

Understanding the development of rural-ICT service providers in the Tanzanian agro-pastoral system

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Abstract

Information and communication technologies are commonly acknowledged as the best means of knowledge and information acquisition for socio-economic growth in rural areas of developing countries. The study was carried out to generate information on the socio-economic characteristics of agro-pastoralists, sources of production information, type of information and communication technology obtained, the level of utilization and effect of information and communication technology on the agro-pastoral system. The study adopted a combination of cross-sectional and case study designs. Data were generated through direct administration of structured questionnaires to 407 agro-pastoralists, key informants interview that involved managers from Rural-ICT Service Providers (RISP) and village extension officers.

Results show that seventy percent (70%) of the agro-pastoralists contacted were men, with the higher proportion of ages ranging between 18-34 years followed by 35-54 years old. 62.4% of sample agro-pastoralists had attended primary education, with the rest (37.6%) having secondary education and above. In terms of ownership of important ICT assets, agro-pastoralists contacted have and are more familiar with radio (84.5%), mobile phones (76.2%), telecentre (64.1%), and television (73.7%) for agricultural and livestock information and knowledge acquisition than magazines (44.0%) and newspapers (36.4%). Only 42.2% of the agro-pastoralists agreed that ICT have highly positively impacted their livestock and agriculture (agro-pastoral livelihoods); 31.0% confirmed that they have been impacted; while 24.8% agreed that they have not been able to coordinate and harness information obtained from ICT to improve their productivity in livestock and agriculture. It is concluded that the potential of ICT services in rural areas as yet remains untapped. This is because of the limited level of awareness on the use of RISP

(telecentres alongside with community radio) to improve and enhance agriculture and livestock production. Therefore, urgent measures are required to derive maximum benefits of ICT among agro-pastoralists for sustainable agro-pastoral system in rural Tanzania.

Keywords: *development, information, information and communication technology (ICT), rural-ICT service providers (RISP)*

Introduction

Information and communication technology (ICT) refers to all information and communication systems and technologies including not only the digital formats such as the internet or the world-wide web, but also interfaces with radio, television, video, cellular phones and print media (Hazelman and Flor 2004). Tanzania's economy depends mostly on agriculture, which accounts for more than 24.7% of gross domestic product (GDP) in 2013, provides for more than 30.9% of exports and employs 70% of the workforce (URT 2013). Eighty percent of the land in Tanzania is classified as semi-arid and the main source of livelihoods in these areas is agriculture and livestock-keeping (Shem et al 2010). Seventy percent of the Tanzania's population lives in rural areas, where agriculture and livestock-keeping by smallholder producers are the major economic activities (URT 2009). Information and knowledge acquisition through the use of ICT is indispensable for empowering agriculture and livestock producers (agro-pastoralists) to make informed production decisions. As such, in rural areas, Rural-ICT Services Providers (RISP) provide linkages among producers especially agro-pastoralists, as a source of information and knowledge acquisition, available information on agro-inputs, credits, weather conditions, sowing time, extension services, and markets outlets, (Soundari 2011). The use of Rural-ICT Service Providers (telecentres alongside with community radio) is being regarded as a mechanism to bridge the information and knowledge divide; thus enabling agro-pastoralists in the rural areas to use ICT services which have profound implications for improving agro-pastoral livelihoods (Etta and Parvyn-Wamahiu 2003; Harsha 2008). Most development support communication researchers and extension experts are recommending the use of community radios in rural areas as the cheapest medium for reaching majority of agro-pastoralists in developing nations (Adams 1982).

Television is another medium for information and knowledge acquisition to agro-pastoralists in most developing nations including Tanzania. The introduction of community radio and television had profound effects on many countries where they are vital tools of development in creating a sense of nation and national identity and enhancing livestock and agricultural productivity in the country. Slots are devoted to weekly programs, interesting livestock and agricultural information and knowledge generally, but it is not widely distributed like radio due to the fact that many agro-pastoralists cannot afford it and also lack of electricity in the rural areas where majority of the full time agro-pastoralists dwell (Kubkomawa and Salihu 2010).

Likewise, ever since the introduction of the Global System of Mobile Communication (GSM), mobile phones have become popular for agro-pastoralists to communicate with RISP in case of advice regarding farming activities (Lwoga 2010), and in dissemination of information and knowledge among agro-pastoralists easily. However, this also is restricted due to short of service

coverage and also lack of electricity in the rural areas. Increased growth rates of mobile phones have been attributed to many factors including the liberalisation of telecommunication markets, user-friendliness of the mobile phones, prepayment modes, faster delivery of information and knowledge and usage of local languages in communication (Forlin et al 2008; Rashid and Elder 2009).

In Tanzania, the use of networked information and communication is mostly the privilege of the moderate and well-off agro-pastoralists in wealthy categories. The agro-pastoralists in the poor category relegated in area of information and communication technology even though they are the food producers of the nation. Access, efficiency and affordability of information related to agriculture and livestock production are the major barriers in the battle to uplift agro-pastoral livelihoods productivity amongst agro-pastoralists in Tanzania.

The central focus of the study were to describe the socio-economic characteristics of agro-pastoralists; determine the sources of information and communication technology obtained by agro-pastoralists; determine the type of information being obtained by agro-pastoralists; assess the level of information and communication technology utilization by the agro-pastoralists and assess the impact of information and communication technology on the Tanzanian agro-pastoral system. This is premised on the facts that effective rural-ICT services provision can bridge the knowledge and information divide and contribute to agricultural and livestock growth. This helps to generate potential information required for designing and formulating strategies and ways to improve access and use of ICT services for sustainable agro-pastoral system in rural Tanzania.

Materials and methods

The study area

The study was carried out in rural areas in Tanzania, with particular emphasis on two selected rural areas of Kilosa District in Morogoro Region and Sengerema District in Mwanza Region. The identification and selection of these study areas were guided by specific features related to the availability and accessibility of RISP in forms of telecentres alongside with community radio, agriculture and pastoral livelihoods development in these rural districts that necessitates the need to link the fastest growing sector in Tanzania (ICT) with one of the most important economic sector (agro-pastoral livelihoods). Data on the socio-economic characteristics of agro-pastoralists, various sources, type, utilization and impact of information and communication technology on Tanzanian agro-pastoral system were generated through direct administration of 407 agro-pastoralists using structured questionnaires, key informants interview of RISP managers and village extension officers. The data generated were subjected to descriptive and inferential statistics.

Research design and data collection methods

To achieve the purpose of the study, empirical data from agro-pastoralists living in rural areas where the telecentres alongside with community radios and mobile phone technology are available and accessible were collected; the rationale was to fill the gap between the expectations of what ICT can do for agro-pastoralists and the reality of how these technologies have actually

been used for information and knowledge acquisition in rural areas. The study employed a combination of cross-sectional and case study research designs as the logic makeup of inquiry. The main data collection methods employed was household survey, key informant interviews, and focus group discussions (FGDs). The mixed methods approach was chosen to allow collection of both quantitative and qualitative data sequentially. The study began with a broad household survey in order to generalize results to agro-pastoralists population. Thereafter, focus group discussions (FGDs) and key informant interviews were conducted to collect detailed views from agro-pastoralists, village extension officers and RISP managers.

In Sengerema District, a total of 180 (73.2%) out of 246 (100%) agro-pastoralists who had access and use ICT services offered by RISP were randomly selected to be included in the study because of their heterogeneous characteristics in terms of livestock numbers. In Kilosa District, a decision was made to include 227 (100%) agro-pastoralists who had access and use ICT services offered by RISP because of their homogenous characteristics in terms of livestock numbers.

Data processing and analysis

Qualitative and quantitative data analyses have been used in this study. Qualitative data analysis focused on making deductions out of views of the respondents. As such, information collected during the FGDs and key informants interviews were subjected to content analysis. Quantitative data collected were coded, processed and analysed using the Statistical Package for Social Sciences (SPSS 16.0 version) computer software. Descriptive and inferential statistics were used in describing the socio-economic characteristics of agro-pastoralists, various sources, type, utilization and impact of information and communication technology. Furthermore, Chi-square test used in testing for significance of the findings.

Results and discussion

Demographic characteristics

As regards to socio-economic and demographic characteristics of agro-pastoralists; age, sex and household size are among factors that may influence access and use of ICT services on the agro-pastoral system in most part of the rural areas in developing countries. This is from the fact that users of the RISP are disadvantaged on the basis of age, sex, literacy levels and socio-economic status (Etta and Parvyn-Wamahiu 2003). In order to ascertain this, a cross-tabulation was performed to describe the demographic characteristics of agro-pastoralists in Kilosa and Sengerema districts. The results in Table 1 depict the distribution of the demographic characteristics of the respondents in Kilosa and Sengerema districts.

The results in Table 1 show higher proportion of agro-pastoralists that access and use ICT services were of ages ranging between 18-34 years followed by 35-54 both in Kilosa and Sengerema districts. The results are statistically significant different at 1% level. This finding is similar to previous studies conducted elsewhere in most parts of rural areas in Africa (Etta and Parvyn-Wamahiu 2003; Chilimo 2008). Etta and Parvyn-Wamahiu (2003) and Chilimo (2008) point out that in Mali and Tanzania, youth and adults younger than 40 years of age constitute more than 80% of users of ICT services in rural areas, whereby the most active ICT service users

were between 17 and 40 years of age. The results also show that in Sengerema District agro-pastoralists have larger household size approximately 6 persons as compared to Kilosa District with only approximately 4 persons. This is statistically significant at less than 1%. The household size is in accordance with those reported in the 2012 Tanzania national census, which are 6.0 and 4.2 persons per household in Sengerema and Kilosa districts respectively (NBS 2013).

Table 1. Distribution of agro-pastoralists based on their socio-economic status

Attributes	Kilosa District (n=227)	Sengerema District (n=180)	Total	X ² value
<i>Age (Years)</i>				
<18	0.20% (1)	0.20% (1)	0.40% (2)	71.9***
18-34	37.7% (153)	25.1%(102)	56.3% (229)	
35-54	17.2% (70)	18.7% (76)	42.3% (172)	
55-64	0.70% (3)	0.20% (1)	1.01% (4)	
Total	55.8% (227)	44.2%(180)	100(407)	
Average household Size	4.20	5.60		1.55***
<i>Sex</i>				
Male	41.3% (168)	32.4%(132)	73.7% (300)	0.79 ^{NS}
Female	14.5% (59)	11.8% (48)	26.3% (107)	
Total	55.8% (227)	42.2%(180)	100%(407)	
<i>Education Status</i>				
Primary School	30.0% (122)	32.4%(132)	62.4% (254)	28.5***
Lower Secondary (Form I-IV)	23.1% (94)	8.60% (35)	31.7% (129)	
Senior Secondary (Form V-VI)	0.99% (4)	0.10% (1)	0.99% (4)	
Post Secondary	0.20% (1)	0.10% (1)	0.50% (2)	
Adult Education	0.99% (4)	2.30% (8)	3.20% (13)	
No formal education	0.50% (2)	0.70% (3)	1.20% (5)	
Total	55.8% (227)	44.2%(180)	100(407)	

Note: *** Significant at 1% level; ^{NS} not significant

X² value = Chi-square

Furthermore, the results in Table 1 show that a higher proportion of male (73.7%) were interviewed in this study compared to only 26.3% of female household. This is in accordance with other studies which highlight gender differences in the use of ICT services resulting in what can be termed the gender digital divide or gender disparities (Huyer and Sikoska 2003; Lee 2006). Some of the reasons for women's exclusion or the gender digital divide are illiteracy, poverty, lack of time and insufficient skills. Roman and Colle (2002) point out that there are hundreds of thousands of women all over the world who may be shut out of the information society because of their literacy level and their gender. Literacy is necessary in acquiring skills associated with the use of ICT services. Those with formal education are more likely to have better skills than those who do not have. Literacy level in terms of agro-pastoralists' ability to

read and write in the national language (Swahili) is quite high both in the study areas. Roman and Colle (2002) argue that literacy is an important element for people to access and use ICT services, because no matter how “wired” a country becomes, without basic literacy the major benefits of ICT services will be lost. As such, without basic literacy, many agro-pastoralists will not be able to use ICT services, not because they do not have physical access to ICT services but because they cannot write or read the off-line and on-line materials. This is supported with the results in Table 1, which show that a higher proportion (62.4%) of sample agro-pastoralists had attended primary education, with the rest (37.6%) having secondary education and above in both Kilosa and Sengerema districts. This is statistically significant at 1% level.

Sources of information and asset ownership

The study results in Table 2 indicate that agro-pastoralists have and are more familiar with radio (84.5%), mobile phones (76.2%), telecentre (64.1%), and television (73.7%) for agricultural and livestock information and knowledge acquisition than magazines (44.0%) and newspapers (36.4%) as shown in Table 2. These results are in line with that of ICT Update (2004) which reports that in rural areas of Africa, radio, mobile phones and television remain the most frequently used tools of relaying information and knowledge acquisition. Only few people use information and knowledge obtained from dailies and magazines for livestock and agriculture advancement and development. Few agriculture and livestock marketers use ICT in relating information regarding to market prices, weather, security and other critical issues for quick decision making.

Table 2. Distribution of agro-pastoralists based on sources of information N=407)

Variables	Kilosa District	Sengerema District	Total
Radio	85.9% (195)	82.8% (149)	84.5% (344)
Telecentre	66.1% (150)	61.7% (111)	64.1% (261)
Mobile Phone	76.2% (173)	76.1% (137)	76.2% (310)
Television	72.2% (164)	75.6% (136)	73.7% (300)
Newspaper	40.1% (91)	31.7% (57)	36.4% (148)
Magazine	48.9% (111)	37.8% (68)	44.0% (179)

Note: Data set were based on multiple responses

N=number of respondents

In Table 3, a cross-tabulation was performed to assess the possession of different household assets owned by agro-pastoralists in the two study areas. The results indicate that there are clear and significance differences (statistically significant at less than 5% and 10% respectively) between Kilosa and Sengerema districts in terms of ownership of important assets. There are clear indications from the results that a larger proportion of agro-pastoralists have radio, mobile phone, and bicycle. In both districts, radio services are prevalent and the radio is identified as the main source of information and knowledge acquisition for the majority of the agro-pastoralists. Broadcasting from national radio stations is still very important, but it is evident that there is much interest in the community radio stations offered by RISIP in rural areas.

Table 3. Asset ownership of agro-pastoralists

Assets	Kilosa District (n=227)	Sengerema District (n=180)	X ² value
Radio ownership	100% (227)	100% (180)	-
Mobile phone ownership	93.0% (211)	97.8% (176)	4.38**
Television ownership	43.2% (98)	58.3% (105)	2.55*
Bicycle ownership	64.3% (146)	85.6% (154)	0.12 ^{NS}
Computer ownership	0.40% (1)	3.40% (7)	3.33*
Ox-plough ownership	27.3% (62)	37.8% (68)	0.87 ^{NS}
Motorbike ownership	22.0% (50)	33.3% (60)	0.08 ^{NS}
Power tiller ownership	3.50% (8)	6.10% (11)	1.49 ^{NS}

Note: ** Significant at 5% level; * Significant at 10% level; ^{NS} not significant
X² value = Chi-square

Furthermore, even where there are no statistical significance differences, it is evident that agro-pastoralists in Sengerema District have more household productive assets compared to Kilosa District. It is also evident from the results in Table 3 that there are no statistical significant differences in terms of ownership of television, bicycle, ox-plough and power tillers.

Asset ownership of agro-pastoralists has an implication on access and use of ICT services. A well-off agro-pastoralist in terms of ICT assets ownership has the ability to access and use ICT services, and in so doing, creates a stream of information and knowledge benefits. The limited assets that agro-pastoralist own, keep them in disadvantages of information and knowledge utilization.

ICT services and information

The results in Table 4 describe the responses of agro-pastoralists on the type of ICT services and information obtained. In both Kilosa and Sengerema districts, agro-pastoralists had access to different ICT services and information provided by the RISP. Table 4 depicts a number of services that are rendered by RISP to agro-pastoralists. The results show that ICT services range from capacity building, information, links and support in availing reading materials. Generally speaking, it can be observed from the results that agro-pastoralists in the two study locations had access to different ICT services and information that were used in their production activities. This is clearly substantiated by the study results in Table 4.

Table 4. Distribution of agro-pastoralists based on type of information/services obtained

ICT Services and Information	Kilosa District (n=227)	Sengerema District (n=180)	Total
Computer literacy and ICT use	15.5% (35)	15.6% (28)	15.5% (63)
Agro-pastoralists extension services	6.67% (3)	15.5% (35)	9.36% (38)
Agro-pastoralists empowerment	12.9% (20)	15.0% (27)	11.6% (47)
Market information services (e.g. market prices, new market outlets)	18.2% (36)	19.4% (35)	17.5% (71)
Linking to agro-inputs stockist	13.9% (25)	15.1% (36)	14.5% (61)
Costs of production	0.44% (1)	3.89% (7)	1.97% (8)
Capacity building on rural microfinance	4.21% (5)	0.00% (0)	1.23% (5)

Provision of information on new inputs (e.g. pesticides, seeds)	1.33% (3)	0.56% (2)	0.99% (5)
Weather conditions information (e.g. early rains)	0.00% (0)	0.44% (1)	0.25% (1)
Value addition and processing information	14.4% (26)	15.1% (29)	14.2% (55)
Emails and internet information	0.41% (1)	1.00% (2)	0.11% (3)
Livestock husbandry	11.9% (25)	13.9% (25)	12.8% (52)

Note: Data set are based on multiple responses

*χ^2 value = 36.995***; *** Significant at 1% level*

It is evident from the results that a relatively large proportion of agro-pastoralists in Sengerema District had access to extension services (15.5%) and links to agricultural stockist (15.1%). Additionally, a relatively high proportion of agro-pastoralists in Sengerema District had access to computer literacy and ICT use (15.6%), empowerment of agro-pastoralists (15.0%), market information (19.4%), value addition and processing information (15.1%), livestock husbandry (13.9%) and weather condition information (0.44%). A small proportion of agro-pastoralists had access to capacity building on rural microfinance in Kilosa District as opposed to none in Sengerema District. The results are statistically significantly different at less than 1% level of significance.

The study findings show that few numbers of agro-pastoralists reported the use of internet and email services for information and knowledge acquisition. Similar observations have been observed in India and Mozambique that few farmers use internet and email services for knowledge acquisition (Souter et al 2005). This shows that there is a great need for extensive awareness creation and training programmes on the use of the RISP to enhance ICT utilisation for livestock and agricultural development. The same has been reported by Sadaf et al (2006) and Zappacosta (2008) that will help to promote the utilisation ICT services. This is important due to the fact that some local communities still rely on traditional ways by relying on their neighbors, family and fellow farmers in getting livestock and agricultural information. According to Obiechina (2004), agro-pastoralists have the opportunity to access and use information and knowledge through ICT to create networks with development agencies and other agro-pastoralists, thus increasing their chances to strengthen their productivity.

Impact of Information and Communication Technology in agro-pastoral communities

Table 5 shows that Only 42.2% of the agro-pastoralists agreed that ICT have highly positively impacted their livestock and agriculture (agro-pastoral livelihoods); 31.0% confirmed that they have been impacted; while 24.8% agreed that they have not been able to coordinate and harness information obtained from ICT to improve their productivity in livestock and agriculture. This is expected since majority of the animals are in the hands of agro-pastoralists that have little or no formal education and agro-pastoralists who are economically disadvantaged. The few agro-pastoralists that are civil servants perhaps are mostly absentee agro-pastoralists that only buy land for cultivation and animals and handed them over to herdsman and remain in District headquarters in pursuit of white collar jobs like school teachers.

Table 5. Distribution of agro-pastoralists based on the effect of Information and Communication Technology

Variable category	Kilosa District	Sengerema District	Total	X ² Value
Highly affected	40.1% (91)	50.4% (89)	44.2% (180)	4.45*
Affected	34.8% (79)	26.1% (47)	31.0% (126)	
Not affected	25.1% (57)	25.0% (44)	24.8% (101)	

Note: *Significant at 10% level

X² value = Chi-square

With regard to which study location, agro-pastoralists was positively impacted agro-pastoral livelihoods, the results in Table 5 reveal that the agro-pastoralists in Sengerema District (50.4%) had a relatively better impacted with ICT as compared to those in Kilosa District (40.1%). This is statistically significantly different at 10%. However, results show that there is still limited level of awareness on the use of ICT to improve and enhance agriculture and livestock production in both rural areas of Kilosa and Sengerema districts, Tanzania.

Conclusions and recommendations

It is evident from the study that agro-pastoralists are more familiar with radio (84.5%), mobile phones (76.2%), telecentre (64.1%), and television (73.7%) for agricultural and livestock information and knowledge acquisition than magazines (44.0%) and newspapers (36.4%). However, there is still limited level of awareness on the use of ICT to improve and enhance livestock production in the selected study areas of rural settings since few agro-pastoralists indicated that the use of ICT have positively affected their livestock and agriculture while others confirmed that they have not been able to coordinate and harness information obtained from ICT to improve their productivity in livestock agriculture. Furthermore, it was observed that majority of the agro-pastoralists in the study areas are men and only 42.2% of the agro-pastoralists used the various sources of information frequently and have been highly impacted their agro-pastoral system. In nearly all agro-pastoral communities, women have a lower status compared to men. This is despite the fact that women are the main actors in the agro-pastoral economies. The important policy implications that can be drawn from this findings is that in order to promote women participation in access and utilization of ICT services for acquisition of important information and knowledge, policy interventions and programmes should strengthen and take into account gender digital divide. Such efforts should focus on improving access and utilization of ICT services for acquisition of important information and knowledge on production activities for both women and men.

It is recommended that more awareness should be created on the utilization of ICT by agro-pastoralists to promote agriculture and livestock production in rural areas of Tanzania. This challenge can be addressed through the effective exploitation of innovative solutions that integrate information and communication technologies in the dissemination of livestock and agricultural information.

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References

Adams M E 1982 Agricultural Extension in Developing Countries, Longman, Essex, UK. pp 58

Chilimo W 2008 Information and Communication Technologies and Sustainable Livelihood: A Case of Selected Rural Areas of Tanzania. PhD Thesis. University of KwaZulu-Natal, Pietermaritzburg. pp 284

Etta F E and Parvyn-Wamahiu S (eds) 2003 *Information and communication technologies for development in Africa The experience with community telecentres* Vol. 2. Ottawa: International Development Research Centre (IDRC). pp 211

Forlin M, Larcher R and Schivo S 2008 Review of Current Use of Mobile Telephony in Developing Regions. Retrieved February 11, 2015 from https://www.it46.se/projects/UNITN_ict4sd/assignments/ICT4SD_forlin_larcher_schivo.pdf

Harsha S 2008 *Scoping study: ICT and rural livelihood South Asia component* . Draft ICT4RL Research Scoping Report for International Development Research Centre (IDRC). pp 54

Hazelman M and Flor A G 2004 Regional prospects and initiatives for bridging the rural digital divide. AFITA/WCCA Joint Congress on Agriculture. pp 37

Huyer S and Sikoska T 2003 Overcoming the gender digital divide: understanding ICT and their potential for the empowerment of women. INSTRAW research paper series No.1. Retrieved October 6, 2013 from http://www.un-instraw.org/en/docs/gender_and_ict/Synthesis_Paper.pdf

ICT Update 2004 Information is Changing Things in The Market Place. ICT Update, A Current Awareness Bulletin For ACP Agric 18: 4-5

Kubkomawa H I and Salihu J M 2010 Role of Information and Communication Technology in the Nigerian Livestock Industry. *International Journal of Sustainable Agriculture*, 2(3): 51-54.

Lee M 2006 What's missing in the feminist research in new information and communication technologies? *Feminist Media Studies* 6(2): 192-210

Lwoga T E 2010 Bridging the agricultural knowledge & information divide: The case of selected telecenters and rural radio in Tanzania. *The Electronic Journal on Information Systems in Developing Countries*, 43(6): 1-14

Molnár S and Karvalics L Z 2002 Two models and six types of telecentres: a typological experiment. *Proceedings of the second biennial DISSAnet Conference (ProLISSA)* Eds: Bothma, T. and Kaniki, A. Infuse, Pretoria, 327 – 332

National Bureau of Statistics (NBS) 2013 2012 Population and Housing Census; Population Distribution by Administrative Area. Retrieved May 17, 2015 from [http://www.kilimanjaro.go.tz/Census General Report](http://www.kilimanjaro.go.tz/Census%20General%20Report)

Obiechina J 2004 *ICT and Agriculture: A contest Project on ICT and Agriculture*. Paper presented at AYF's seminar on ICT and Agriculture, Accra, Ghana, 21-23 April, 2004. pp 19

Rashid A T and Elder L 2009 Mobile Phones and Development: An Analysis of IDRC-supported Projects. *The Electronic Journal of Information Systems in Developing Countries* 36(2): 1-16

Roman R and Colle R D 2002 Themes and issues in telecentre sustainability. Retrieved December 9, 2014 from http://www.sed.man.ac.uk/idpm/research/publications/wp/di/documents/di_wp10.pdf

Sadaf S, Javed A and Luqman M 2006 Preference of rural women for agriculture information sources: A case study of district Faisalabad, Pakistan. *J. Agric. Soc. Sci* 2: 145–149.

Shem M N, Mtengeti E and Mutayoba K S 2010 *Development of Livestock Management and Policy Strategies for Pastoralists in Kilosa, Morogoro Region, Tanzania* . Final Report for AICAD. pp 73

Soundari H M (ed.) 2011 *Indian Agriculture and Information and Communications Technology (ICT)*. New Century Publications: New Delhi. pp 37

Souter D, Scott N, Garforth C, Jain R, Mascarenhas O and McKemey K 2005 The Economic Impact of Telecommunications on Rural Livelihood and Poverty Reduction: a study of rural communities in India (Gujarat), Mozambique and Tanzania Commonwealth Telecommunications Organisation for UK Department for International Development. pp 63

United Republic of Tanzania URT 2013 The Economic Survey 2012. Retrieved October 3, 2014 from <http://www.tanzania.go.tz/pdf>.

URT 2009 Communication Strategy for the National Strategy for Growth and Reduction of Poverty. Retrieved October 6, 2013 from <http://www.povertymonitoring.go.tz/downloads/new/commstrat.pdf>

Zappacosta M 2008 Connectivity in rural regions: bottlenecks and policy options. Retrieved May 18, 2014 from <http://www.jrc.es/home/report/english/articles/vol58/REG1E586.htm>

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