

The Use of Cell Phones in Sharing Market Information among Beef Cattle Smallholders in Mpwapwa District, Tanzania

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Abstract

This study sought to establish the role of cell phones in communication and dissemination of market information for beef cattle smallholders in Mpwapwa District, Tanzania. The study also identified the existing channels related to beef cattle market information for smallholders. A sample of 120 respondents, four (4) focus groups of discussants and 12 key informants were interviewed. Data were collected using a structured questionnaire from the 120 respondents, a focus group discussion guide and a guide for key informant. The questionnaire-based data were analyzed using the Statistical Package for Social Sciences where descriptive statistics, and inferential analysis using Chi-square (χ^2) test. The findings reveal that the majority of respondents possessed and used cell phones in sharing market information. This method was complemented by face-to-face interaction and using annual auctions calendar channels. The Chi-square (χ^2) test showed positive significant association between access to beef cattle market information via cell phones and awareness of market prices exploration; also between sales volumes demands and high beef cattle grades applicable in the market. From these findings, it is concluded that cell phone technology is one of innovative communication pathways that can improve traditional communication channels. However, the effective use of cell phones was constrained by major problems, which were established to be: limited availability of electricity for charging the phones and lack of reliable sources of market information. It is therefore recommended that the government should increase availability of power in rural areas, from various sources including solar energy and from the National grid to facilitate effective use of cell phones. Also, livestock information units should be established at the ward and village levels for easy access to reliable livestock information.

Keywords: *Cell phones, communication, market information, beef cattle smallholders*

Introduction

The past decade has witnessed significant progress in using information and communication technologies (ICTs) within agriculture in developing countries, mainly in the area of farmers' access to market information (CTA, 2009).

The present application of ICTs in communicating diverse knowledge is changing traditional ways of communication in rural areas that require more face-to-face interaction. This creates a challenge to identify appropriate innovative pathways to provide an enabling environment for accessing and using resource information in rural areas for increasing productivity. According to Cieslikowsk *et al.* (2009), a revolution in the rural areas has resulted in an increased rate of ICT use in developing countries such as cell phones, telecast, radio and information centres, which have also significantly increased in number.

Among ICT facilities, mobile telephone use has been growing rapidly and extensively in many countries of Latin America, India and Africa. The average number of cell phones rose between 100% and 400% per 100 inhabitants in five years, and subscriptions increased from 30% to 70% of the world's total from the year 2000 to 2007, respectively (Cieslikowsk *et al.*, 2009; Orbicom, 2007). One of the recent reports released by the International Telecommunication Union (ITU) (2015) has shown that there are more than seven (7) billion cell phone subscriptions worldwide, up from less than one (1) billion in the year 2000, corresponding to a penetration rate of 97%, up from 738 million in 2000. Moreover, there is evidence that many emerging cell phone users in the developing world are found in rural areas (Sood, 2006), and Africa has the world's fastest growing cell phones subscription (ITU, 2006).

In addition, Farrell and Isaacs (2009) noted the growth of economic development in Sub-Saharan Africa (SSA), which is associated with the existing advancement in ICT use related to agricultural and livestock sectors, which are the backbone of their economies. The technical Centre for Agricultural and Rural Cooperation (CTA) (2009) also demonstrated a high level of cell phone use in Uganda for providing extension services, sharing market data and weather forecasts. It is well established that information and communication are very crucial assets in all economic sectors of development in any country (Angello and Wema, 2010).

According to Tanzania Communication Regulatory Authority (TCRA) report (2011), mobile telephony is the fastest growing ICT sub-sector in Tanzania. Until June 2015, there were several mobile telephone service providers in the country including: Airtel, Tigo, Zantel, Vodacom and TTCL. The TCRA (2012) also reported a rapid increase in the number of cell phone subscriptions from 17.6 million in 2009 to 25.8 million in 2011, representing a 34.1% increase per annum. Statistics reveal that 25.6 million subscriptions recorded in Tanzania, were cellular connections, led by Vodacom with 11.6 million subscribers, followed by Airtel (6.9 million), Tigo (5.4 million) Zantel (1.5 million), while TTCL was trailing with only 96,000 subscribers (TCRA, 2011).

Cell phone technology is becoming an important way to connect rural livestock keepers to the marketing for their livestock and beef cattle in particular. Studies have shown that in Mali, cell phone technology is used to disseminate livestock market information to cattle producers and traders in an attempt to improve market transparency to reduce the rate of risks (Angerer *et al.*, 2010). Evidence from the same literature suggests that the use of cell phones to deliver livestock market information is one of the efforts that are employed in Mali to ensure access to reliable and timely market information which provides a basis for livestock keepers' decision making. In Zambia the use of cell phones in veterinary services and beef cattle marketing has enabled smallholder livestock producers to compare prices in their district, province or nationwide to make the best decision on where to sell their cattle (e-Transform Africa, 2012).

Similarly, according to Houghton (2009) cell phone technology has enabled livestock owners in Swaziland to access different markets thereby trading their cattle more effectively. The author argues that using this technology has improved the capacity of livestock producers to act according to the market contexts and go for the best value for their animals and products. Moreover, the existing literature from Niger and Nigeria provide evidence that livestock keepers are now downloading the latest price of cattle on their cell phones thus; the use of cell phones ensures rapid access to market price information in different regional cattle markets in North Africa for enhanced decision making (de Jode, 2010).

The link between ICT, including cell phones, and the performance of the livestock sector is rising largely from recognizing that information sharing is a crucial component in the development of any sector. The beef cattle sub-sector in Tanzania is under an extensive system whereas dissemination of market information is done through home visits or village gatherings.

However, the efficiency of such a system is reduced due to insufficient personnel to cope with the scattered grazing areas. Such an extensive system limits the efficiency of this method of livestock production, hence also beef production. This calls for establishing innovative information systems to address the gap not filled by extension services (Gakuru *et al.*, 2009).

The few studies conducted in Mpwapwa District on the use of innovative devices concentrated on education, telecenters and information sharing among scientists (Mtega and Malekani, 2009; Lwoga, 2010; Angello and Wema, 2010). However, little is documented about the position of cell phones in accessing market information for beef cattle production and marketing, among the actors. This study sought to fill the present knowledge by establishing the role of cell phones in communication and dissemination of market information among beef cattle stakeholders for increased access to market knowledge sharing in Mpwapwa District. The study also identified the existing communication channels related to sharing beef cattle market information among smallholders in the study areas.

Conceptual Framework

The conceptual framework presented in Fig 1 outlines three groups of variables which were studied, explaining the relationships between and among the variables. The framework groups the variables into background, independent and dependent variables. The main variable (dependent variable) is access to market information for beef cattle smallholders by the use of cell phones. This variable was measured in terms of whether the respondent had or did not have any access to beef cattle market information via cell phone in the past 12 months-from September 2011 to September 2012.

From Fig. 1 there is a direct relationship between background variables (sex, age, education, economic activities and marital status) and the dependent variables. In addition, there is a direct relationship between independent variables and dependent variable. Henceforth, both background and independent variable relationships end up affecting the dependent variable that is access to cattle market information via cell phones.

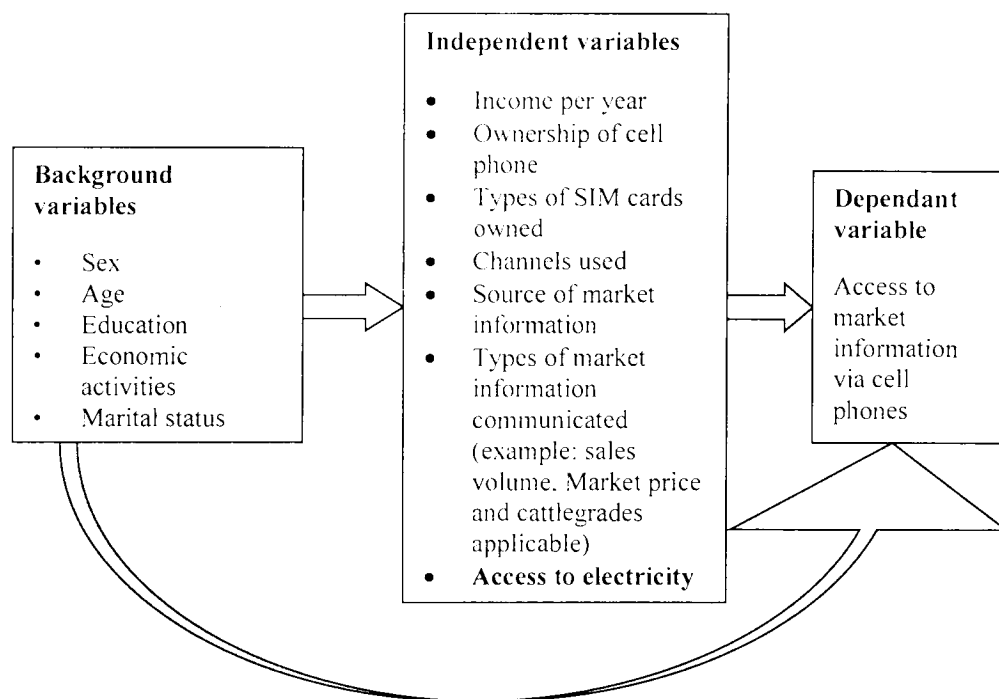


Figure 1: Conceptual framework

Methodology

Description of the Study Area

The study was conducted in Mpwapwa District located in Dodoma region Tanzania. The district was selected for the research because it is connected to four mobile telephone service providers and it is one of the catchment areas for beef cattle marketing in the country. The traditional beef cattle population in the district accounts for 167 976 (URT, 2009). The district has about 14 livestock primary markets where smallholder livestock producers and cattle traders market their cattle (URT, 2009).

Research Design and Source of Data

A cross-sectional research design was used to collect data from individual beef cattle smallholders. The study collected primary and secondary data using quantitative and qualitative tools. The sampling frame consisted of all beef cattle smallholders in Rudi and Mpwapwa divisions, residing in four wards namely Rudi, Chipogoro, Gulwe and Godegode. From each of these wards, one village was purposively selected including; Chilendu, Gulwe Chipogoro and Godegode for the study because they accommodate a significant cattle population. Moreover, cell phones local network coverage exists in these villages. From each village, 30 respondents were selected to

get a sample of 120 respondents. Quantitative data were mainly collected using a structured questionnaire. Likewise, secondary data about cattle population and marketing were obtained from the village and district livestock offices as well as from various reports by the Ministry of Livestock and Fisheries Development.

Table 1: Study locations and sample size

District	Divisions	Wards	Villages	Respondents (quantitative data)	Respondents (qualitative data)
Mpwapwa	Rudi	Rudi	Chilendu	30	11
		Chipogoro	Chipogoro	30	11
	Mpwapwa	Gulwe	Gulwe	30	11
		Godegode	Godegode	30	11
Total				120	44

Data Analysis

Quantitative data were analyzed using the Statistical Package for Social Sciences (SPSS) whereby descriptive statistics including means, percentages, frequencies and multiple responses were computed. Likewise, inferential analysis was done using the Chi-square test at $p \leq 0.05$. Cross tabulations was used to analyze associations between some categorical variables, such as; the use of cell phones to access beef cattle market information and market prices, beef cattle grades as well as sales volume prevailing in the market.

The Chi-square model used is:

$$\chi^2 = \sum \frac{(o - e)^2}{e}$$

Where:

χ^2 = the value of Chi-Square statistics

o = Observed frequencies in the contingency table

e = expected frequencies in the contingency table

Qualitative data obtained from Focus Group Discussions (FGDs) and Key Informant Interviews (KIIs) were analyzed thematically to highlight diversity among the individual experiences, and results were reported concurrently with quantitative data.

Results and Discussion

Background Characteristics of the Respondents

The background characteristics of the respondents comprised of age, sex, marital status, economic activities and education. The age of respondent ranged from 21 to 76 years. Among the 120 respondents, 12.5% were between 21 and 30 years old; 30.8% were between 31 and 40 years; 26.8% were between 41 and 50 years; 6.5% were between 61 and 70 years, while 0.8% were between 71 and 80 years old. The majority of the respondents (86%) were active and within the productive age group, being between 21 to 56 years old. The mean age for all respondents was 43.8 years.

Regarding the sex categories, 96.7% were males while only 3.3% were females (see Table 2). As it should be expected, the sample was dominated by male respondents because females are not very actively involved in marketing livestock, especially cattle. They are however engaged in producing and marketing other types of livestock especially poultry. With regard to marital status, the majority (97.5%) of the respondents were married, 1.7% were separated and 0.8% were widowed. The big percentage of married couples fell in the beef cattle farming category probably due to the high amount of start-up capital, which is attained either by inheritance upon marriage or after one has accumulated wealth from working for several years. Regarding levels of education, the majority (87.5%) of respondents had attended formal education. Four fifths (82.8 %) had primary school education (1 – 7 years) whereas one-eighth (12.5%) did not have any formal education. Only 0.8% of the respondents had attended training related to selling cattle using market information accessed by phone. Since the use of cell phone requires some basic level of education to operate important functions, the literacy level of livestock keepers can enable them to use cell phone technology to facilitate marketing their animals.

The distribution of respondents by major economic activities shows that more than two-thirds (68.6%) of the respondents were involved in crop and livestock production, consistent with the main economic activities in the area. Some farmers were also engaged in off-farm activities including petty trade (30.8%), and paid employment (0.6%). The most common petty trade activities carried out included: running small shops, milling machines, making and selling local brew, guesthouses and tearooms. Other activities related to petty trade were buying and selling livestock for instance cattle, pigs, sheep and goats as well as buying and selling crops. There was a small proportion of employees in the formal sector in the study area, confirming

the general trend in Tanzania where most rural people sustain their life through subsistence farming and livestock keeping.

Table 2: Background characteristics of respondents in Rudi and Mpwapwa divisions (n=120)

Variable	Frequency	Percent
Sex		
Male	116	96.7
Female	4	3.3
Total	120	100.0
Marital Status		
Married	117	97.5
Separated	2	1.7
Widowed	1	0.8
Total	120	100.0
Education		
Attained formal education	105	87.5
No formal education	15	12.5
Total	120	100.0

The average income earned by an individual respondent has a direct relationship with their adoption of new technologies. Individuals who have higher income can afford the price of innovative technologies than the one with low income (Rogers, 2003). In order to estimate the average income of individual respondent for the past 12 months (September 2011–September 2012) various sources of smallholder's income were examined. These included the average net income from crop production; livestock production; selling cattle; trading other items; rentals of various assets and remittances. Other sources considered, including; charcoal making and selling local beer. According to these results the minimum average income was TZS 75,000, and the maximum income was TZS 104,430,000 with an average of TZS 5,758,762 per year per an individual livestock producer. More than two-fifths (45.8%) of the respondents were earning from TZS 500,001 to 1,000,000. Such income could be used to enhance the adoption and utilization of cell phone technology.

Ownership of Cell Phones

The ownership of cell phones and related elements were examined in relation to their use in communication and dissemination of market information for beef cattle smallholders. The study revealed that 83.3% of the respondents possessed and utilized cell phones. Of these, 15.8% had two or more cell phones. In addition, 65.8% of the respondent had access to cattle market information via cellphones during the past 12 months from September 2011 to September 2012. These findings are consistent with

similar finding by Masuki *et al.* (2010) in a study conducted from Uganda, which indicated that the use of cell phone by individuals who possessed their own cell phones was expanding rapidly in the country. The findings in Table 3 show the number of cell phones, Subscriber Identity Module (SIM) cards and the monetary values of cell phones owned. However, none of the interviewed respondents had access to landline phones at home, implying that the use of cell phones has outshined the diffusion of the landline technology in the study area.

The statistics in Table 3 show that the number of SIM cards owned by the respondents ranged from one to four. However, all SIM cards were not necessarily active at the same time. Normally one SIM card was used frequently and only a few respondents had access to cell phones that can accommodate the dual SIM cards where all SIM cards owned can be active all the time. Respondents owned cellphones whose value was between TZS 20,000 and 300,000 depending on the type, year and place of purchasing as well as brand of the cell phone owned.

Table 3: Distribution of quantity and monetary values of cell phones owned (n=120)

Item	Minimum	Maximum	Mean	Std Deviation
Cell phones	1.00	3.00	1.31	0.58
SIM cards	1.00	4.00	1.65	0.69
Monetary value	20 000.00	300 000.00	71 270.00	53 291.62

Distribution of Respondents Based on Types of SIM Cards Owned

In the study area, cell phone services were provided by Airtel, Vodacom, Tigo and Zantel. As Fig. 2 shows, Airtel had the highest proportion of subscribers (48.2%) followed by Tigo (39.8%), Vodacom (8.4%) and Zantel (3.6%). Since then, another cell phone service provider has recently (2016) entered the market – Halotel, competing for the same market. While Vodacom is the most subscribed provider in Tanzania (TCRA, 2011), these findings reflect the spatial variation in the dominance of each provider, an indication of the consumers' preference or the quality of services in the area. According to FGD and responses from key informants, the user's preference for a particular provider may be due to many factors including: the quality of network connections, market competition among service providers, ability to penetrate remote areas to introduce services within a locality, and the cost of making calls.

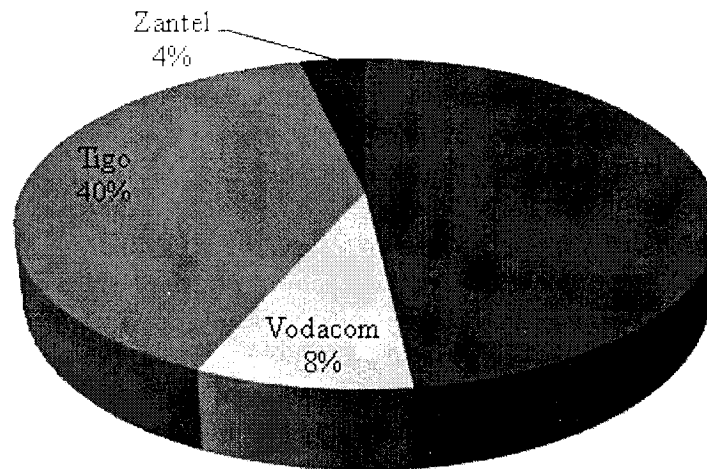


Figure 2: Types of SIM cards owned

Among the Subscriber Identity Module (SIM) cards owned by the respondents, Airtel was used most often by more than three-fifths (60.3%) the respondents, followed by Tigo, which was slightly below three-eighths (37.1%) whilst Vodacom was used by only 2.6%. This was attributed to the level of network coverage and service charges whereby, the network for Vodacom was largely unreliable in the surveyed villages. Good quality connections were only concentrated in a few locations compared to Airtel and Tigo, which had stronger and more widespread signals. Hence, having more than one service provider in the study villages enabled cell phone users to choose a provider whose services were reliable and affordable.

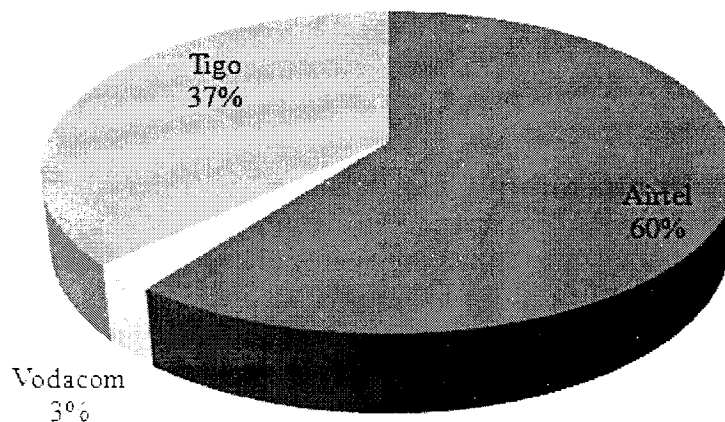


Figure 3: Types of SIM cards used most often

The respondents had various reasons for using more than one SIM cards (Table 4). More than two-thirds (34.2%) were using multiple cards for saving costs by making on-net calls. The findings are consistent with those from other studies conducted in Babati, Kilosa and Mvomero districts in Tanzania. (Furuholt and Matotay, 2011; Sife *et al.*, 2010).

About 27.4% of the respondents were using multiple SIM cards to ensure they had network access in locations where their favourite network was not accessible. About a quarter (25.6%) of the respondents used multiple cards whenever one service provider had network problem: while more than one-eighth (12.8%) used multiple cards to benefit from different promotions offered by their local network service providers. This implies that, dissatisfaction with one provider based on cost and network coverage have forced cell phone users to use several SIM cards to reduce cost by shifting to a service provider that offers lower charges at any point in time. The percentage of cases presented in Table 4 exceeds 100% because each respondent was allowed to give more than one reason for using more than one SIM card.

Table 4: Distribution of respondents by rationale for using multiple SIM cards (n=120)

Reasons	Count	Percent of responses	Percent of cases
Benefiting from different promotions	15	12.8	28.3
Saving cost by making on-net calls	40	34.2	75.5
Using whenever one service provider has network problem	30	25.6	56.6
Using in places where there is no service normally applied by the respondent	32	27.4	60.4
Total	117*	100.0	220.8*

*Multiple responses

The Existing Communication Channels

This study intended to identify the existing communication pathways related to beef cattle market information for smallholders hence to establish the use of cell phones for accessing market information in the study area and beyond. In order to address this objective and corresponding research questions, respondents were asked multiple-response questions about the existing market information pathways in order to establish insights regarding the communication pathways exploited by smallholder in rural areas, in relation to cattle market information sharing. The study revealed that the leading channel for most respondents (36.1%) to access market

information was face-to-face mode of communication, which they used to facilitate marketing beef cattle (Table 5). This mode of communication involves home and market place visits, as well as livestock keepers' group meetings.

Annual/monthly auction calendars were also used by more than one third of the respondents (35.5%). The calendar was issued by the District Council in the form of posters. Many beef cattle keepers were familiar with various auction dates for different livestock market places. Cell phones came in third, being used by about 28.4% of respondents to obtain market information. This implies that this relatively new communication technology is gaining ground in the rural areas and in the agro-pastoral communities in particular, to facilitate cattle market information sharing that coordinates routine interaction among various actors thereby providing more space for bargaining and timely decision-making. Likewise, the technology complements other traditional communication pathways including face-to-face methods and posters. Similar results were reported by Kubkomawa and Salihu (2010) and Salia *et al.* (2011) in studies conducted within livestock and fishing communities, which indicated that about 20% and 22% of the respondents were using cell phones for sharing market price information, which provided better market coordination and prices alert.

Smallholders are therefore more likely to obtain market information through channels that could facilitate feedback in the process of information sharing. Findings in Table 5 suggest that more than one third of the respondents reported that among the identified channels, face-to-face (55.9%) communication and cell phones use (44.1%) were able to facilitate feedback for the actors involved, since they involved two way communications. Studies by Rabayah and Qalalwi (2011) as well as Churi *et al.* (2012) also pointed out that, the exchange of information is required for both the seller and the buyer. Hence, gathering and exchanging market information is a vital skill for both parties.

**Table 5: Channels used to convey beef cattle market information
(n=120)**

Communication pathways	Count	Percent of responses	Percent of cases
Face to face (home visits, market place visits and/livestock keepers group gatherings)	118	36.1	99.2
Annual/monthly calendar in form of posters	116	35.5	97.5
Cell phones	93	28.4	78.2
Total	327	100.0	274.8
Channels that allow feedback			
Face to face	119	55.9	100.0
Cell phones	94	44.1	79.0
Total	213*	100.0	179.0*

*Multiple responses

Source of Market Information for Beef Cattle

It was found that market information sharing was highly dominated by personal relationships. Nearly two-thirds (65%) of respondents reported that the source of market information for selling their beef cattle was their fellow livestock keepers, followed by middlemen (*Magalagaja in Gogo native language*) (27.7%) and principle cattle traders from other regions (7.3%). Related findings have also been reported in agricultural market information literature, which emphasized that smallholders in the rural areas normally rely on informal networks (friends, relatives and local traders) to acquire information due to insufficient formal information systems. (FAO, 2004; Chilimo, 2008; Mwakaje, 2010; and Mittal *et al.*, 2010).

The findings in Table 6 similarly indicate that the most valid and reliable source of market information for respondents in this study were their fellow beef cattle keepers (91.7%), followed at a distant by principle buyers (5%) because they considered weight of cattle to determine the price, which is contrary to the middlemen/brokers who take advantage of the sellers ignorance regarding the market and prices. It was revealed that respondents who dealt with principle buyers were willing to communicate with them via cell phones from various secondary cattle markets outside the district since this channel was time and cost effective. Only a few respondents (3.3%) reported to consult middlemen/brokers as their last alternative due their common behaviour of cheating regarding the price of cattle. This information was confirmed during interviews with key informants (cattle buyer) in Chipogoro village who reported that cheating about the market price is a normal practice for intermediaries because they want to make as much profit as possible from each cattle-trading mission. Since, there was

no formal livestock information centres established in the district, lack of regular and reliable formal source of market information may constrain efforts to seek market information prior to selling cattle. Actors may therefore end up having unreliable information from their local networks.

Table 6: Main source of beef cattle market information (n=120)

Main source	Count	Percent of responses	Percent of Cases
Fellow beef cattle keepers	115	65.0	98.3
Principal cattle buyers	13	7.3	11.1
Middlemen (<i>Magalagaja</i>)	49	27.7	41.9
Total	177	100.0	151.3
The most valid and reliable source			
Fellow beef cattle keepers	110	91.7	95.7
Principal cattle buyers	6	5.0	5.2
Middlemen (<i>Magalagaja</i>)	4	3.3	3.5
Total	120*	100.0	104.3*

*Multiple responses

Types of Market Information Shared

The types of market information shared by respondents as indicated in Table 7 were market prices (42.4%), beef cattle grades (25.1%), auction dates (15.5%) and sales volumes (17%). The findings revealed that there was significant association between access to beef cattle market information via cell phones and market prices exploration ($\chi^2 = 6.444$; $p \leq 0.011$); access to market information and beef cattle grades ($\chi^2 = 10.704$; $p \leq 0.001$); as well as access to market information and sales volumes ($\chi^2 = 13.860$; $p \leq 0.001$). This implies that beef cattle keepers were actively using their cell phones to access required market information, which could guide them in decision-making based on the type and number of cattle to be sold at a certain time. These findings corroborated those of Masuki *et al.* (2010) and Abel-Ratovo *et al.* (2012) who reported that cell phones were used to seek market information about prices, volumes and quality or grades applicable. However, there was no significant association between access to market information via cell phones and searching for auction dates. This may be due to the experience of using monthly and annual auction calendars, since the auction dates are already known there is no need to seek them by phone.

Table 7: Types of market information shared (n=120)

Type of information	Count	Percent of responses	Percent of cases	χ^2	P-value
Market prices	115	42.4	98.3	6.444**	0.011
Beef cattle grades applicable	68	25.1	58.1	10.704***	0.001
Dates for sales/auction dates	42	15.5	35.9		
Sales volume	46	17.0	39.3	13.860***	0.000
Total	271*	100.0	231.6*		

(Multiple responses) Note: ***, **, * significant at 0.1, 1 and 5% levels respectively ($P \leq 0.001$, $P < 0.01$ and $P \leq 0.05$)

Access to Electricity

Access to electricity and sources of energy were examined. The findings in Table 8 show that 13.3% had access to off-grid electricity at their home places mainly solar panels 10.8% and 2.5% had access to diesel generators. However, none of the respondent had access to the national grid electricity in their homes at Gulwe village despite the availability of the national grid only five km away; this is due to the high initial cost of installment. This findings contrast from the national statistics indicating that about 2% of rural households were connected to the national grid (URT, 2010). If electricity is lacking cell phone owners face difficulty to charge their cell phone batteries at home. Findings of other studies have similarly explained that lack of electricity in rural areas is a dictating factor for using innovative communication devices hence contributing to information asymmetry (Chilimo, 2008; Mwakaje, 2010; Sife *et al.*, 2010; Jooste and Groenewald, 2012).

Table 8: Distribution of Respondents based on Access to Electricity (n=120)

Access to electricity and Land	Frequency	Percent
Access to electricity	16	13.3
Type of electricity		
Power generators	3	2.5
Solar panels	13	10.8

Conclusions and Recommendations

This study sought to establish the use of cell phones in communication and dissemination of beef cattle market information for smallholders and the existing channels in place. The findings show that the majority of respondents in the study areas possessed and used cell phones in market information sharing while complementing face-to-face and annual auctions calendar, which are used most often to obtain beef cattle market

information for smallholders. The results also pointed out that fellow livestock keepers were the main source of market information to beef cattle smallholders. Moreover, the Chi-square (χ^2) test showed significant association between the use of cell phones for accessing beef cattle market information in terms of current market prices, beef cattle grades applicable and sells volumes. This implies that the use of cell phone technology ensures rapid access to technical and cattle market information for beef cattle smallholders' hence facilitating timely decision making during marketing processes.

From these findings, it is concluded that cell phones have complemented traditional communication pathways in terms of rapid access to technical and market information among beef cattle smallholders in Mpwapwa District. However, the main problems related to using this technology were established to include: limited availability of electricity for charging cell phones and lack of reliable sources of market information. It is therefore recommended that the government should promote availability of reliable power in rural areas, from various sources including solar or from national grid, to facilitate efficient and effective use of cell phones. In addition, livestock information units should be established at the ward and village levels to facilitate easy access to reliable livestock information.

Acknowledgement

Sincere gratitude is due to the Enhancing Pro-poor Innovations in Natural Resources and Agricultural Value-chains (EPINAV) programme of Sokoine University of Agriculture for the financial support that enabled this study to be undertaken.

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