

Chapter 13

Adoption and Use of ICTs by Livestock Keepers for Improved Access to Livestock Information: A Case of Selected Urban Areas in Tanzania

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ABSTRACT

Information and communication technologies (ICTs) are very important tools for economic development and poverty reduction when used effectively by individuals in all economic sectors including agriculture. Urban livestock keepers need ICTs in their activities so that they can make informed decisions that can lead to improvement of the livestock industry. Despite its importance, ICT use is hindered by several factors including unawareness of the radio and television programmes and lack of computer skills. This chapter reveals the extent of use of ICTs by urban and peri-urban livestock keepers whereby different types of ICTs are used by urban livestock keepers to access livestock information, though some ICTs, for example, mobile phones are used more than other ICTs (radio and television). Internet is used by very few livestock keepers due computer illiteracy. Policy implications include improvement of the telecommunications services by the government through relevant bodies in order to facilitate more access to information through mobile phones, radio, television, and the internet.

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INTRODUCTION

The use of ICTs has increased dramatically since the 1990s; information can now be disseminated to different people more easily, faster and at a cheaper cost, regardless of the distance between the people. ICTs are often categorized based on how long they have been in common use, and to some extent the technology used for the transmission and storage of information. ICTs can be grouped as new (or modern), old (or traditional) and very old ICTs (Thioune, 2003). Computers, satellites, wireless, mobile phones, the Internet, e-mail and multimedia generally fall into the new ICT category. The concepts behind these technologies are not particularly new, but the common and inexpensive use of them is what makes them new. Most of these, and virtually all new versions of them, are based on digital communications. Old or Traditional ICTs include radio, television, fixed line telephones, and facsimile machines. These are technologies that have been in common use throughout much of the world for many decades. Traditionally, these technologies have used analog transmission techniques, although they too are migrating to the now less expensive digital format, which have been gradually ingrained in the daily habits and lives of people and communities. Newspapers, books and libraries fall into the very old ICTs category. They have been in common use for several hundred years.

In Africa, ICTs have a very great potential in enhancing access to agricultural information hence improving the agricultural sector. The ICTs have become important tools for recording livestock performance and production levels. Many commercial farmers in Africa run computer-based recording and management software that turns raw performance data into information that can be used immediately at the local farm level. In South Africa for example, most local livestock data is fed into a centralized information system called the Integrated Registration and Genetic Information System (INTERGIS), which sets national livestock productivity benchmarks, enables comparisons of all animals in terms of genetic potential, and provides policymakers and farmers with a reliable source of reference (Westhuizen, 2003). Farmers in Senegal are now better placed to receive accurate market information on their mobile phones. 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).

Various studies have indicated that ICTs have been used for accessing agricultural information in some East African countries including Kenya and Uganda (Ferris, 2004; Achora, 2009; Kiplagat, 2009; Gantt and Cantor, 2010). In Kenya, ICTs such as mobile phones have successfully been used by community animal health workers in disseminating information. The phones have enabled the animal health care service providers to keep one another updated on animal health issues and share information on availability of essential veterinary drugs. It has also contributed to a reduction in transaction costs (transport, time spent travelling and other miscellaneous costs involved in animal treatment), leading to increased access to and efficiency of animal health service delivery (Kithuka *et al*, 2001).

Background Information

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).

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. Kapange (2002) states that, 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.

MAIN FOCUS OF THE CHAPTER

Issues, Controversies and Problems

In Tanzania there is still no clear evidence on how ICTs such as mobile phones, radio, television and the Internet help the urban livestock keepers to access livestock information. Despite the relatively well developed ICT infrastructure in the urban areas, urban livestock keepers still lack adequate information on livestock keeping practices (CIRAD, 2009). This is because they mostly rely on advice services as

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sources of information which are usually insufficient (Gakuru *et al*, 2009). Lack of timely information is well known to be the largest constraint on small-scale agricultural production, a sector that provides livelihood for 70-80% of Africa's population. The lack of information leads to poor husbandry practices, which in turn leads to poor production. Other information-related problems that face the livestock sector in Tanzania include; poor husbandry practices (e.g. poor nutrition of the animals, poor housing and un-hygienic conditions), poor disease control measures and lack of markets for the livestock products. This situation could probably be improved by making use of ICTs to get the required information on time, hence solve some of the information-related problems the livestock keepers face in livestock keeping. Jensen (2002) and African Connection, Strategic Planning (2002) state that, with improved information systems, it would be easier to obtain much better market-related prices, sell their produce directly to distributors and negotiate for better prices. However so far, the potential for ICTs to impact this sector has not yet received much attention.

According to Schilderman (2002), ICTs have not played their role in getting the required information to the urban people (especially the poor), though it is generally believed that ICTs have great potential to significantly improve the urban people's access to knowledge and information. There is little scientific evidence in specific urban communities about the ways in which individuals and communities exploit access to ICTs and the impact they have on livelihoods in urban communities (Souter *et al*, 2005). A study by Chilimo (2009) reported that, despite the strong belief in the role of ICTs for socio-economic development, clear evidence on how ICTs can be used to achieve this purpose in the Tanzanian context is still lacking. This research therefore investigates the extent of adoption and use of ICTs by urban livestock keepers and thus contributes to knowledge on how these ICTs are used in accessing livestock information and thereby improving the livestock keeping practices in urban and peri-urban areas of Tanzania.

Conceptual Framework

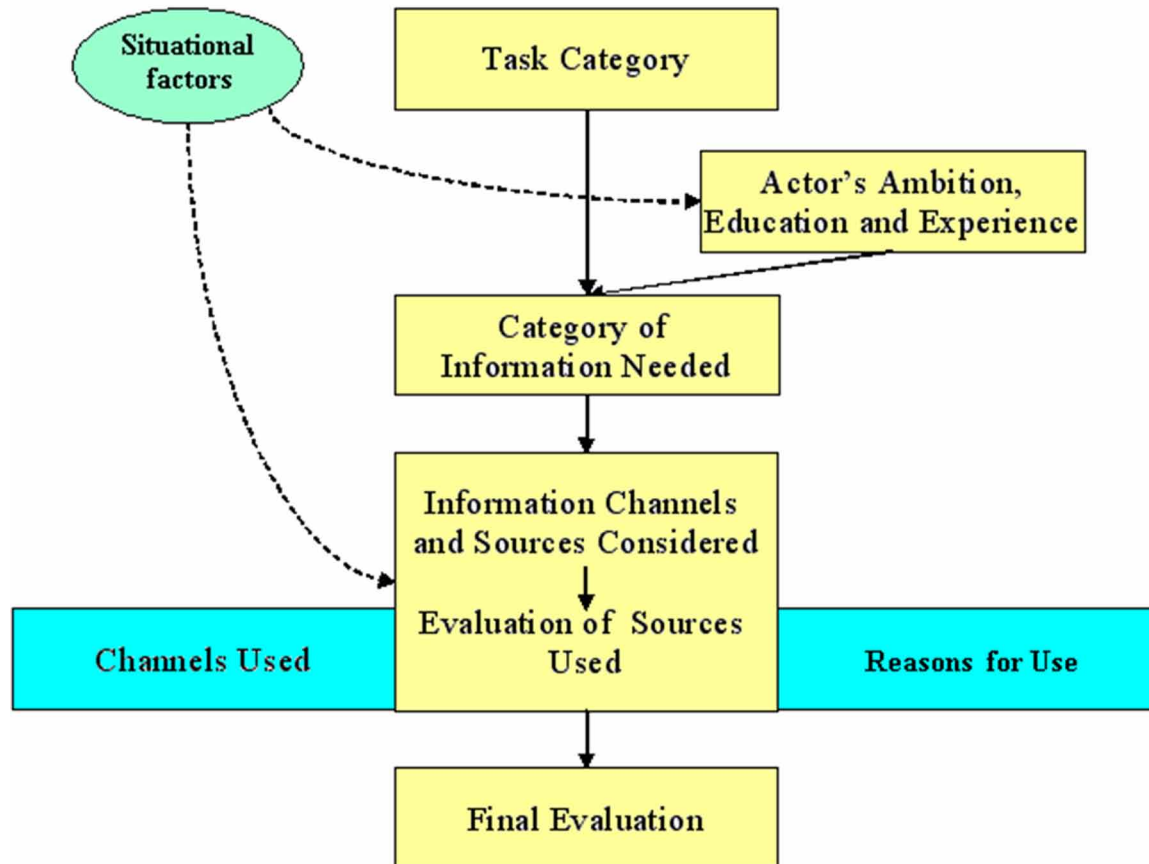
This study has adopted the work chart structure conceptual framework by Bystrom and Jarvelin (1995) that incorporates different information concepts and how these concepts are related with one another, these concepts include the terms; information, information need, information source, information channel and information and communication technology. This conceptual framework classifies tasks into different categories based on different individual's work roles. It also classifies different information categories based on the needs of different individuals, and finally it classifies different sources of information according to the category of information that is looked for. In combination, the three classifications suggest a set of hypotheses of the type: "*Tasks of complexity type X require information of type Y that is available from sources of type Z*" (Jarvelin and Wilson, 2003). Thus the classifications suggest analytical relationships between the variables, as shown in Figure 1.

ADOPTION AND USE OF DIFFERENT TYPES OF ICTS BY URBAN LIVESTOCK KEEPERS

The main objective in this chapter intends to reveal the perceptions of the livestock keepers on the adoption and use of different ICTs in accessing livestock information. The first question that the respondents were asked in order to fulfill this objective was whether they used any of the ICTs to access livestock information. The results of this study are presented in Table 1.

Figure 1. The work chart structure (Bystrom and Jarvelin, 1995)

Source: (Jarvelin and Wilson, 2003)



As indicated in Table 1, most of the respondents 239 (94.1%) admitted having used at least one of the ICTs to access livestock information as opposed to 15 respondents (5.9%) who did not use any of the ICTs to access livestock information. The results further indicate that 144 of the respondents in Kinondoni (94.7%) used ICTs as opposed to 95 (93.1%) in Morogoro urban district. This was probably because of the relatively well developed ICT infrastructure in Kinondoni compared to Morogoro urban

Table 1. Use of ICTs in accessing livestock information

ICT use	Kinondoni		Morogoro urban		Overall	
	Freq.	%	Freq.	%	Freq.	%
Yes	144	94.7	95	93.1	239	94.1
No	8	5.3	7	6.9	15	5.9

Source: (Author, 2013)

N=152 (Kinondoni), N=102 (Morogoro urban), N=254 (Overall)

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district or because of the fact that many respondents in this study were from Kinondoni District. Only 15 (5.9%) respondents did not use any of the ICTs and 7 (6.9%) of these were from Morogoro urban while 8 (6.1%) were from Kinondoni district. These findings have revealed that ICTs are being used by many livestock keepers in urban areas to access livestock information, though the primary reason for acquiring ICTs was for communication purposes (for mobile phones and internet), news and entertainment (for radio and television). This is an indication that urban livestock keepers can now be more informed if they make proper use of ICTs to access livestock information. This can be through getting advice or help from veterinarians and/or extension officers through mobile phones, radio television and the Internet, and this may lead to quick solving of problems and improvement of the urban livestock keeping practice.

The respondents were then asked to mention the types of ICTs that they used in accessing livestock information. Findings reveal that different types of ICTs are mentioned by the livestock keepers including radio, television, mobile phone and the Internet. Most livestock keepers use at least one of the ICTs while some use more than one type of ICT and very few livestock keepers use all types of ICTs to access livestock information. These ICTs are used at different levels by respondents in each of the two districts. Table 2 shows the number of respondents who use each of the ICTs in the two districts.

Table 2. Types of ICTs used by urban livestock keepers

Type of ICT used	Kinondoni		Morogoro urban		Overall	
	Freq.	%	Freq.	%	Freq.	%
Mobile phone	141	92.8	93	91.2	234	92.1
Television	37	24.3	30	29.4	67	24.6
Radio	19	12.5	36	35.3	55	21.7
Internet	5	3.3	1	1.0	6	2.4

Source: (Author, 2013)

N=152 (Kinondoni), N=102 (Morogoro urban), N=254 (Overall)

The results in Table 2 indicate that mobile phone were used by most (234) of the livestock keepers (92.1%). It shows that respondents in Kinondoni (92.8%) used mobile phones slightly more than respondents in Morogoro urban (91.2%). Another type of ICT that was mentioned by the respondents was television 67 (24.4%). This was watched more by respondents in Morogoro urban (29.4%) compared to the respondents in Kinondoni (24.3%). Radio was also mentioned more by respondents in Morogoro urban (35.3%) compared to the respondents in Kinondoni (12.5%). Internet was used by the least; 6 (2.4%) number of respondents. Respondents who used the Internet were more in Kinondoni 5 (3.3%) than in Morogoro urban district 1 (1.0%).

Adejo and Haruna (2010) classified ICTs into conventional ICTs (radio, television) and contemporary ICTs (telephones, computer/internet). These results mean that mobile phone and the Internet (contemporary ICTs) are used more by respondents in Kinondoni compared to radio and television (Conventional ICTs) which are used more by respondents in Morogoro urban districts. This could probably be due to the fact that respondents in Dar es Salaam are busier with other economic activities hence they may be lacking time to watch television and listen to radio livestock programmes. The livestock keepers in Kinondoni District may also be ignorant on the importance of the livestock programmes or they may

not have been aware of the livestock programmes in the radio and television. The well developed ICT infrastructure in Kinondoni may be the reason as to why mobile phones and the Internet are used more by respondents in Kinondoni. The livestock keepers explained how they used different types of ICTs in accessing livestock information, the usefulness of each of the ICTs in livestock keeping and reasons why they did not use some or all of the ICTs. The following section will discuss how different types of ICTs are used by urban livestock keepers to access livestock information and the perceptions of the livestock keepers on each of the ICTs. The reasons as to why some types of ICTs are not used by some of the respondents to access livestock information are also discussed.

Use of Radio in Accessing Livestock Information

The respondents were asked to explain how they used their radios to access livestock information. First they were asked to mention any livestock keeping programmes that they knew and the frequency of listening to these programmes. Various radio programmes were mentioned. The radio programmes included; ‘Mfugaji wa Kisasa’ (TBC Taifa), which was watched by 41 out of 55 (74.5%) of the respondents, ‘PADEP’ (TBC Taifa) which was watched by 19 out of 55 (34.5%) of the respondents and ‘Inuka’ (Radio Free Africa) which was watched by 12 out of 55 (21.8%) of the respondents.

Among the radio programmes that were mentioned, it was established that the ‘Mfugaji wa Kisasa’ programme was watched frequently by only 18 out of 41 (43.9%) respondents, the ‘PADEP’ programme was frequently watched by only 3 out of 19 (15.8%) respondents and the ‘inuka’ programme was frequently watched by only 1 out of 12 (8.3%) respondents. The respondents who had watched the programmes less frequently were more (i.e., 51.2% for ‘mfugaji wa kisasa’, 42.1% for PADEP and 50.0% for Inuka) than those who had watched the programmes frequently. Those respondents who had never watched some of these programmes were also relatively many (i.e., 42.1% for PADEP and 41.7% for Inuka) compared to those who had watched the programmes frequently. Table 3 shows the different radio programmes that were listened to by the livestock keepers and the frequency of listening to each of the programmes.

Table 3. Radio programmes listened to by urban livestock keepers

Radio programme		Frequency of listening					
		Frequently		Less frequently		Never watched	
		Freq.	%	Freq.	%	Freq.	%
Mfugaji wa kisasa	N= 41	18	43.9	21	51.2	2	4.9
PADEP	N= 19	3	15.8	8	42.1	8	42.1
Inuka	N= 12	1	8.3	6	50.0	5	41.7

Source: (Author, 2013)

From these results, it may be concluded that these radio programmes are not watched frequently by the livestock keepers. Most of these programmes are watched less frequently and some of them have never been watched by the respondents. This could have been because of many reasons including lack of awareness of the existence of such programmes, lack of time to listen to the programmes and lack of

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interest or ignorance on the importance of such programmes in livestock keeping (as seen in later discussions). As a policy implication, the broadcasting media should ensure that the radio programmes are beneficial to the intended audience and should take the necessary measures to improve the programmes so that the intended audience benefits from the programmes. A similar policy implication was stated by Nazari and Abu (2010) who suggested that since the radio plays a more important role in public education, producers should be familiar with the latest and newest programme structures to be able to meet the needs of people by employing appealing methods.

Perceptions of Livestock Keepers on Use of Radio

The respondents who listened to radio programmes on livestock keeping were then asked whether the programmes provided any useful information on livestock keeping. The findings of this question are presented in Table 4.

Table 4. Usefulness of radio programmes on livestock keeping

N=254					
Usefulness of radio programmes on livestock keeping		listening to livestock keeping programmes in the radio			Total
		Yes	No	Not applicable	
Very useful	Count	27	0	0	27
	% within usefulness	(49.1%)	(.0%)	(.0%)	(10.6%)
Satisfactory	Count	24	0	0	24
	% within usefulness	(43.6%)	(.0%)	(.0%)	(9.4%)
Not useful	Count	1	1	0	2
	% within usefulness	(1.8%)	(.5%)	(.0%)	(.8%)
Not applicable	Count	3	189	9	201
	% within usefulness	(5.5%)	(99.5%)	(100.0%)	(79.1%)
Total	Count	55	190	9	254
	% within usefulness	(100.0%)	(100.0%)	(100.0%)	(100.0%)

Source: (Author, 2013)

Table 4 shows that a total of 27 out of 55 respondents (49.1%) agreed that the programmes were very useful while 24 (43.6%) said that they were satisfactory. Very few (1.8%) respondents said the programmes were not useful at all and a total of 201 out 254 respondents (79.1%) did not respond to the question and these were labeled as “Not applicable”. The respondents were then asked to explain why the radio programmes were useful, satisfactory or not useful. The explanations that were given are shown in Table 5.

As indicated in Table 5, the results show that 27 respondents (100%) admitted that the radio programmes were very useful because they offered a lot of advice on animal husbandry practices. Some of these respondents admitted that they had exercised what they had learnt from the programmes and they had benefited by improving their animal husbandry practices. Although the radio programmes were

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Table 5. Perceptions of livestock keepers on the radio programmes

Perceptions on livestock keeping radio programmes		Usefulness of radio programmes in livestock keeping				Total
		Very useful	Satisfactory	Not useful	Not applicable	
A lot of advice	Count	27	2	0	0	29
	% within perception	(100.0%)	(8.3%)	(.0%)	(.0%)	(11.4%)
Insufficient technical advice	Count	0	8	0	0	8
	% within perception	(.0%)	(33.3%)	(.0%)	(.0%)	(3.1%)
Lack enough time	Count	0	12	1	0	13
	% within perception	(.0%)	(50.0%)	(50.0%)	(.0%)	(5.1%)
Radio programmes are biased	Count	0	2	0	6	8
	% within perception	(.0%)	(8.3%)	(.0%)	(3.0%)	(3.1%)
Not applicable	Count	0	0	1	195	196
	% within perception	(.0%)	(.0%)	(50.0%)	(97.0%)	(77.2%)
Total	Count	27	24	2	201	254
	% within perception	(100.0%)	(100.0%)	(100.0%)	(100.0%)	(100.0%)

Source: (Author, 2013)
N=254

said to be useful by most of the respondents, some of the respondents (33.3%) said that the programmes were satisfactory because the programmes offered insufficient technical advice. Another 12 out of 24 respondents (50.0%) complained that the programmes were satisfactory because the respondents had no enough time of listening to radio and following up the programmes due to their tight schedules. Very few of these respondents (8.3%) complained that the radio programmes were biased to only some few animals and therefore not all the livestock keepers were benefitting from the programmes.

These results are an indication that radio programmes on livestock keeping are very important to the livestock keepers despite the fact that only a few livestock keepers accessed the programmes. The radio programmes are useful because some of the livestock keepers admitted that they could benefit from the programmes despite the fact that time was a limitation to listening the programmes. This means that the radio programmes could be very beneficial to the livestock keepers if only the programmes could be accessed by many or all the livestock keepers. These programmes could lead to access of relevant information which could help the livestock keepers improve their practice hence increase their income and reduce poverty. If these programmes were advertised and their broadcasting schedules improved, more livestock keepers could benefit from the programmes. The broadcasting media and the programme producers are therefore responsible in ensuring that more livestock programmes are introduced and the programmes are advertised frequently in order to increase the awareness of the livestock keepers on the existence and importance of these programmes. Yahaya and Badiru (2002) also recommended that more effort should be made in advertisement of the radio programmes for more access to relevant agricultural information.

Reasons for not Using Radio to Access Livestock Information

The respondents who did not listen to the radio programmes were asked to give their reasons as to why they did not listen to the programmes and the findings are presented in Table 6.

Table 6. Reasons for not listening to radio livestock programmes

Reasons for not listening to the programmes	Frequency	Percentage (%)
No time to listen to the programmes	90	47.4
Not aware of the radio programmes	82	43.2
Not aware of the programme schedules	59	31.1
The programmes are not useful	4	2.1

Source: (Author, 2013)

N=190

The results in Table 6 show that out of 190 respondents who did not listen to radio programmes, 90 of the respondents (47.4%) claimed that they had no time for listening to the radio programmes because they were tied up with other activities during the day hence could not listen to the programmes. 82 respondents (43.2%) said that they did not listen to the programmes because they were not aware of the existence of the programmes. These respondents complained that the programmes were not being advertised hence the reason why they were not aware of the programmes. A total 59 of 190 respondents (31.1%) claimed that they were not aware of the programme schedules, thus they could not listen to the programmes because they did not know when they were being broadcasted. Very few respondents (2.1%) said that they did not listen to the programmes because they did not find the programmes useful to them.

Despite the fact that most of the livestock keepers in urban and peri-urban areas own radios, findings of this study have revealed that the radios are used by few livestock keepers to access livestock information and they are used mostly to access information on entertainment, news and other social purposes. This is an indication that most of the urban and peri-urban livestock keepers still lack the awareness that they can use their radios to access important information on livestock keeping. Lack of time to access the radio programmes on livestock keeping and ignorance on the existence of these programmes are also reasons for not listening to the radio programmes on livestock keeping. The livestock keepers therefore need to be knowledgeable on the existence and importance of the programmes and sensitized (through extension services and advertisements) to use radio to access information that can help them improve their livestock keeping practices.

Use of Television in Accessing Livestock Information

The respondents were asked to mention the livestock keeping television programmes that they watched. 67 out of 254 respondents watched different livestock television programmes including; 'Mfugaji wa Kisasa' (TBC one) which was watched by 33 out of 67 (49.3%) respondents, PADEP which was watched by 30 out of 67 (44.8%), 'Kilimo cha Kisasa' (StarTV) which was mentioned by 9 out of 67 (13.4%) of the respondents and SUA TV programmes that were mentioned by 2 out of 67 (3.0%) of the respon-

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Table 7. Television programmes watched by urban livestock keepers

Television programme		Frequency of watching television programmes					
		Frequently		Less frequently		Never watched	
		Freq.	%	Freq.	%	Freq.	%
Mfugaji wa kisasa	N= 33	19	57.6	13	39.4	1	3.0
PADEP	N= 30	20	66.7	9	30.0	1	3.3
Kilimo cha kisasa	N= 9	7	77.8	2	22.2	0	0.0
SUA TV	N= 2	2	100	-	-	0	0.0

Source: (Author, 2013)

dents. These respondents were then asked to indicate the frequency of watching each of the television programmes. The findings are presented in Table 7.

Results in Table 7 indicate that ‘mfugaji wa kisasa’ (TBC one) programme was watched frequently by 19 out of 33 respondents (57.6%), PADEP was watched frequently by 30 out of 30 (66.7%) and ‘Kilimo cha Kisasa’ programme was watched frequently by 7 out of 9 (77.8%) respondents. These television programmes had been watched less frequently by 39.4% respondents for ‘Mfugaji wa Kisasa’, 30.0% for PADEP and 22.2% for ‘Kilimo cha Kisasa’. The SUA TV programmes had been watched only by the respondents in Morogoro and not those in Kinondoni because SUA TV is a local channel in Morogoro and could only be seen by Morogoro residents. These results show that urban livestock keepers access livestock information through television programmes more than they do for radio programmes.

Perceptions of Livestock Keepers on the Use of Television

The respondents were then asked on the usefulness of the television programmes on their practice of livestock keeping. Findings in Table 8 indicate that out of 67 respondents who watched the television

Table 8. Usefulness of television programmes

Usefulness of TV programmes on livestock keeping		Watching livestock programmes on Television			Total
		Yes	No	Not applicable	
Very useful	Count	46	0	0	46
	% within usefulness	(68.7%)	(.0%)	(.0%)	(18.1%)
Satisfactory	Count	18	0	0	18
	% within usefulness	(26.9%)	(.0%)	(.0%)	(7.1%)
Not useful	Count	1	0	1	2
	% within usefulness	(1.5%)	(.0%)	(9.1%)	(.8%)
Not applicable	Count	2	176	10	188
	% within usefulness	(3.0%)	(100.0%)	(90.9%)	(74.0%)
Total	Count	67	176	11	254
	% within usefulness	(100.0%)	(100.0%)	(100.0%)	(100.0%)

Source: (Author, 2013)

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programmes, 46 (68.7%) respondents admitted that the programmes were very useful. 18 out of 67 (26.9%) respondents said that the programmes were satisfactory and one out of 67 (1.5%) respondents replied that the programmes were not useful to them. These results are an indication that television livestock programmes are very useful to the urban livestock keepers because the livestock keepers gain knowledge from the programmes.

When asked to explain their answers, 44 out of 46 respondents (95.7%) admitted that the television programmes were very useful because they offered a lot of technical advice to the livestock keepers and one out of the 46 respondent (2.2%) said that the programmes were important because the lessons were by demonstrations hence they were easily understood. Some of the respondents (18 out of 254) claimed that the programmes were satisfactory. The results show that 11 out of 18 of these respondents (61.1%) explained that the television programmes were satisfactory because the respondents had no frequent follow-ups of the programmes. Four out of 18 respondents (22.2%) said that the programmes were satisfactory because the respondents had no time to watch the programmes. Some few (three out of 18) respondents (16.7%) claimed that the programmes were satisfactory because they showed complicated and expensive equipment hence they could not be applied in our environment. Very few (two out of 254) respondents complained that the television programmes were not useful at all. These respondents claimed that they lacked time to frequently follow-up the programmes hence they did not benefit from them. These results are shown in Table 9.

Table 9. Perceptions on the usefulness of livestock keeping TV programmes

Perceptions on livestock keeping TV programmes		Usefulness of TV programmes on livestock keeping				Total
		Very useful	Satisfactory	Not useful	Not applicable	
I get a lot of technical advice	Count	44	0	0	1	45
	%	(95.7%)	(.0%)	(.0%)	(.5%)	(17.7%)
Lessons are by demonstrations	Count	1	0	0	0	1
	%	(2.2%)	(.0%)	(.0%)	(.0%)	(.4%)
No frequent follow ups	Count	1	11	1	0	13
	%	(2.2%)	(61.1%)	(50.0%)	(.0%)	(5.1%)
No time to watch the programmes	Count	0	4	0	4	8
	%	(.0%)	(22.2%)	(.0%)	(2.1%)	(3.1%)
Show complicated techniques	Count	0	3	0	0	3
	%	(.0%)	(16.7%)	(.0%)	(.0%)	(1.2%)
Not applicable	Count	0	0	1	183	184
	%	(.0%)	(.0%)	950.0%)	(97.3%)	(72.4%)
Total	Count	46	18	2	188	254
	%	(100.0%)	(100.0%)	(100.0%)	(100.0%)	(100.0%)

Source: (Author, 2013)
N=254

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From the results above, it may be concluded that though the television programmes were said to be very useful by the majority of the respondents, these programmes were not watched by many livestock keepers because of limited time to watch the programmes. This is also a policy implication for the relevant bodies to increase the number of livestock programmes and the frequency of broadcasting so that many livestock keepers are able to watch and follow-up the programmes.

Reasons for not Using Television to Access Livestock Information

The respondents who did not watch the television livestock programmes were asked to give reasons why they did not watch the programmes and the findings are presented in Table 10.

Table 10. Reasons for not watching television livestock programmes

Reason for not watching television	Frequency	Percentage (%)
No time to watch the programmes	81	46.0
Not aware of the programmes	63	35.8
Not aware of the programme schedules	54	30.7
No electricity	19	10.8
No television	10	5.7
No satellite dish	2	1.1
Programmes not useful	2	1.1

Source: (Author, 2013)

N= 176

As shown in Table 10, several reasons were mentioned by the respondents. 81 out of 176 respondents (46.0%) gave the reason that they had no time to watch the television programmes due to being busy with many other socio-economic activities. Another reason for not watching the programmes was the unawareness of the existence of the television livestock programmes, a reason given by 63 out of 176 (35.8%) respondents. Another 54 out of 176 (30.7%) respondents gave their reason for not watching the programmes as not being aware of the time when the television programme were broadcasted. 10.8% of the respondents said that they had no electricity in their houses that is why they were not watching the programmes while others (5.7%) said that they had no television. A few livestock keepers (1.1%) complained of lack of satellite dishes as reasons for not accessing some of the channels e.g. TBC one which broadcasted the programmes and others (1.1%) claimed that they did not watch the livestock programmes because the programmes were not useful to them.

These results show that many urban livestock keepers do not watch television programmes because they are tied up with other economic activities during the day that they have no time to watch the programmes most of which are shown at day time. Many urban livestock keepers were also not aware of the livestock programmes and their broadcasting schedules. This situation could be improved by increasing the frequency of advertising the programmes in order to increase awareness of the respondents on the existence of the programmes, as opposed to the present situation whereby these programmes are advertised only once in a while. The programme schedules should also be improved and should be shown at

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night or during the weekends to enable the livestock keepers to watch the programmes and benefit from them. Hassan *et al*, (2011) emphasizes that if television (and radio) programmes need to be used as effective channels for agriculture information dissemination, efforts must be taken to guarantee that the airing times are suitable. This is supported by (Chhachhar *et al*, 2012) who points out that many farmers prefer to watch agricultural related programs in evening because they work in fields during the day and thus evening time is good and suitable for watching such programs on television.

Use of Mobile Phone in Accessing Livestock Information

The respondents were also asked to mention how they used their mobile phones and the frequency in each use. It was found out that the respondents used their mobile phones in different ways. Results show that out of the 234 respondents who used mobile phones to access livestock information, 210 (89.7%) respondents used their mobile phones for calling or communicating with veterinary/extension officers. 121 out of 234 (51.7%) of the respondents used their mobile phones to exchange ideas or communicate with clients. 79 out of 234 (39.8%) of the respondents used their mobile phones to communicate with fellow livestock keepers, while 5 out of 234 (5.1%) respondents used their mobile phones in availing chicks and the remaining 10 out of 234 (4.3%) secured feeds through their mobile phones.

These results are an indication that many livestock keepers use their mobile phones in different ways in their livestock keeping practice. Urban livestock keepers benefit from their mobile phones in that they can easily get relevant information or advice from veterinarians or extension officers. Urban livestock keepers are also able to communicate with their clients and exchange ideas with their fellow livestock keepers. The livestock keepers can also get chicks and feeds by using their mobile phones whereby they can call and press orders, which mean their needs are met through their mobile phones. These respondents were then asked to state the frequency of each use of their mobile phones and the findings are shown in Table 11.

Table 11. Uses of mobile phones by urban livestock keepers

Uses of mobile phone		Frequency of use of mobile phone					
		Frequently		Less frequently		Least frequently	
		Freq.	%	Freq.	%	Freq.	%
Calling extension officers	N= 210	200	95.2	4	1.9	6	2.9
Communication with clients	N=121	101	83.5	13	10.7	7	5.8
Communication with fellows	N= 79	51	64.6	17	21.5	9	11.4
Buying feeds	N= 10	10	100	-	-	-	-
Buying chicks	N=5	5	100	-	-	-	-

Source: (Author, 2013)

As presented in Table 11, it was found out that 200 out of 210 (95.2%) respondents frequently used their mobile phones to communicate with veterinary or extension officers. This was followed by 101 out of 121 (83.5%) of the respondents who frequently used their mobile phones to communicate with their clients and 51 out of 79 (64.6%) respondents who frequently used their mobile phones to communicate

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with their fellow livestock keepers. Other respondents used their mobile phones frequently in securing chicks and feeds. Mobile phones were used less frequently by a few respondents to communicate with extension officers (1.9%), to communicate with clients (10.7%) and to communicate with fellow livestock keepers (21.5%). This is an indication that mobile phones are very important to urban livestock keepers in many ways that have been discussed. This result implies that most urban livestock keepers can hardly do without mobile phones in their livestock keeping practice.

Perceptions of Livestock Keepers on use of Mobile Phones

The respondents who used mobile phones were asked whether the mobile phones were important to them in their livestock keeping practice. They were also asked to explain the reasons why they thought the mobile phones were useful or not useful. These findings are shown in Table 12.

Table 12. Importance of mobile phones in accessing livestock information

Explanation for importance of mobile phone in livestock keeping		Importance of mobile phone in livestock keeping			Total
		Yes	No	Not applicable	
Easy communication	Count	199	0	0	199
	%	(85.0%)	(.0%)	(.0%)	(78.3%)
Easy availability of feeds, chicks and markets	Count	22	0	0	22
	%	(9.4%)	(.0%)	(.0%)	(8.7%)
Quick solving of problems	Count	10	0	2	12
	%	(4.3%)	(.0%)	(10.5%)	(4.7%)
Save time and cost	Count	3	0	0	3
	%	(1.3%)	(.0%)	(.0%)	(1.2%)
Not applicable	Count	0	1	17	18
	%	(.0%)	(100.0%)	(89.5%)	(7.1%)
Total	Count	234	1	19	254
	%	(100.0%)	(100.0%)	(100.0%)	(100.0%)

Source: (Author, 2013)
N=234

The findings presented in Table 12 indicate all 234 respondents (100%) who used mobile phones in accessing livestock information agreed that the mobile phone was important to them. 1 out of 10 (10%) respondents who did not use mobile phones to access livestock information said that mobile phone was not important in the livestock keeping practice while 19 out of 254 (7.5%) respondents did not respond to the question. The respondents were then asked to give reasons why they thought mobile phones were important to them. 199 out of 234 respondents (85.0%) admitted that mobile phones enabled them to communicate easily with veterinarians, extension officers, clients and their fellow livestock keepers. 22 out of 234 respondents (9.4%) said that mobile phones enabled them to secure feeds, chicks and markets easily. 10 out of 234 respondents (4.3%) said that mobile phones enabled them to solve their problems

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quickly and 3 out of 234 respondents (1.3%) explained that mobile phones enabled them save time and costs.

Reasons for not Using Mobile Phones to Access Livestock Information

The findings from this study showed that only 10 out of 254 (3.9%) respondents did not use their mobile phones in accessing livestock information. These respondents claimed that they used their mobile phones in other activities including facilitating cultivation of their crops, businesses and social activities. Observations from this study revealed that almost all the respondents who did not use mobile phones did not also use any of the other ICTs. Observations also revealed that most of the respondents who did not use mobile phones to access livestock information were in either one or more of the following groups;

1. Young in age (less than 30 years)
2. Less experience in livestock keeping (beginners)
3. Very old (more than 60 years)
4. Illiterate.

Findings from this study also revealed that although very few respondents did not use mobile phones to access livestock information, most of these respondents admitted that mobile phones were important because they made communication easier.

Use of Internet in Accessing Livestock Information

The Internet was used by only 6 out of 254 of the respondents (2.4%) to access livestock information. Out of the 6 respondents who used the Internet, only 1 (16.7%) respondent used the Internet to send and receive e-mails with livestock information. All the 6 respondents (100%) used the Internet to search for relevant information on livestock keeping and there were no respondents who used the Internet to share ideas on livestock keeping with colleagues. Results presented in Table 13 shows that 1 respondent frequently used the Internet to exchange e-mails with extension officers. 4 out of 6 (66.7%) used the Internet

Table 13. Uses of Internet in accessing livestock information

Internet uses		Frequency of use					
		Frequently		Less frequently		Least frequently	
		Freq.	%	Freq.	%	Freq.	%
Searching	N= 6	4	66.7	2	33.3	0	0.0
E-mail	N= 1	1	100	-	-	0	0.0
Sharing	N= 6	-	-	-	-	0	0.0

Source: (Author, 2013)

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frequently to search for relevant information and 2 out of 6 (33.3%) used the Internet less frequently to search for relevant information on livestock keeping.

From these results, it may be concluded that Internet users are very few compared to users of other ICTs. The low usage of the Internet is contributed to a large extent by lack of computer and Internet skills among the livestock keepers. The Internet however is a very good source of a lot and diverse amount of livestock information if only the IT skills are imparted to the livestock keepers to enable them use the Internet and access the information.

Perceptions of Livestock Keepers on Use of the Internet

The few respondents who used the Internet to access livestock information were asked whether the Internet was useful to them. Table 14 indicates that all of these respondents (2.4%) admitted that the Internet was very useful to them because it helped them to access a lot of relevant information on livestock keeping. The respondents who did not use the Internet were asked to give their reasons why they did not use the Internet. It was realized that 205 out of 238 (86.1%) of these respondents did not use the Internet because they did not have the computer skills. These were followed by 14 out of 238 (5.9%) of the respondents who had the computer skills but did not have the knowledge to use the Internet. Other 14 respondents (5.9%) had no interest of using the Internet to search for relevant livestock information though they had the Internet skills. Other reasons that were given by the respondents were; lack of time to use the Internet (3.8%), long distances to the Internet cafes' (2.9%), expensive Internet services (0.4%), ignorance of the usefulness of the Internet (0.4%) and lack of relevant websites to access livestock information (1.3%).

Table 14. Reasons for not using the Internet

Reason	Frequency	Percentage (%)
Lack of computer skills	205	86.1
Lack of Internet skills	14	5.9
Lack of interest to use the Internet	14	5.9
Lack of time	9	3.8
Long distances to Internet facilities	7	2.9
Lack of relevant websites	3	1.3
The Internet is not useful	1	0.4
Expensive Internet services	1	0.4

Source: (Author, 2013)

N=238

Responses from interviews revealed that most of the extension officers also lacked the basic computer skills nor did they have the necessary skills to use the Internet. Most of the extension officers had no e-mail addresses neither did they use the Internet to search for relevant livestock information. A few of the extension officers with Internet skills only used the Internet to exchange e-mails with friends.

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Observations from this study revealed that there were no computers in almost all government offices for extension officers (except for one office in Morogoro- Bigwa Ward) and the computer was not connected to the Internet. The extension officers had to go out of their offices get the Internet services. Observations also revealed that there were a few Internet cafes most of which were located far from the livestock keepers.

RECOMMENDATIONS AND WAY FORWARD

Several recommendations have emanated from the findings of this study; some of which were given by the livestock keepers on how to improve the use of ICTs in accessing livestock information. Other 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;

Improve 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.

Enhance use of Mobile Phones and Internet to Access Livestock Information

The costs of using mobile phone and Internet services should be reduced so that all livestock keepers are able to use them. 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.

Form 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 study 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.

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.

Introduce Livestock Information Centres

This study 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 which are located far from most of the livestock keepers. The information centres can also enable the livestock keepers to access print information sources that have been revealed to be scarce from the finding of this study.

CONCLUSION

Different types of ICTs are used by urban livestock keepers to access livestock information. Mobile phone is used by the majority of livestock keepers whereby it helps them to get veterinary services easily and quickly, it enables availability of markets, feeds and chicks. It also enables the livestock keepers to exchange ideas with fellow livestock keepers. Radio and television are used by a few livestock keepers to access livestock information (though they are commonly used otherwise). This is due to unawareness of the existing livestock programmes. These programmes are very important to the few livestock keepers who access them because through the programmes, the livestock keepers are educated and learn a lot of experiences from other farmers. The Internet is used by very few livestock keepers to search for relevant livestock information. These livestock keepers admit that they get a lot of information in the Internet on different issues concerning livestock keeping. Internet use is hindered by lack of computer skills for the majority of the livestock keepers. Use of the Internet is also deterred by long distances to the Internet cafes, use of English language and ignorance on the importance of the Internet in accessing livestock information.

FUTURE RESEARCH DIRECTIONS

The literature review and findings from this study have revealed that there are some research and information gaps which need to be filled. This suggests that there are some areas that need to be researched on including the following.

A Participatory Action Research to Promote use of ICTs in Accessing Livestock Information

From the findings of this study, it was revealed that some of the urban livestock keepers were not aware of the fact that they can get a lot of information on livestock keeping through the use of ICTs. These livestock keepers need to be given the necessary knowledge and sensitized to use some of these ICTs like radio, television and the Internet, so that they can benefit by getting relevant information that could help them improve their livestock keeping practice. A participatory action research could therefore be a very useful study in ensuring that these livestock keepers are imparted with the necessary knowledge to enable them use the ICTs effectively in accessing livestock information.

Role of ICT Projects in Specific Urban Communities

This study has revealed that there are various ICT projects in Tanzania most of which are geared towards improving rural livelihoods, but little has been done on the role that these projects have played in improving the livelihoods of specific urban communities. Given the importance of ICT projects in rural areas of Tanzania and Africa at large, a study needs to be done to investigate the existence of ICT projects in urban areas and the extent to which specific urban communities benefit from these projects.

A Comparative Study on Role of ICTs Between Urban and Rural Communities

Findings of this study have revealed the importance of ICTs in accessing livestock information in urban areas and several other studies have been conducted to assess the role of ICTs in rural livelihoods in Tanzania. A comparative study therefore needs to be done to identify gaps of ICT use that exist between urban and rural communities in Tanzania and what can be done to fill the gaps and reduce the digital divide.

REFERENCES

Achora, J. C., & Ngolobe, B. (2009). Digital opportunities for change. ICT update: A current awareness bulletin for ACP agriculture, 50, 20.

Adejo, P. E., & Haruna, U. (2009). Access of farmers to ICTs for agricultural development in Bauchi local government area, Bauchi state. *Proceedings of the 43rd annual conference of the Agricultural Society of Nigeria*.

African Connection, Centre for Strategic Planning. (2002). *The Next Step: a rural ICT programme for Africa, Draft 2*. Prepared by Intelcom Research and Consultancy Ltd.

Adoption and Use of ICTs by Livestock Keepers for Improved Access to Livestock Information

Asiedu, F., Gouro, A. S., Ndlovu, L., Nuru, H., & Lameta, K. (2009), *The role of Science, Technology and Innovation in addressing the challenges to food security and economic empowerment*. www.ypard.org/ypard/.../589_Livestock_Policy_Brief_Final_090529.pdf

Brodnig, G., & Mayer-Schönberger, V. (2000). Bridging the Gap: The role of spatial information technologies in the integration of traditional environmental knowledge and western science. *The Electronic Journal on Information Systems in Developing Countries*, 1. <http://www.is.cityu.edu.hk/ejisdc.htm>

Bystrom, K., & Jarvelin, K. (1995). Task complexity affects information seeking and use. *Information Processing & Management*, 31(2), 191–213. doi:10.1016/0306-4573(95)80035-R

Chhachhar, A. R., Hassan, M. S., Omar, S. Z., & Soomro, B. (2012). The Role of Television in Dissemination of Agriculture Information among Farmers. *Journal of Applied Environmental and Biological Sciences*, 2(11), 586-591.

Chilimo, W. L. (2009). *Use of Information and Communication Technologies for improved rural livelihoods in Tanzania* (PhD Thesis). University of Kwazulu Natal.

CIRAD. (2009). *Livestock keeping in urban areas: A review of traditional technologies based on literature and field experience*. <http://pigtrop.cirad.fr>

CTA. (2009). *The many uses of mobile phones*. CTA, Technical Centre for Agricultural and Rural Cooperation (ACP-EU).

FAO. (1999a), *Urban and Peri-urban food production; a new challenge for the Food and Agriculture Organization (FAO) of the United Nations*, by A.W.Drescher and B.L. Laquinta. Internal Report. Rome: FAO.

Ferris, S. (2004, June). FOODNET: Information is changing things in the market place. ICT Update.

Gakuru, M., Winters, K., & Stepman, F. (2009). *Inventory of Innovative Farmer Advisory Services using ICTs*. The Forum for Agricultural Research in Africa (FARA).

Gantt, W., & Cantor, E. (2010). Direct data on demand. ICT update: A current awareness bulletin for ACP agriculture, 53, 4.

Guendel, S. (2002). *Peri-urban and urban livestock keeping in East Africa: A coping strategy for the poor?* <https://www.eldis.org/static/DOC9069.htm>

Hassan, M. S., Yassin, M. D., Shaffril, H. A., Othman, M. S., Samah, B. A., Samah, A. A., & Ramli, S. A. (2011). Receiving the Agriculture Information through Mass Media and Interpersonal Sources among the Rural Community. *American Journal of Agricultural and Biological Sciences*, 6(3), 451-461.

Jacobi, P., Amend, J., & Kiango, S. (2005). *Urban agriculture in Dar Es Salaam: Providing an indispensable part of the diet*. Resource Centres on Urban Agriculture and Food Security (RUAF) Foundation.

Jarvelin, K., & Wilson, T. D. (2003). On conceptual models for information seeking and retrieval research. *Information Research*, 9(1), paper 163.

Jensen, M. (2002). *Information and Communication Technologies (ICTS) in Africa*. A Status Report. http://www.panos.org.uk/files/Why_RadioMatters.pdf

Adoption and Use of ICTs by Livestock Keepers for Improved Access to Livestock Information

Kapange, B. (2002). *ICTs and National Agricultural Research Systems—Development for the Grass-roots: The Tanzania Case*. Academic Press.

Karamagi, H., & Nalumansi, L. (2009). No more spilt milk. ICT update: A current awareness bulletin for ACP agriculture, 47, 5.

Kiplagat, R. (2009). Computerizing dairy cooperatives. ICT update: A current awareness bulletin for ACP agriculture, 47, 14.

Kithuka, J., Mutemi, J., & Mohammed, A. H. (2007). *Keeping up with Technology: The use of mobile telephony in delivering community-based decentralized animal health services in Mwingi and Kitui Districts, Kenya*. Farm-Africa working paper.

Maru, A. (2003). *Potential Contributions from Use of New Information and Communication Technologies (ICT) for Livestock Production and Services in India*. <https://www.indiaveterinarycommunity.com/profperspective/featuredarticle/feb-04/art-maru.htm>

Morton, J., & Matthewman, R. (1996). *Improving livestock production through extension: information needs institutions and opportunities*. Academic Press.

Nazari, M. N., & Abu, A. H. (2010). Radio as an Educational Media Agricultural Development. *The Journal of the South East Asia Research Centre for Communication and Humanities*, 2, 13–20.

Okolla, W. A. (2002). The Kenya Agricultural Commodity Exchange. ICT Update: A current awareness bulletin for ACP agriculture, 9.

Ozowa, V. (1995). Information Needs of Small Scale Farmers in Africa: The Nigerian Example. *Quarterly Bulletin of the International Association of Agricultural Information Specialists*, 40(1).

Reitz, J. M. (2007). *Online Dictionary for Library and Information Science (ODLIS)*. Information. lu.com/odlis/

Schilderman, T. (2002). *Strengthening the knowledge and information systems of the urban poor*. Department for International Development (DFID). <https://practicalaction.org/docs/ia3/kis-urban-poor-report-2002.pdf>

Souter, D., Scott, N., Garforth, C., Jain, R., & Mascarenhas, O. (2005). *The Economic Impact of Telecommunications on Rural Livelihoods and Poverty Reduction: A Study of rural Communities in India (Gujarat), Mozambique and Tanzania*. <https://ideas.repec.org/p/iim/iimawp/2005-11-04.html>

URT. (2005). *Livestock sector brief*. Prepared by Food and Agricultural Organization (FAO) and Livestock Information, Sector Analysis and Policy Branch (AGAL).

URT. (2007). *Livestock*. <http://www.tanzania.go.tz/livestock.html>

Weeks, J. R. (2008). *Population: an introduction to concepts and issues* (10th ed.). Wadsworth Thompson Learning.

Westhuizen, J. V. (2003). Q&A: ICTs and livestock performance. ICT update: A current awareness bulletin for ACP agriculture, 15, 5.

Yahaya, M. K., & Badiru, O. I. (2002). Measuring the Impact of Agricultural Radio and Television Programmes in Southwest Nigeria. *Journal of Applied Communications*, 86(3), 2002. doi:10.4148/1051-0834.2171

KEY TERMS AND DEFINITIONS

Information: For the purpose of this study, livestock information is all facts, conclusions, ideas, and creative works related to livestock keeping.

Information and Communication Technologies: In this study, ICT will encompass the definitions of Old ICTs and New ICTs. The term generally refers to electronic and computer-based technologies that are used in communication e.g. mobile phones, radio, television, and the internet.

Information Source: In the context of this study an information source can be defined as any document or person that provide information required by a livestock keeper searching for livestock information, e.g. extension workers, veterinary officers and fellow livestock keepers, customers and potential customers of livestock products and printed materials.

Peri-Urban Areas: In this study, peri-urban is defined as an area immediately surrounding a city or town

Urban Areas: An urban area can be defined differently by different countries depending on population density, human activities and building structures. In the context of this study, an urban area is defined as a geographical location found in a city or town.

Urban Livestock Keeping: An urban livestock keeping can be generally defined as the raising of domesticated animals that is concentrated in and around cities (FAO, 2007). This definition is adopted for this study and the animals involved in this study include cattle, goats, pigs, sheep, and chicken.