on the importance and challenges of urban livestock keeping around the world and the actions that can be taken to deal with the challenges. The practice of urban and peri-urban agriculture in Tanzania is discussed with its policy and legal actions. The information needs of urban livestock keepers are discussed followed by the limitations of using extension services as the main information sources used by livestock keepers. Use of ICTs and the challenges of using ICTs in agricultural extension services are also discussed. The review looks into the ICT environment in Tanzania, followed by the different types of ICTs (i.e. radio/television, mobile phones and Internet) and how these are used in accessing agricultural information. Here, the literature review also discusses some of the ICT based initiatives in Africa and specifically in Tanzania and emphasizes on the potential contribution of ICTs in agriculture, economic development and poverty reduction. Finally, the review points out on the limitations of using ICTs and the factors influencing the use of ICTs in Africa in addition to the digital divide.

2.2 An overview of urban and peri-urban agriculture

Veenhuizen (2006) defines urban agriculture as the growing of plants and the raising of animals for food and other uses within and around cities and towns, and related activities such as the production and delivery of inputs, and the processing and marketing of products. Urban agriculture, which includes both crop production and livestock raising, has been recognized as serving an important role in the economic, social, and dietary life of many cities in Sub-Saharan Africa (UNCHS, 1996). Schmidt (2011) points out that, in addition to being an important source of fresh produce, meat, and dairy products for consumers, it plays a vital economic role as a source of income for producers and distributors and also serves a socializing function for farmers, communities, and neighborhoods. In addition, urban agriculture has a number of secondary impacts, including reducing food transportation costs and providing environmental benefits. Whether practiced at the subsistence level or undertaken as a way to supplement income by a professional, urban agriculture is a widely practiced, integral component of the urban environment.

Schmidt (2011) further argues that, until recently the main focus of agricultural development initiatives has been on rural areas with the view that improved food production in rural areas can supply the expanding urban population. This is especially true for livestock production which has received little attention from research and development initiatives in urban areas. According to ICT Update (2006), much of the agricultural policy community has for the most part focused on rural agriculture, but as many as 800 million people (most of them in the developing world) are involved in urban farming. Moreover, some 15% to 20% of the world's food is actually being produced by urban farmers. The poor in developing countries generally spend between 50% and 70% of their incomes on food. However, urban agriculture can produce significant reductions in household expenditures on food, and also open up opportunities for barter and selling surplus produce for cash. Although urban agriculture is often associated with uncontrolled activity, and governments too often have seen urban agriculture as a problem to be stamped out rather than encouraged, the practice thus should be a component of any strategy for poverty alleviation. Until recently, some few authorities have recognized the importance of urban agriculture as a productive sector. Many cities are now reassessing this attitude as they can see benefits for the environment, food security and poverty reduction (ICT Update, 2006).

According to FAO (1995), the status of peri-urban agriculture has changed from illegal to tolerated and only in recent years has peri-urban agriculture begun to receive attention from donors, researchers and development organisations as a new development strategy. Most of the existing peri-urban agriculture studies have focused on crop production in urban and peri-urban areas, leaving to one side the role of livestock production. Others have emphasised the

overall importance of peri-urban agriculture without distinguishing between crop and livestock production or social groups. Consequently, information on urban and peri-urban livestock production from a pro-poor perspective is limited.

2.2.1 Importance of urban livestock keeping

The functions and forms of urban livestock have changed over time, and after decades of neglect, the roles of urban livestock are now being recognized again by urban officials. Animals can be both a nuisance and a benefit, serving several direct and indirect functions in urban ecosystems, each with different priorities at household; city and national level (Schiere *et al*, 2006). Livestock keeping is recognized for the positive role that it can play in urban living conditions across the world (RUAF, 2000; Bakker *et al.*, 2000; Schiere, 2000). Livestock keeping is of economic importance, contributing, on average 14-30% of the agricultural GDP (FAO, 2006; NEPAD, 2006; UNSTAT, 2006; FAO, 2007). Livestock contribute to nutritional security through the provision of meat, milk and eggs and provide important farm inputs such as draught power and manure to sustain crop production for food and feed. Animals also serve as investment sinks and sources of cash income in times of need, as providers of transport for goods and services and are central to many socio-cultural events and ceremonies, (Asiedu *et al*, 2009).

According to Otte and Knips (2005), livestock production can contribute to poverty reduction in various ways. It can increase food supply, serve as a source of income and a means for capital accumulation, generate employment and supply inputs and services for crop production. Through increased livestock production many poor smallholders would have direct access to more livestock-derived food items (Neumann *et al*, 2003). Livestock and livestock products are the most important sources of cash in many smallholder mixed farming systems in Sub Saharan Africa. Sales of livestock products such as milk, eggs and fibre generate a constant stream of income and the sale of live animals, meat and hides produce substantial sporadic income. Livestock also contribute to the stability of the incomes of farm households as they act as a cash buffer (small stock), a capital reserve (large animals) and as a hedge against inflation (Slingerland, 2000). Sansoucy *et al*, (1995) states that in mixed farming systems livestock reduce the risks resulting from seasonal crop failures as they add to the diversification of production and income sources Livestock play a critical role in process of the agricultural intensification through the provision of draught power and manure. While draught animal use is declining worldwide this trend does not hold for SSA. Especially in areas where mixed crop-livestock farming is practiced, increased use of animal traction can help intensification and contribute to higher output. Sansoucy *et al*, (1995) further emphasizes that the integration of livestock and crops also allows for efficient recycling of crop residues and by-products as animal feed and the use of animal manure as crop fertilizer. Livestock farming, especially in the case of dairying, also generates employment.

2.2.2 Challenges in urban livestock systems and possible solutions

Despite the importance of keeping livestock in urban areas, there are several problems and challenges posed by urban livestock keeping. Ishani (2007) states one of the challenges as poor livestock management practices by livestock keepers leading to community health risks. Environmental risks associated with animals allowed to roam freely and due to large amounts of waste generated and left haphazardly is another challenge of livestock keeping. The third challenge is enforcing of by-laws and regulations due to outdated by-laws governing urban agriculture and poor co-ordination amongst the various concerned Ministries and the Local Authority. According to Guendel (2002), some of the weaknesses and constraints that affect urban livestock keeping are as follows;

- i) Inappropriate waste management; there is strong evidence from all the case studies that animal waste disposal in its current form causes environmental and public health problems, which will become even more severe as urban livestock numbers increase.
- ii) Water availability; at present urban livestock keeping competes for water resources with humans as the demand for water for this activity is not taken into account by the supply services. In many slum areas municipal water has to be bought and, therefore, other water sources, which are often contaminated, are accessed for livestock.
- iii) Poor livestock health and high cost of veterinary services; case studies show that animal health is often poor due to inadequate husbandry practices. Poor livestock keepers seldom vaccinate their livestock, especially smaller species such as goats, sheep and chickens. Due to the high cost of veterinary services and livestock drugs treatment is sub-optimal.
- iv) Feed availability and quality; feed availability is a particular constraint for larger livestock species such as cattle, which are usually zero-grazed. Feed quality is a problem for free-roaming livestock as there is no, or very limited, control over feed sources.
- v) Low production levels; due to limited feed availability, poor quality and poor management practices the production level of livestock is generally low.
- vi) Poor networking and organization among poor livestock keepers; poor livestock keepers are not organized and can, therefore, not express their demands in a concerted way.
- vii) Lack of research and services provision; information access and adoption of improved technologies is limited for poor urban livestock keepers. This is made worse by the fact that existing services are not tailored to the needs and circumstances of the poor (e.g. extension services and training courses promote species which are less relevant for the poor).
- viii) Limited knowledge of livestock husbandry practices; as information sources and advice services are lacking, poor livestock keepers often have limited knowledge of livestock husbandry practices.

Furthermore, Shiere *et al* (2006) state that, animals near homes and workplaces may be a nuisance to neighbors (odour, noise), clog sewage systems, cause traffic problems and/or contaminate water sources (UNDP, 1996). They may also cause pollution, disease and inequality by increasing the workload of women and children.

There are however possible actions that can be taken to minimize the challenges. One of the solutions is engaging stakeholders through multi-stakeholder forums which include the community, government, market sectors and others such as academics, research organizations amongst others. Another approach is carrying out research on current and other unknown situations such as the prevalence of zoonotic diseases amongst the livestock keepers. Production of relevant knowledge on livestock management practices and training livestock keepers on proper livestock management practices is another possible solution in addition to dissemination of knowledge produced to relevant stakeholders. Another action is using a multi-stakeholder approach of involving the government, community and others in the formulation of policy governing urban agriculture so that the activity is both enabling and regulative. The last but not least action is to ensure that urban plans incorporate urban agriculture and that all arms of the government are involved (Ishani, 2007). Despite the challenges, urban livestock keeping is on the increase and cannot be ignored. We must work together to maximize its strengths and opportunities, minimize its constraints and weaknesses and thereby provide a better quality of life for all (Richards and Godfrey, 2003).

2.3 Urban agriculture in Tanzania

In Tanzania, urban agriculture is very common and involves the raising of livestock and the cultivation of crops in and around towns or cities. Urban agriculture is under-taken for both subsistence and commercial purposes and has evolved to the point where it is regarded as a survival strategy for the urban poor and an economic imperative for wealthier households. It is seen as especially important for low-income households and for female-headed households in particular (Foeken, *et al*, 2004). Urban agriculture in Tanzania is practiced in a generally favorable political and legal context. At the ministerial level, urban agriculture has been partly encouraged by agricultural extension officers who offer non-formal education to urban dwellers. In a bid to encourage urban dwellers to produce own food, the government set up an urban agriculture extension service in the 1970s under the Ministry of Agriculture and Food Security (MAFS). Currently, MAFS uses its urban-based Agriculture/Livestock Extension Agents (ALEAs) who work in towns to promote the raising of livestock and growing of crops. ALEAs visit urban dwellers and impart modern skills and knowledge (non-formal education) about agriculture so that the farmers' production will increase (Mlozi, 2003).

The National Human Settlements Development Policy of 2000 of the Ministry of Lands and Human Settlement Development says that “Urban agriculture exists in most urban areas both in the developed and developing countries. As an economic activity, it provides income and employment opportunities to the urban populations, and a reliable supplementary source of food supply to urban dwellers at affordable prices.” It further states that “although urban agriculture is considered an important component in sustainable development, improperly practiced urban agriculture conflicts with other urban land uses and leads to land degradation, water pollution, and is a threat to health and safety.” As a policy statement, the government shall therefore:

- i) Designate special areas within planning areas whereby people will be granted legal rights to engage themselves in agricultural activities
- ii) continue to regulate and research on the conduct of urban agriculture and will ensure that it does not disrupt planned urban development
- iii) review existing laws to facilitate planned urban agriculture
- iv) facilitate the construction of appropriate infrastructure to mitigate/prevent land degradation, water pollution, and health and safety hazards in areas whereby urban agriculture is permitted (URT, 2000).

2.3.1 Legal and policy aspects of urban agriculture in Tanzania

Currently, Tanzania has no national policy for urban agriculture. As a result, the various ministries that deal in some way with agriculture do not have a common reference point from which to craft policies and regulations related to or affecting urban agriculture. The legal environment at the local level for urban agriculture is also somewhat ambiguous partly because of inadequate knowledge and understanding among residents and decision makers of the role of urban agriculture (Schmidt, 2011). Foeken (2004) states that, both the national government and the urban authorities in Tanzania generally support urban agriculture. This positive attitude dates from the 1970s and 1980s, a period characterised by a poor economy and food shortages. To enhance the food-security situation, government and political leaders time and again told urban dwellers to produce their own food and raise livestock in their backyards and on open spaces (Mlozi 2001a). Since then, several laws and regulations have been launched, which can be seen as recognition of the sector but, at the same time, as an attempt to control it. For instance, the 1997 Agricultural and Livestock Policy observes that ‘agriculture is not a principle function of towns but when properly organized, it has the potential to provide employment, income and is a complementary source of food supply’ (Kitilla 2001: 79).

According to Jacobi *et al* (2005), urban agriculture in Dar es Salaam has received attention on various policy levels and is somehow accepted as a feature in the city. The recognition of urban agriculture is reflected in several laws and regulations like the Local Government Act (Section

80) of 1982, the Town and Planning Ordinance (CAP 378, 1992) and the Agricultural and Livestock Policy by the Ministry of Agriculture and Cooperatives (MoAC) 1997.

The following guidelines are given (1992):

- i) Urban farming means the carrying out of plant and animal husbandry activities within statutory township boundaries.
- ii) No person shall occupy or use more than three acres of land for urban farming.
- iii) Only zero-grazing is allowed and the number of cattle is restricted to four cattle per person.
- iv) Any farming activity which is deemed to constitute a nuisance in the form of noise or smell or pose a physical danger to the safety of the public shall not be permitted in areas other than those zoned for urban agriculture.

The National Livestock Policy states that there are several laws and by-laws applicable in the livestock industry (URT, 2006b). Some of these laws are outdated and sometimes overlap, resulting in costly institutional and management arrangements. Schmidt (2011) emphasizes that these by-laws which have never been amended or updated to reflect current conditions or issues, such as water pollution, present a number of issues. First, they are ambiguous. It is unclear, for example, which animals are permissible. It is also unclear whether the by-laws refer only to the urbanized areas of the city or to peri-urban areas as well. In addition, the procedure for obtaining permits is not explained. Second, some of the by-laws fail to account for the specific needs of farming in urban areas. For example, the livestock limitation of four animals does not necessarily make sense, and it has been suggested that these regulations should vary according to species type and population density. Jacobi *et al*, (2005) states that, urban livestock keeping is clearly permitted, but regulated in its practice. Despite the detailed regulations, authorities are not very strong in enforcing these by-laws. Especially livestock keeping is widely practiced, often not following the rules and causing complaints of authorities and city residents

2.3.2 Peri-urban livestock keeping in Tanzania

According to the National Livestock Policy of 2006, this type of farming refers to keeping livestock in peripheries of urban centres. Currently, peri-urban livestock farming is being practiced in all towns and cities in Tanzania. Types of livestock kept under this system include dairy and beef cattle, poultry, pigs, chicken and pets. This type of production system if promoted has the potential to provide employment, income and supplementary source of livestock products to town dwellers. Peri-urban livestock farming is constrained by inadequate land, insufficient supply of quality stocks and inputs, conflicts among communities, inadequate expertise, pollution and unorganized markets. The Policy further states that the main objective is to promote peri-urban livestock farming in order to provide employment, improve household

income and food security. Peri-urban livestock keeping is governed by the following policy statements;

- (i) The Government will strengthen technical support services and promote peri-urban livestock farming.
- (ii) The Government will encourage and support peri-urban livestock farming that is environmentally friendly (URT, 2006b).

2.4 Information needs of livestock keepers

Case (2007) defines information need as a recognition that individual knowledge is inadequate that satisfy an intended goal. This inadequacy influences the way individuals seek for information. A study by Kalusopa (2005) revealed that livestock keepers have several information needs. Information needs of livestock keepers can be grouped into dairy management, poultry management and technology depending on the type of livestock that they keep. Dairy farmers need information related to milk processing, housing and environment, building materials and equipment, feeds and feeding, food preservation, feed additives and dairy products. Most livestock keepers needed information on disease control. The survey also revealed that, poultry farmers needed information on poultry management, poultry equipment and accessories, hatching equipment, feed equipment, feed storage, feed manufacturing machinery, product handling/transport equipment, quality testing equipment and energy saving equipment. Livestock keepers in urban areas need information on how to prevent environmental pollution by their animals, in addition to other information needs. Urban livestock keepers need to seek for information from various sources in order to satisfy their needs.

2.5 Information sources of farmers and their limitations

2.5.1 Agricultural extension services

Extension service is the ongoing process of transferring useful information to the people and then assisting them to acquire the necessary knowledge, skills and attitudes to utilize effectively this information or technology (Sasidhar and Sharma, 2005). In most developing countries, farmers largely depend on agricultural extension services as their main sources of information. These services are usually offered freely by the government through extension officers. Kalusopa (2005) argues that, the government extension services provide relevant information for farming activities and most farmers still rely on indigenous farming methods due to lack of reliable information delivery systems. According to Kalusopa, the farmers rely on local groups, relatives and personal experiences in their farming activities.

The objective of Agricultural extension in developing countries including Nigeria is to improve the productivity and livelihoods of rural farmer and their families. The important task of

extension is the exchange and sharing of information knowledge and skills (Sanusi *et al*, 2010). Extension therefore is essentially a communication process whereby various participants are linked to exchange information and is a critical requirement for sustainable development. The paradigm shift in participation and sustainability coupled with revolution in the information and communication, technologies has provided opportunities for extension and rural communities to move into the information age (Arokoyo, 2003). However, in developed countries such as United States of America (USA) and Europe, agricultural information is becoming a price-tag commodity and is increasingly fee-based, with the private sector taking a greater role in information transfer (Rivera, 2000). Various studies have shown that farmers view extension officers as important sources of information (Mgeni, 1978; Isinika and Mdoe, 2001). The role of extension officers is to reach out to farmers through extension services such as; visits to individual farmers, demonstration/on-farm trials, agricultural exhibitions, radio and television programmes and printed materials carrying agricultural messages (Matovelo, 2008).

Benor (1984) describes livestock extension as an activity that relates to the process of carrying the technology of animal husbandry to the livestock owner to enable him/her to utilize the information in making appropriate decisions to improve the production of animals and thus improve his / her economy. Livestock extension services seek to impart the necessary skills to the farmers for undertaking improved animal husbandry operations, to make available timely information and improved practices in an easily understandable form suited to their level of literacy and awareness and to create in them a favorable attitude for innovation and change. According to Samanta (1993), extension service is the central mechanism in the livestock development process, both in terms of technology transfer and human resource development.

2.5.2 Limitations of agricultural extension services

Over the years agricultural extension services in Africa have either collapsed or failed to operate altogether. Where they operate, they have not effectively and efficiently addressed the problems of small-scale farmers (Munyua, 2008). According to Matovelo (2008) extension services have their own shortcomings in that they tend to be package oriented in solving farmers' problems. These approaches tend to assume that farmers are homogeneous in terms of their needs, priorities, abilities and attitudes towards farming activities. Relying on extension agents as main sources of information has also contributed to a delay in innovation diffusion since most farmers do not meet the extension agents for long periods of time. This is because of the shortage of extension agents who cannot visit all the farmers on time. Mathewman and Mortan (1995) emphasizes that, extension services are expensive in that it costs a lot of money to produce and print extension materials and to train a whole chain of extension personnel to understand the new technology and to answer the possible queries from the farmers. Extension services are also time consuming because, for a message to pass from a source (research

station or university) to the farmers, it involves many actors to understand and deliver the message to next layer; the process takes lots of time and efforts.

2.6 Use of ICTs in agricultural extension services and their challenges

Agricultural extension, which depends to a large extent on information exchange between and among farmers on the one hand, and a broad range of other actors on the other hand, has been identified as one area in which ICTs can have a particularly significant impact. Extension agents as intermediaries between farmers and other actors in the agricultural knowledge and information system are especially well-placed to make use of ICTs to access expert knowledge or other types of information (CTA, 2003). According to Gakuru *et al*, (2009), ICTs have become increasingly integrated into the dissemination of agricultural information throughout Africa. Traditional forms of ICTs such as radio and television have become more prevalent in advisory service provision by producing programmes that feature agricultural information. National ministries of agriculture have attempted to integrate ICTs into the delivery of information and have established district information centres providing agricultural information. Many NGOs and research organizations have also attempted to facilitate technology transfer in the agricultural sector. Munyua (2008) states that currently, most agricultural information is provided by extension workers but unfortunately, the number of extension workers has been going down while that of farmers has been growing, hence the need for innovative information systems to address this gap. As a result there has been a shift in the extension process and focus is now on the facilitation of information, knowledge, communication and advocacy services and providing broader services that improve livelihoods. An appropriate blend of ICTs could be used to free time for extension workers and cut down the number of change agents required and the associated costs, thereby freeing resources to implement activities that directly impact on production, productivity and marketing agricultural produce by small-scale farmers.

The diffusion of ICTs in the agricultural sector provides the necessary digital opportunities for productivity increase, income generation, decrease in regional disparity, and improving their linkages with the market (Ratna, 2008). There are several initiatives in Africa that employ ICTs in offering extension services and training to small-scale farmers. Munyua (2008) cites several examples of such initiatives that have employed ICTs to restructure extension services in Africa include; the Machobane Farming System (MFS) in Lesotho, the Agricultural Technology and Information Response Initiative (ATIRI), and the Linking Local Learners (LLL) initiative in Kenya, the Virtual Extension Research and Communication Network (VERCON) in Egypt, the National Agricultural Advisory Services Programme (NAADS) in Uganda, the Agricultural Research and Extension Network (ARENET) in Uganda and the District Agricultural Training and Information Centres (DATICS) in Uganda. Although several ICT projects in Africa have been established to fill

the gap, most of these initiatives are web-based. Seeking information from these and other platforms becomes a difficult task for the illiterate farmers as it entails going through many publications or surfing a large number of web-pages. Web-based solutions also bring challenges because Internet infrastructure in Africa is still very sparse. Nevertheless, these are very useful resources and all that is needed is to provide an easy way for the farmers to navigate them. The use of mobile phones and SMS are examples of solutions that should find more use as they offer easy accessibility. However, SMS carries only a limited amount of information and requires a basic level of literacy (Gakuru *et al*, 2009).

2.7 The ICT environment in Tanzania

The Tanzania ICT Policy of 2003 states that Tanzania has made a remarkable progress in deploying ICT; access of technologies such as Internet, computers, satellite, radios and mobile phone has been growing fast in the past 10 years in Tanzania (URT, 2003). Despite the rapid improvements, Tanzania's ICT environment is still somewhat challenged. Gillwald (2005) has reported that ICT is concentrated in Dar es Salaam, the commercial capital with little deployment or access in other urban centers or in rural Tanzania. About 10 percent of Tanzanians own mobile phone, 17 percent of Dar es Salaam population, 10 percent of other urban areas, and 4 percent of rural population.

The telephone services were very unreliable in 1990s in Tanzania. The fixed telephone provided by Tanzania Telecommunication Company (TTCL) gave services in capital cities and had a slow expansion (Isamuyo, 2006). The Government of Tanzania introduced liberalization of the Telecommunications Sector in 1994 following the dissolution of the then Tanzania Posts and Telecommunications Corporation (TP&TC) into two independent bodies namely; Tanzania Telecommunication Company (TTCL) and Tanzania Postal Corporation. Later in 2003 the Tanzania Communications Regulatory Authority (TCRA) was established which merged the Tanzania Communications Commission and the Tanzania Broadcasting Commission (Mutagahywa *et al*, 2006). Availability and accessibility of telephone service has improved significantly in both urban and rural areas resulting into increase in penetration from less than 1% in 1990's to over 30% by December, 2008 (TCRA, 2008).

According to Swarts and Wachira (2010), Tanzania accounts for 5% of the mobile phone users in Africa and is ranked fourth after Nigeria, South Africa and Kenya. The domestic fixed-line telephone network is less than one connection per 100 persons while the mobile-cellular service, aided by multiple providers, is increasing. Like most of the African countries, Tanzania has recorded exponential growth in mobile phones while the growth in fixed lines has been minimal in comparison. The Director General of TCRA (Prof. John S. Nkhoma) reported that; "We (Tanzania) have experienced high growth of numbers of connected telephone subscribers

from 300,237 in the year 2000 to over 20 Million subscribers today, most of whom are young and live in urban areas. There are over 50 Postal/Courier Service providers compared to 13 in the year 2000. We have 60 Radio Stations and 20 Television Stations currently operating compared to 14 and 10 stations in the year 2000 respectively.” (Majira Newspaper (2011), Calandro *et al* (2010)). According to Ngalinda and Mutagahywa (2005), access to the Internet and computers is extremely limited. Only 2% of people in Tanzania have email addresses, and most of these live in Dar es Salaam. More than three-quarters of those who have email addresses use free public accounts. Only 2% of all households in Tanzania have a computer, all in urban areas. Even then, a mere 15% of these are connected to Internet, and they almost exclusively live in Dar es Salaam.

Nielinger (2003) opines that Tanzania attempts to promote a deeper ICT diffusion and the government and other stakeholders have started to address the issue of ICT and development potentials of the technology in many different sectors. Government institutions, private companies, and academic institutions have made a step towards computerization of their respective business processes. For example the number of people accessing the Internet is increasing with time. Shoki (2010) reports that, there are more than 300 Internet cafes in Dar es Salaam alone and at least 20 in Zanzibar. This can be evidenced by the increase in the number of Internet cafes especially in Dar es Salaam as well as other urban areas like Mwanza, Mbeya, Arusha, Tanga and Dodoma (TCRA, 2010). Business process re-engineering is also picking up whereby many organizations have computerized their financial information systems, human resources information systems, academic information systems, and library information systems just a few to mention. Such remarkable improvements in ICT result from significant government reforms in the following areas: formation of Legal and regulatory framework, telecommunication sector liberalization, the emerging of private sector in ICT, partial Privatization of National Telecommunication Company (TTCL), removal of all taxes and duties on computers and peripherals, issuing of licenses to private data and services operators, establishment of Rural Community Telecentres in Tanzania and establishment of communications Converged Licensing Framework (i.e. converging Telecommunication and Broadcasting) opportunities that Tanzania can exploit towards meeting the Vision 2025 (Mutagahywa *et al*, 2006). The International Telecommunications Union (ITU) Secretary General (Hamadoun I. Toure) emphasizes that; “Today ICTs are powerhouses of the global economy and offer real solutions towards generating sustainable economic growth and prosperity. ICTs also act as catalysts in accelerating progress towards meeting the Millennium Development Goals.” (Majira Newspaper, 2011). In addition, the advent of the information society offers increased scope for ICTs to be used to uplifting the agricultural sector and thus address and enhance livelihoods (Stienen *et al*, 2007).

2.8 Different ICTs and their potential in promoting the growth of agriculture

ICTs can be effective means of disseminating to communities huge amounts of relevant information on markets, technology, prices, successful experiences, credit facilities, government services and policies, weather, crop, livestock and natural resource protection. The acquired knowledge and information can greatly impact on agricultural production and food security (Girard, 2003). Some of the emerging ICT applications in small-scale agriculture in Africa include market information system (MIS), databases, public access facilities and mobile applications. These modern ICTs could play a major role in communicating knowledge and information to agricultural communities, delivering education modules, accessing inputs, markets and market prices, credit, conducting business, facilitating networking and strengthening partnerships, scaling up inter-linkages of development interventions and increasing agricultural productivity. Media such as the Internet, web-based means, mobile telephony and computer-mediated networks among others are being used in a number of initiatives in Africa to provide development solutions (Munyua, 2008). Personal and community communications technologies tend to fall into three categories namely; radio/television, mobile phones and Internet-based Communications.

2.8.1 Radio and television

Padania and Silvani (2005) state that radio is one of the most important ICTs in many developing countries and should be included in any discussion about what kind of Information Society will contribute to achieving the Millennium Development Goals. One of the reasons why radio is often excluded from discussions about ICTs is because it has been around for so long. It is a traditional communication technology, perhaps not considered to be part of the new information revolution, yet it has many characteristics which make it as important as the Internet in providing access to information and a platform for interactivity. Padania and Silvani (2005) further argue that radio continues to have extremely wide penetration and reach, particularly in Africa, South America and parts of Asia. It is well-placed, even in more remote areas, to provide and interpret information in a relevant way for its listeners. Just as importantly, local radio stations can offer ordinary people a relatively low-cost way to participate in discussions about the local or global issues that are top of their own agenda. In fact, one of the most exciting information revolutions in the last 15 years is this radio revolution, which has swept through many parts of the developing world, and still continues today.

For many African farmers, the only source of information outside the community is the radio. Radio sets are relatively inexpensive and can be used in remote areas where electricity supplies are unreliable or even non-existent. Local radio also gives farmers a voice, enabling them to share their knowledge and experiences, and to acquire practical information that they can use

to improve their livelihoods. Traditionally, radio has been a one-way communication medium, where programme makers deliver information to their listeners. But in recent years the number of radio stations across Africa has grown rapidly (there are now more than 300 stations in Mali, 120 in Ghana and over 150 in Uganda) and new information technologies have become more accessible, providing many possibilities for developing more interactive, two-way radio communication for farmers (Rao, 2009). In Africa, there are initiatives that deal with information dissemination to farmers, an example of such initiative is the African Farm Radio Research Initiative (AFRRI). AFRRI is helping broadcasters to make programmes with information that is useful to farmers, and give farmers a chance to provide feedback on programme content. The Frequency Modulated (FM) radio stations, which are mostly private sector initiatives and are a result of liberalized airwaves in Africa, have become handy tools in improvement of small-scale agriculture in rural areas. These FM stations are being applied to facilitate access to markets, electronic trading and accessing up-to-date and timely agricultural and market information (Munyua, 2008).

In Tanzania, radio broadcasting is the main way of information delivery and source of entertainments that has succeeded to reach more than 85 % of the Tanzanians. Approximately 90 % of the television broadcasting services is available in big cities (Dar es Salaam, Mwanza, and Arusha); people in small towns have to use satellite dishes to receive television signals, which prevent a large number of people accessing the service due to high initial cost. The situation is worse for people living in rural areas as they lack off grid electricity and enough financial power to use other sources of energy like solar panels. Recently, Tanzania national television station (now TBC one) has started a program of building towers for television broadcasting in every region (some regions are ready) with the intention of providing terrestrial local coverage, this effort is expected to raise the number of people accessing television services although much has to be done in rural areas (Isamuyo, 2006).

According to the Tanzania Communications Regulatory Authority (TCRA), Digital Terrestrial Television (DTT) (or digital terrestrial transmission) refers to the terrestrial broadcasting of television in a digital format. Currently, terrestrial broadcasting in most African countries is in an analogue format. But more and more countries (including Tanzania) are in the process of planning and implementing migration from analogue to digital broadcasting. The main reason for the migration is to release valuable spectrum which can be used for other services. Spectrum is scarce, and hence making more efficient use of the spectrum available is necessary if more telecommunications and broadcasting services are to be made available on a terrestrial basis (TCRA, 2013). There are various radio and television programmes that can be accessed by livestock keepers in Tanzania. Examples of these programmes include:

- i. 'Kilimo bora' (a research based feature TV program meant for educating farmers on basic principles of agriculture - raising of crops and keeping of animals, soil treatment, pest management and alternative agricultural methods. It covers too the evaluation on implementation of agricultural policies, programs and projects. It is broadcasted by Star TV).
- ii. 'Inuka' (a radio programme for farmers and livestock keepers broadcasted by Radio Free Africa),
- iii. 'Makala ya kilimo' (a radio programme on agriculture broadcasted by TBC taifa radio)
- iv. 'Mfugaji wa kisasa' (a radio programme on livestock keeping broadcasted by TBC taifa radio and TBC one television)
- v. Participatory Agricultural Development and Empowerment Project (PADEP); a programme on agricultural development broadcasted by both TBC one television and TBC taifa radio).

According to Greenberg (2005), radio is unique in that it is relatively inexpensive to set up, it is estimated that more than 50% of all households in developing countries have ready access to radio receivers, receiving broadcasts does not require literacy, and it can use indigenous languages even if the population served is small. The cost of receiver batteries is its major limitation. Local radio can be an effective tool in community building, particularly for those who live in rural and sparsely populated areas. It has also proven effective at disseminating information about livelihoods (market prices, weather forecasts, healthcare, education and potential disasters). Although more costly to implement and less accessible to the poor, television can have similar characteristics to the radio. Its major limitations are availability of receivers, electrical power and coverage.

2.8.2 Mobile phones

In many parts of the developing world, mobile telephone communications are now widely available and can be accessed at modest costs. The ability to place a phone call can either avoid a time-consuming and potentially risky trip to the city, or by scheduling appointments, make the trip more effective. This can improve quality of life, reduce costs and reduce time spent away from food or income-producing activities. In areas where telephone service is available, studies have shown that a large percentage of the population will make a call regularly; entrepreneurs spring up and allow effective phone sharing. Short Message Service (SMS) where text messages can be sent via mobile phones is an added value service that can be very cost-effective, though literacy and the use of a language which the technology supports in written form limits accessibility to some of the users (Greenberg, 2005).

Nowadays, mobile phones have become the clear technology of choice for communication. SMS in particular has become an extremely important way to send and receive information.

These short and simple messages are convenient and affordable and, perhaps most important, they are (usually) free to receive. Another advantage of SMS is that it is possible to set up a system to deliver messages automatically to a large number of people at the same time. SMS is, therefore, an ideal way for organizations and businesses to reach their target audience, if they want to get a message across to people with limited or no access to the Internet. Farmers are now far better placed to receive accurate market information on their mobile phone. Small producers no longer have to accept the first price they are offered; with access to up to date market information, they can negotiate to try to get a better deal. They can also communicate with other farmers more easily, making it feasible for them to set up cooperatives that can explore new markets and sell their products to bigger buyers (CTA, 2009). The cellular phone is now considered one of the most promising emerging ICTs that has not only revolutionized the manner in which business is transacted in Africa but also enabled a large constituency of agricultural producers to access markets and market information using phone-in and Short Messaging Service (SMS). Some of the initiatives that use the SMS to access market information include DrumNet (Kenya) and MACE (Malawi), among others. Safaricom Limited and Celtel Limited have introduced direct money transfer by cell phone to transfer credit in Kenya (Munyua, 2008).

With the Enhancing Access to Agricultural Information project, which targets rural women farmers in northern Uganda, the organization uses SMS in combination with a number of other technologies and media including a website, community radio broadcasts and an information centre, the Kubere Information Centre. The project uses this range of technologies to deliver agricultural information to women farmers to help them improve productivity, as well as to provide regular, up-to-date market data to enable them to reach new buyers and thus increase their incomes. SMS messages generated by the participating organizations are translated into the local language, Luo, and sent to the farmers. The women are also able to use the SMS services to contact agricultural experts for advice and to share details about other available information sources (Achora and Ngolobe, 2009).

2.8.3 Internet-based Communications

World over, the Internet, e-mail, web-sites and web-based applications are becoming increasingly important for sharing and disseminating agricultural information and knowledge, marketing of goods and services and for trading purposes. In Africa, DrumNet in Kenya is developing a web-based system to facilitate small-scale farmers to access information, markets, credit, inputs and some trading transactions while Tradenet.biz in West Africa, Foodnet in East and Central Africa, KACE in Kenya and MACE in Malawi have developed electronic trading platforms (Munyua, 2008).

Based on Tanzania Communication Regulatory Authority (TCRA), the Internet industry in Tanzania is believed to have experienced an exponential growth in recent years. The industry has expanded and changed rapidly since the introduction of Converged Licensing Framework (CLF) in 2005 that took advantage of advances in technology, number and types of services provided in the market and growth of Internet usage. The number of Internet users in Tanzania is said to have increased from 5% in 2005 to 11% by June 2010. A rapid technological change in electronic communication including usage of mobile handsets for Internet access is another factor which has contributed to the registered increase of Internet penetration in Tanzania (TCRA, 2010). Access of Internet services including emails and peer to peer communication has been widened in urban areas through the introduction of Internet cafes (Isamuyo, 2006). A recent study conducted by Tanzania Business Times shows that thousands of people flock into the Internet cafes everyday to surf the Internet and read their e-mails. As a result of the growing demand of these services, Internet cafes have been mushrooming all over the country (Shoki, 2010). Isamuyo (2006) states one of the limitations of Internet use in Tanzania as the use of English in most web contents, which is a language of elite in Tanzania. Currently, about 70 per cent of all Internet content is in English and only 12 languages out of the world's 6,000 or so accounts for about 98 per cent of the total web content. Swahili language, which constitutes over 80 per cent of the local media and public information contents in Tanzania, is not among the 12 languages. In other words, Swahili is among more than 5,900 world languages, which constitutes only two per cent of the Internet content. Isamuyo (2006) further narrates that Swahili is the official national language of 122 tribes of Tanzania, and over 95 percent of the population can only speak, read and write in either Swahili or tribal languages and hence cannot comprehend most of the contents in the Internet even if they get access to it.

ICT projects in Tanzania also face the common problem of low capacity and costly Internet connectivity. Today, TCRA has licensed less than a dozen companies to provide public data communication services including Internet bandwidth. Many Internet Service Providers (ISPs) in Tanzania still rely on Public Switched Telephone Network (PSTN), VSAT and Microwave networks to provide Internet services (Materu-Behitse and Diyamett, 2010). According to the current National ICT Policy of Tanzania, these data operators have isolated initiatives of connecting their Points-of-Presence (PoPs) to the global Internet backbone. As a result, Tanzania lacks cheaper and high capacity connections to the global Internet (Centre for Science, Development and Media Studies, 2008).

The Web's enormous amount of information and knowledge does not correspond to the needs of the majority of the population. Different countries have different needs and a diversity of cultures and problems that need specific approaches, especially in developing countries. There is therefore a need to invent and multiply mini-networks, small geographical webs or local

community networks to make the Web really wide and useful for the majority of the people in the world (Girard, 2003). Internet-based communications and particularly e-mail serve similar purposes to those discussed for the telephone. The high cost of communications and the lack of skills is a major barrier to wide use, in addition to unreliable electrical power (Greenberg, 2005).

2.9 Agricultural information delivery ICTs Initiatives in Africa

Market information services are now helping farmers in ACP (African, Caribbean and Pacific) countries by delivering the information they need to build their businesses. There are several initiatives that have continued to innovate and develop these services. One such initiative is the Senegalese company (Manobi) which is delivering agricultural market information throughout West Africa. Manobi has developed a system that collects data in real time and makes use of Internet and mobile technologies to follow the daily price fluctuations and deliveries of produce to markets. Throughout every step of production farmers get information on a whole range of topics from access to credit and supplies (seeds, pest control, fertilizers) to contact with extension services, pricing details, processing and packaging (Annerose, 2009). Like Manobi, the Kenya Agricultural Commodity Exchange (KACE) realized that farmers need more than simple market information; they need to connect to other businesses involved in bringing their products to market and to consumers. In other words, the farmers need to become part of the market supply chain. KACE helps to link farmers, companies and markets through a network of franchised market resource centres (MRCs). The centres provide KACE with up-to-date market data, which is then distributed via SMS to farmers. The MRCs also offer on-site Internet, email and phone facilities. Also in Kenya, DrumNet operates a network of information access points or 'info-kiosks' that offer marketing, financial and information services for farmers. Each info-kiosk is equipped with an Internet connection, a computer and mobile phones, and is connected to a hub in Nairobi. There, information from around the country is aggregated in a central database and is then distributed to the info-kiosks and to the farmers by SMS.

Similar services are currently operating elsewhere in East Africa. These include the Farmers' Information Communication Management (FICOM) project, which began by supporting dairy farmers in Uganda, and FoodNet, which delivers market information via mobile phone and FM radio broadcasts. In West Africa, BusyLab, a group of Ghanaian software developers, launched TradeNet (now known as Esoko), a service that allows farmers to send SMS messages advertising their products. The messages are published on the web and are sent via SMS to subscribers who may be interested in those products. The advantage of this service is that the information reaches a broad audience (anyone with access to the Internet) thus encouraging cross-border trade between neighbouring countries and even other continents (CTA, 2009).

In Tanzania, there are several ICT projects which deal with collecting and disseminating agricultural information, most of which target the rural farmers. Crops Marketing Bureau (CROMABU) is an example of these projects which gathers and disseminates relevant information regarding crop prices in local and international markets. The project is aimed at empowering small scale farmers by enhancing their access to price information and insights in trade flow (Menda, 2005). LINKS (Livestock Information Networking and Knowledge System) is another ongoing and expanding regional linked livestock marketing information project that is geared towards addressing the needs for timely and reliable livestock marketing information or producers, traders and policy makers in the livestock sub-sector. Gakuru et al, (2009) point out the Agricultural Sector Development Programme (ASDP) as another project in Tanzania aimed at enabling stakeholders in the agricultural sector including ministries, local government authorities, processors, marketers, service providers and farmers to communicate better and more effectively, through mobile telephones and computers linked to wide area networks (WAN) and the Internet. First Mile project is an initiative of the Tanzanian Government's Agricultural Marketing Systems Development Programme (AMSDP) to help farmers improve their bargaining position in the market place by strengthening their capacity to identify market opportunities, to negotiate prices for both buying and selling and to have a say in policy making. The essence of all these projects is to enable farmers especially in the rural areas to acquire the necessary marketing information.

2.10 The contribution of ICTs in economic development and poverty reduction

2.10.1 Role of ICTs in Small and Medium Enterprises (SMEs)

ICTs can help address many of the challenges to the creation and growth of SMEs. They can make them more efficient both by the direct impact of technology on production processes and business practices and by access to global best practice. They can broaden their access to markets, to suppliers, to domestic and international business partners, and to sources of capital. They can improve their access to customers and make it easier for existing customers to interact with them. In all these ways, ICTs can help SMEs serve as an engine of jobs and growth in developing countries (McNamara, 2003). Generally, more complete and current information about prices at market can help small scale farmers and fishers secure better prices for their goods and the ICTs can increase their access to this information in a timely fashion. (Hewitt de Alcantara, 2001).

The Tanzanian ICT Policy points out ICT as one of the key pillars of socio-economic development of any country. However, to exploit the full potential of ICTs, access to networked resources must be made available to a bigger segment of the citizens. This is equally true for developed and developing countries (URT, 2003). Research findings have clearly indicated that there is a

direct link between socioeconomic growth and per capita vis-à-vis Internet penetration (Accenture 2001). ICTs are now widely believed to have a significant part to play in promoting social and economic development, including the improvement of individual livelihoods, community prosperity and the achievement of national development goals related to the UN Millennium Development Goals (Souter *et al*, 2005).

2.10.2 ICTs and poverty reduction

Poverty is not just a case of low income, but also a lack of access to health care, schools and social security. Other factors include exposure to violence, injustice, and powerlessness and uncertainty in the face of unexpected situations like sickness, accidents and natural catastrophes. Poverty has multiple and complex causes. The poor are not just deprived of basic resources; they also lack access to information that is vital to their lives and livelihoods: information about market prices for the goods they produce, about health, about the structure and services of public institutions, and about their rights. They lack political visibility and voice in the institutions and power relations that shape their lives. They lack access to knowledge, education and skills development that could improve their livelihoods. They often lack access to markets and institutions, both governmental and societal that could provide them with needed resources and services. They lack access to, and information about, income earning opportunities (Marker *et al*, 2002).

There has been a strong belief in some parts of the development community that ICTs such as radio, television, telephone/mobile phones and the Internet can be effective tools and enablers for poverty reduction, (Harris, 2003). Despite this strong belief, large investments and encouraging evidence, there has been little readily hard evidence that the use of ICTs could be a significant contributor to poverty alleviation. In the cases where there has been some evidence of benefits from the use of ICT, there has been little indication that it could be cost-effective and scalable. Moreover, even when there is a good case for using technology, there is the background worry that funds could be better used satisfying some more basic need. Other development practitioners have felt that ICT is purely a tool for computerizing processes and has no relevance to poverty alleviation. Regardless of these points of view, the growing importance of ICTs in the developing world cannot be ignored (Greenberg, 2005).

2.11 Information-related challenges facing small-scale farmers in Africa

According to Munyua (2008), small-scale farmers in Africa are faced with many challenges that are related to lack of sufficient information on agricultural practices. These farmers have a weak knowledge-base. They practice subsistence agricultural production systems and use mainly traditional tools. They do not use adequate agricultural inputs which lead to declining agricultural productivity. Small-scale farmers have a poor market infrastructure and inadequate

marketing experience. The prices offered for farmers' produce are poor and there is poor access to credit and weak backward and forward links between agriculture and other sectors. Munyua (2008) further argues that there are challenges of food insecurity, poor storage facilities, inadequate value addition, natural resource and environmental degradation. Other challenges include poor extension services, poor access to agricultural knowledge, information and technologies and inappropriate technologies for the circumstances of farmers. Small-scale farmers are often threatened by globalization and unfair trade practices. Further, they are exploited by middlemen and lack subsidies.

2.12 Factors influencing use of ICTs in Africa

Obijiofor, et al (2000) states that, although there is perceived appropriateness of ICTs to African countries, a wide range of factors are identified as inhibiting the widespread introduction and use of the new technologies. These factors include: ignorance about the importance of and need for ICTs which makes even those rich enough to acquire them indifferent to ICTs; general poverty which leads to the perception of computers, for example, as foreign and luxury acquisitions; poor maintenance and repair culture in which spare parts and technical experts from the manufacturers are imported whenever the technologies break down; this leads to waste of resources, time and money. Obijiofor *et al*, (2005) further states other factors as poor infrastructural support base; examples include inefficient electricity and telephone systems; lack of support from the government leading to underfunding of science and technology programs in tertiary institutions; illiteracy and lack of basic computing skills; the absence of a culture of democracy, this feeds political unrest and the unwillingness of foreign investors to invest in the area of ICTs; and perception of the technologies (example, computer) as a status symbol or statement of one's hierarchy in society.

Despite the high potential of ICTs in improving small-scale agriculture in Africa, there are low usage patterns and unreliable adoption. This situation is mainly due to the fact that ICT initiatives are scattered and uncoordinated. Consequently, there is high cost of available technologies, inadequate infrastructure and ICT skills, poor and expensive connectivity, inappropriate ICT policies, language barriers, high cost of ICTs and telecommunication, low bandwidth, inadequate and/or inappropriate credit facilities and systems. Further, there is poor involvement of women and other disadvantaged groups, inadequate appropriate local content, weak institutions and inadequate collaboration and awareness of existing ICT facilities and resources, a poor information sharing culture and low awareness of the role of ICTs in development at all levels (Munyua, 2008).

2.13 The digital divide

The global disparities in access to the Internet and other ICTs have led to a digital divide between technological haves and have-nots (United Nations, 2006). The digital divide results from the socio-economic differences between communities, which in turn affects their access to digital information, mainly but not exclusively through the Internet. In developing countries in particular, there are tendencies of increased concentration of information flows to urban and central areas (Wong, 2002; Mwesige, 2004). Economically disadvantaged countries and rural and peripheral districts within these nations tend to fall further behind in human resource development as well as in economic progress and political participation. Even if the above presented access oriented definition is commonly used in literature and everyday discussions, the digital divide will not be understood if it is viewed purely as a technological phenomenon. A broader interpretation of the digital divide is necessary. Van Dijk (2006) claims that the term cannot be understood without addressing issues such as digital skills and cultural analyses of lifestyles and daily usage patterns. On the other hand, the great merit of the sudden rise of the term digital divide is that it has put the important issue of inequality in the information society on the scholarly and political agenda.

The digital divide is essentially a geographical division, and can be categorized as global, regional or national (Rao, 2005). The global digital divide is a term often used to describe disparities in opportunity to access the Internet between wealthy and poor nations, or between developed and developing countries. According to Wong (2002), the extension of infrastructure for the use of the Internet in developing countries has generally been much slower than in economically rich parts of the world. This is mostly due to low demand and thereby low profitability of ICT businesses. The disparity in the intensity of ICT adoption among countries is wider than the disparities in their GDP per capita, indicating that the digital divide is also increasing and likely to become even more severe in the future. At the regional level, Africa is in a particularly bad condition. According to the UN ICT Task Force (2002), the digital divide is at its most extreme in Africa, where the use of ICT is still at a very early stage of development compared to other regions of the world. Sub-Saharan Africa remains at the bottom of the list of developing regions in Internet usage surveys around the world. For instance, Sub-Saharan Africa had only one-third of the Internet penetration compared to North Africa or one-thirtieth of the European penetration (ITU, 2006). At the national level, there is an urban-rural digital divide. In developing countries, in particular, there are clear tendencies of increased concentration of information flows to urban and central areas (Wong (2002); Mwesige (2004); Rao (2005)). Economically disadvantaged countries and rural and peripheral districts within these nations tend to fall further behind in human resource development as well as in economic progress and political participation and thus widening the intra-country or national digital divide (Furuholt and Kristiansen, 2007).

2.14 THE RESEARCH GAP

This literature review has revealed the importance of ICTs in enhancing access and dissemination of agricultural information in Africa. Literature has also revealed that ICTs can be very important tools for access to relevant agricultural information if used effectively by targeted communities (for example, ICT initiatives like Manobi (Senegal), DrumNet and KACE (Kenya) and CROMABU (Tanzania)). The review has disclosed that in Tanzania there are various ICT projects in Agriculture but unfortunately, there is no clear evidence on how the farmers and especially the urban livestock keepers in particular have benefited from the projects (since most of these projects are located in rural areas). There is therefore a research gap in literature on the application of ICTs by specific communities in Tanzania and in particular the urban livestock keepers, and how these communities benefit from the ICTs. Further research needs to be done to assess the extent of use of ICTs by specific urban communities and the importance and associated challenges of using these ICTs in accessing and disseminating information.

2.15 SUMMARY AND CONCLUSION

This literature review has given an overview of urban and peri-urban agriculture globally, in Africa and in Tanzania. It has discussed the practice of urban livestock keeping around the world with emphasis to its role on urban livelihoods. The challenges of urban livestock keeping with their possible solutions have also been discussed. This literature review has cited examples on how different types of ICTs are used by various agricultural communities in different African countries (including Tanzania) to access and disseminate useful agricultural information. Literature has also shed some light on different ICT projects in Tanzania and other African countries that are intended to help the farmers (especially the rural farmers) to access and use agricultural information. The literature review has confirmed how farmers in different African countries e.g. Kenya, Uganda and Senegal have used and benefitted from different types of ICTs in accessing agricultural information and improving their agricultural activities, but there is still no sufficient evidence on how ICTs have been used by specific urban communities (e.g. the urban livestock keepers) to access information. This gap in literature calls for more research to investigate the extent to which specific communities in Tanzania benefit from the ICTs especially in urban areas where the ICT infrastructure is relatively well developed compared to the rural areas.

From this literature review, it may be concluded that the information needs of urban livestock keepers are vast and diverse depending on the type of livestock kept. The information needs include information categories on: diseases control and treatment, housing techniques, feeds and nutrition, markets and prices of livestock products, availability of loans, availability of good breeds, by-laws and biogas information. All this information is needed by urban livestock keepers in order to keep their animals in a more acceptable manner while abiding to the laws

and regulations of urban livestock keeping and protecting the environment. Urban livestock keepers also use limited sources to access livestock information including extension officers and local groups despite the fact that there are many sources like mobile phones, radio and television, the Internet, agricultural exhibitions, print sources and meetings/seminars. All these information sources can be very useful to the livestock keepers if the limitations of using the sources are taken into considerations and rectified.

RECOMMENDATIONS

Several recommendations have emanated from this literature review. These recommendations have been brought forward as means to increase networking between the urban livestock keepers and improve access and usage of information among them in order to improve the urban livestock keeping practice. Most of these recommendations are for the government bodies and policy makers to implement. These recommendations include the following;

1. Improving the use of radio and television in accessing livestock information

Since ICTs are important tools of accessing livestock information, it is recommended that the broadcasting media should increase the frequency of broadcasting relevant livestock programmes. These radio and television programmes should be advertised frequently to increase the awareness of the livestock keepers on the existence of the programmes. The programmes should also be improved in order to include simple and affordable techniques that are relevant to our environment so that the knowledge obtained from the programmes is applied by all the livestock keepers. The programmes should also be sustainable to enable the livestock keepers to continue learning and benefitting from the programmes. The livestock keepers should also be sensitized through extension services to use radio and television to access livestock information. Community radio and television that are specifically for farmers should be introduced. These will be very useful for the livestock keepers who will learn and benefit from the programmes.

2. Enhancing the use of mobile phones and Internet to access livestock information

Relevant government bodies (e.g. TCRA) in collaboration with mobile phone service providers in Tanzania (e.g. Vodacom, Airtel, Tigo and Zantel) and Internet service providers should take into consideration the possibility of starting up ICT projects in urban areas to help specific urban communities gain easy access to information (as in rural areas). This can be through sending relevant short messages to the urban farmers especially on availability of markets and current market prices of various livestock products on demand in urban areas like meat, milk and eggs. These projects will enable the urban farmers to access relevant information through their mobile phones at cheaper prizes. Relevant websites on livestock keeping should also be introduced and advertised so that the livestock keepers are aware of them. These websites

should be in Swahili language to enable many livestock keepers to benefit from them. The ICT projects can also provide computer and Internet skills to the farmers and extension officers; this will promote use of the Internet to access livestock information.

3. Promoting and improving the use of extension services

In order to meet the various information needs of the urban livestock keepers, it is important for the government to improve the extension services in urban areas. The number of extension officers in urban areas should be increased by the government. This will enable all or most of the livestock keepers to get the extension services which are a very important source of information to the livestock keepers. The extension officers should also be provided with incentives like communication and transport allowance to enable them communicate with the livestock keepers and visit them regularly. The extension officers should also be provided with IT skills; this can be facilitated by the government through provision of training opportunities and funding of the training; computers and Internet facilities should also be provided in government offices. All these efforts by the government will help in improving the services offered by the extension officers to improve the livestock industry.

4. Forming organizations for livestock keepers

Information networking among urban livestock keepers is a very important pre-requisite for easy information access and usage among them. This paper therefore recommends that urban livestock keepers should form small organizations in their areas (through supervision by the government extension officer); this will enable the extension/veterinary services to easily reach many livestock keepers and the livestock keepers will benefit from the extension services. Farmer organizations will enable the livestock keepers cooperate, share information and get treatment or vaccines in case of disease outbreaks; this will lead to control of many animal diseases. The organizations will also help the livestock keepers get and share grazing areas in which the livestock keepers can graze their animals together in one area rather than each livestock keeper grazing his animals on his own. The availability of these grazing areas can be facilitated by the government by setting aside grazing areas for urban livestock keepers which currently is a big problem. Through these organizations, the livestock keepers can also benefit by getting seminars or meetings where they can get a lot of information that will help them in their activities. Formation of organizations can also enable the livestock keepers to get markets for their products and secure loans that will enable them improve their activities.

5. Introducing livestock information centres

This paper recommends that information centres that provide relevant information on farming should be introduced in urban areas (in addition to public libraries). These information centres can help the urban farmers to easily get all the relevant information that they need. The

presence of these information centres can enable the livestock keepers access a lot of information without having to go to the libraries most of which are located far from most of the livestock keepers.

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