

**THE USE OF CELLPHONES IN COMMUNICATION AND DISSEMINATION
OF MARKET INFORMATION FOR BEEF CATTLE SMALLHOLDERS IN
MPWAPWA DISTRICT, TANZANIA**

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**A DISSERTATION SUBMITTED IN PARTIAL FULFILMENT OF THE
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ABSTRACT

The traditional pathways used in dissemination of information including that of market for cattle remain one of the focal challenges for beef cattle smallholder in many rural areas. Although there is evidence in India, Africa and Tanzania distinctively on the expansion of social networking, micro-entrepreneurs growth and access to crops and fish marketing enhanced by cellphones, the use of cellphones in access to beef cattle market information is little in Tanzania particularly in Mpwapwa District. Therefore, this study sought to establish the role of cellphones in communication and dissemination of market information for beef cattle smallholders in Mpwapwa district, Tanzania. The specific objectives were: to identify the existing channels related to beef cattle market information for smallholders; to determine factors that influence smallholders to use cellphones in access to market information disseminated for beef cattle; and to examine the extent to which cellphones are used in accessing cattle market information for smallholders. Data were collected in September 2012 from 120 respondents using a structured questionnaire, a focus group discussion guide and key informant interview guide. The questionnaire-based data were analysed using the Statistical Package for Social Sciences in which the main analytical model was binary logistic regression. In the model, the dependent variable was access to beef cattle market information via cellphones with two options; did not access (0) and accessed (1). Research findings revealed that the use of cellphones in access to market information was mostly influenced by distance from home to the nearest cattle market, the variety of information demands and income earned. From these findings, it is concluded that cellphones has complemented the traditional pathways. However, the major problem was limited availability of electricity. Based on the above conclusion, it is recommended that the government should assist on availability of reliable power to facilitate efficiency of cellphones.

DECLARATION

I, Neema Shiletikwa Urassa, do hereby declare to the senate of Sokoine University of Agriculture that the content of this dissertation is my own original work done within the period of registration and that it has neither been submitted nor being concurrently submitted for degree award in any other institution.

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Date

The above declaration is confirmed by:

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LIST OF ABBREVIATIONS AND ACRONYMS

CTA	Technical Centre for Agricultural and rural cooperation
DALDO	District Agricultural and Livestock Development officer
DED	District Executive Director
DSI	Development Studies Institute
EPINAV	Enhancing Pro-poor Innovation in Natural Resources and Agricultural Value-chains
FAO	Food and Agriculture Organisation
FGD	Focus Group Discussion
ICT	Information and Communication Technology
IDRC	International Development Research Centre
ITU	International Telecommunication Union
KIIs	Key Informants Interviews
MKUKUTA	<i>Mkakati wa Kukuza Uchumi na Kupunguza Umaskini</i>
MLFD	Ministry of Livestock and Fisheries Development
NB	Nota Bene
NBS	National Bureau of Standards
NSGRP	National Strategy for Growth and Reduction of Poverty
OLS	Ordinary Least Square
REPOA	Research on Poverty Alleviation
SIM	Subscriber Identity Module
SMS	Short Message Service
SPSS	Statistical Package for Social Sciences
SSA	Sub-Saharan Africa

SUA	Sokoine University of Agriculture
TALIRI	Tanzania Livestock Research Institute
TCRA	Tanzania Communication Regulatory Authority
TTCL	Tanzania Telecommunication Company Limited
TSZ	Tanzanian Shorthorn Zebu
TZS	Tanzanian Shillings
URT	United Republic of Tanzania
VEOs	Village Executive Officers
WEOs	Ward Executive Officers

CHAPTER ONE

1.0 INTRODUCTION

1.1 Background

The past decade has seen prominent progress in the use of information and communication technologies (ICTs) in agriculture in developing countries, mainly in the area of farmers' access to market information (CTA, 2009). The present application of ICTs in sharing and dissemination of diverse knowledge is changing traditional ways of communication in rural areas that require more of face-to-face interaction. This creates a challenge for social scientists to identify appropriate innovative pathways to provide an enabling environment for accessing and using resource information in rural areas for increased 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 cellphones, telecast, radio and information centres, which have also increased in number amazingly in the same period.

Among the ICT facilities, mobile telephony has been extensively used in Latin America, India and Africa, the average number of cellphones rose between 100 and 400% per 100 inhabitants in five years and subscriptions increased from 30 to 70% of the world's total from 2000 to 2007, respectively (Cieslikowsk *et al.*, 2009; Orbicom, 2007). However, there is evidence that many emerging cellphone users in developing world are found in rural areas (Sood, 2006), and Africa has the world's fastest growing cellphones subscription (ITU, 2006). Similarly, ICTs are increasingly becoming integrated into the dissemination of information to farmers (ITU, 2006; Gakuru *et al.*, 2009). The introduced ICTs are used to deliver extension information to farmers on crop care,

animal husbandry, fertilizer application, livestock inputs, drought mitigation, parasite and disease control, weather forecasting and market prices.

Farrell and Isaacs (2009) reported Rwanda to be the leading ICT user country in East Africa of which 65% of its population have access to cellphones, internet, television and radio broadcast services, followed by Kenya, Uganda, and Burundi. The same authors, Farrell and Isaacs (2009) noted the growth of economic development in Sub-Saharan African (SSA), which is associated with the existing advancement in ICT use related to agricultural and livestock sectors that are the backbone of their economies. CTA (2009) also demonstrated high level of cellphone use in Uganda for providing extension services, sharing market data and weather forecasts. In this respect, the information and communication is said to be a very crucial asset in all economic sectors of development in a particular country (Angello and Wema, 2010).

Tanzania, like most other developing countries, is adopting the use of ICTs in almost all sectors of the economy including the livestock sector. According to the Tanzania Communication Regulatory Authority (2011), mobile telephony is the fastest growing ICT sub-sector in Tanzania in which five mobile telephone service providers identified are Airtel, Tigo, Zantel, Vodacom and TTCL. TCRA (2012) also reported a rapid increase in the number of subscriptions from 17.6 million in 2009 to 25.8 million in 2011. Statistics reveal that 25.6 million subscriptions recorded were cellular connections, led by Vodacom 11.6 million, Airtel 6.9 million, Tigo 5.4 million, and Zantel 1.5 million mobile users, while TTCL recorded to have 96 000 subscribers.

The link between ICTs like cellphones and the performance of livestock sector is rising largely from the recognition that information sharing is a crucial component in the development of any sector. The beef cattle sub-sector in Tanzania is under extensive system where dissemination of market information is through home visits or village gatherings. However, insufficient personnel to cope with the scattered grazing areas under the extensive systems limit the efficiency of this method. This necessitates the need for immediate innovative information systems to address the gap not filled by extension services (Gakuru *et al.*, 2009). The available ICT services, however, could be used to enhance the fast growing beef cattle subsector in meeting the high demand of quality beef in the country. The sustainable use of available local networks in the country for exchange and transfer of information will reduce face-to-face interactions, which are time and resource consuming. This study, therefore seeks to find out the role of cellphones in communication and dissemination of market information among beef cattle stakeholders for increased access to market knowledge sharing in Mpwapwa District. The study is guided by traders' search behaviour theory by Aker (2008) that highlights the use of cellphones for reduced traders' search costs, which also allows searching for a larger number of markets more quickly.

1.2 Justification

The traditional pathways used in dissemination of information including that of market for cattle remain one of the focal challenges for beef cattle smallholder in many rural areas including Mpwapwa District. Although there is evidence in India, Africa and Tanzania distinctively on the expansion of social networking, micro-entrepreneurs growth and access to crops and fish marketing enhanced by cellphones (Sife, 2010; Mwakaje, 2010; Rashid and Elder, 2009; Donner, 2007 and Jensen, 2007), the use of

cellphones in access to beef cattle market information is little in Tanzania particularly in Mpwapwa District. Studies have shown that lack of time and reliable market information in terms of price, trends, techniques, sales-volume and grades applicable is a severe problem facing rural smallholders (Montshwe, 2006; Munyua, 2007 and Musemwa *et al.*, 2008).

In addition, beef cattle smallholders are facing a number of challenges due to insufficient market information including, uncertain timely decision making and insufficient bargaining power. Other challenges comprise threat of theft, transmission of diseases as well as loss of weight by animals on long treks to and from market places when the price is unfavourable (de Jode, 2010). 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 cellphones in accessing market information for beef cattle, among involved actors. This study will fill the present gap of knowledge by finding out the role of cellphones in market information sharing for increased beef cattle marketing performance in the study area.

The information gathered from this study will then inform policy makers and planners hence the formulation of strategies targeting beef cattle smallholders' access to market information for timely decision-making and increased bargaining power. In addition, this study will unfold cattle smallholders' knowledge on the use of cellphones in access to market information in terms of the existing price, sales-volumes, and grades applicable to avoid theft, disease transmission and loss of weight by animals on long treks to and from market places.

The study is in line with the National Livestock Policy (2006) objective three under the livestock information services that emphasizes on “strengthening technical support for livestock information services” regarding the collection and dissemination of market information. It is also in conformity with the National Information and Communication Technologies Policy (2003), as the second objective insists on the application of ICT in information sharing for transformation of the society. It is further in line with cluster one of the National Strategy for Growth and Reduction of Poverty (NSGRP-II) (2010) as well as millennium goal eight, both of which stipulate growth, and reduction of income poverty via innovative communication and knowledge dissemination pathways. It is expected that the findings from this study will provide information to policy makers, planners and development partners who will contribute to sustainable development of the beef sector innovative communication pathways.

1.3 Objectives of the Study

1.3.1 Overall objective

To establish the role of cellphones in communication and dissemination of market information for beef cattle smallholders in Mpwapwa District

1.3.2 Specific objectives

- (i) To identify the existing communication channels related to beef cattle market information for smallholders in Mpwapwa District.
- (ii) To determine factors that influence smallholders to use cellphones in access to market information disseminated for beef cattle.
- (iii) To examine the extent to which cellphones are used in accessing cattle market information for smallholders.

1.3.3 Research Questions

- (i) What are the existing pathways for beef cattle market information sharing among smallholders?
- (ii) What factors that influence smallholders on whether or not to use cellphones in access to information related to beef cattle marketing?
- (iii) To what extent are cellphones used by smallholders in communicating market information for beef cattle marketing?

1.4 Conceptual Framework

The variables studied are presented in Fig.1 and described afterwards.

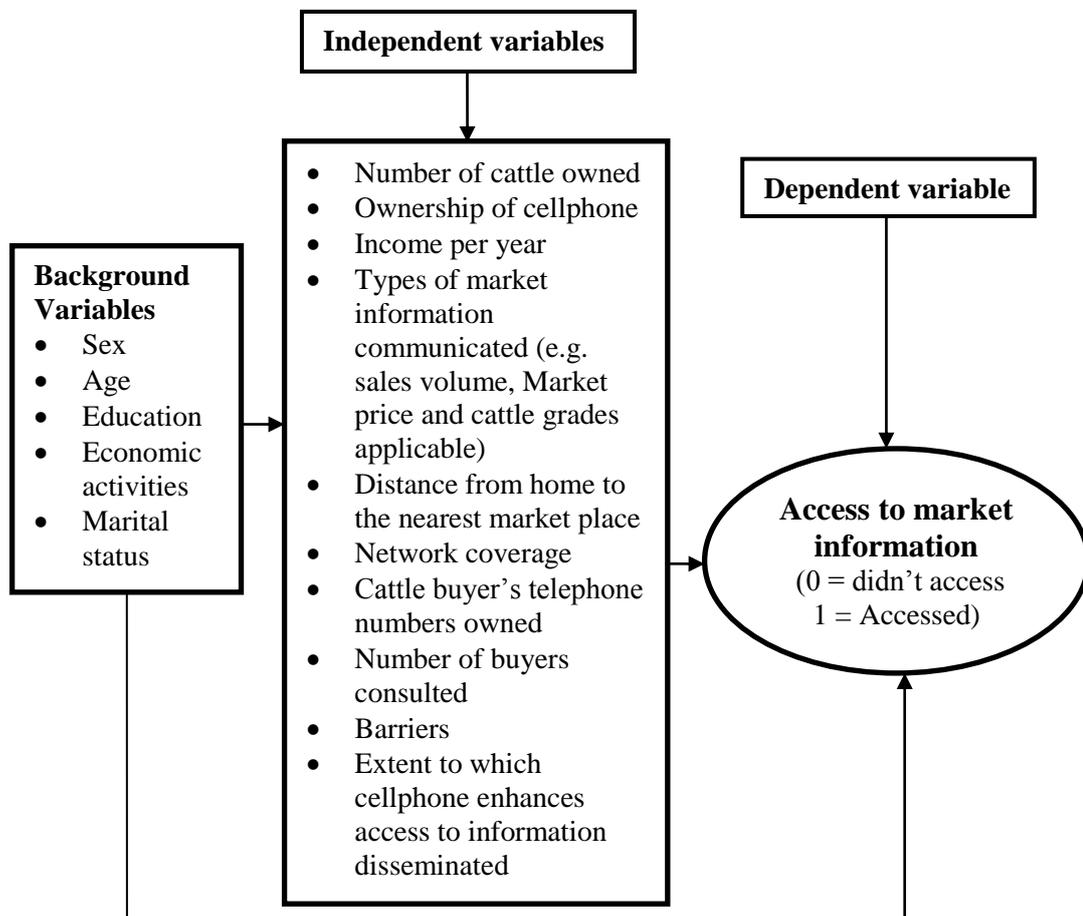


Figure 1: Conceptual framework

The conceptual framework embraces three groups of variables namely background variables, independent variables and dependent variable. The main variable (dependent variable) is access to market information for beef cattle smallholders by the use of cellphones. This variable was measured in terms of whether the respondent had or had not had any access to beef cattle market information via cellphone in the past 12 months that is from September 2011 to September 2012.

From Fig. 1 there is indirect and direct relationship between background variables (sex, age, education, economic activities and marital status) and the dependent variable but there is direct relationship between independent variables and dependent variable. However, both direct and indirect relationships end up affecting the dependent variable that is access to cattle market information via cellphones. The theoretical relationships are as follows:

- (i) The larger the number of cattle owned, the higher the chance for the smallholder to use a cellphone in access to market information concerning sales volumes, prices and beef cattle grades applicable in the various cattle market places hence timely decision-making in terms of category, time and volume of cattle to be sold.
- (ii) The ownership of a cellphone enhances access to beef cattle market information disseminated by assorted actors involved including the local government officials (Extension agents, Ward Extension Officers (WEO) and Village Executive Officers (VEO)).

- (iii) The higher the income earned per individual smallholder per year, the better the chance smallholder stands to use cellphone in access to beef cattle information disseminated.
- (iv) The more the distance from home to the nearest cattle market place the higher the demand and chance of the cellphone's use in access to cattle market information.
- (v) The higher the network coverage, the more the ability of using cellphones in access to cattle market information.
- (vi) The more the number of cattle buyers searched, the more the market information is likely to be accessed hence increased bargaining power for smallholders.

CHAPTER TWO

2.0 LITERATURE REVIEW

2.1 The Concept of ICT and Cellphones

Information and Communication Technology (ICT) is a broad term used to explain communication devices such as radio, television, internet, cellphones, computers and network hardware and software (Aker, 2010). Angello and Wema (2010) consider ICT to be a communication system that encompasses full range of media commonly used in communication process including computers and the internet. However, this study focuses on cellphones technology given its relative growth and high rates of taking up in developing countries, also the technology allows two-way information flows thus there is open room for feedback. According to Garforth (2003), effective communication is the one that considers five elements of communication process, which are source, message, channel, receiver and feedback. Sife *et al.* (2010) explains cellphones as a single devices that can receive, process, store and display text, image and sound together.

2.2 Communication

Communication in the context of this study connotes sending or receiving information via cellphones. The transformation of livestock sub sector specifically beef cattle owned by smallholders inevitably depends on the route and channel by which information communicated or disseminated reaches users. While reporting on agricultural information needs in Tanzania, Shetto (2008) pointed out that, the required information on agriculture including livestock marketing is available but the accessibility by the target group in need is limited due to inappropriate channels used in communication and

knowledge sharing. The author also suggests the use of innovative pathways available to facilitate information sharing among stakeholders.

2.3 Beef Cattle

In the context of this study, these are mainly traditional cattle producing meat for daily human consumption and they are very crucial assets for food security and social obligations in the country. Many herds are dominated by the Tanzania Short horn Zebu (TSZ), Ankole, Boran and their crosses (URT, 2006).

2.4 Beef Cattle Marketing

Marketing of beef cattle in the context of this study is regarded as selling of live animals done by cattle producers at the market places or at home, where beef cattle herds are located. In rural areas, buyers of live animals tend to visit beef cattle keepers at home to buy cattle but sometimes, they do wait for beef cattle owners to bring their animals to the market places, popular as open primary cattle market places or cattle auctions in Tanzania. The study focuses on beef cattle market information sharing since, even if the performance of beef cattle sub-sector is associated with many other factors including proper selection, breeding and improved husbandry, inadequate access to market information may restrict beef cattle smallholders' bargaining power and timely decision-making.

Kristjanson *et al.* (2004) put emphasis on improved husbandry however; these authors also suggest more research on how smallholder livestock keepers can access appropriate information regarding marketing of cattle. Mnenwa and Maliti (2009) explain the absence of an information system in Tanzania as a cause of high level of information

asymmetries, causing inefficiencies in the marketing system in-terms of pricing and condition set for increased efficiency in marketing.

2.5 Market Information Dissemination

Shepherd *et al.* (1997) explained market information dissemination as a regular public dissemination of prevailing market prices, commodity volumes, market conditions and available price trend. Cellphones allow consumers, traders and farmers to search for market information appropriate for timely decision-making. The research has shown that although traditional agricultural market information systems provide information to farmers, buyers and consumers via radios and message boards, market actors have not been active participants in sharing the information gathered to enhance timely decision-making (Aker, 2008).

2.6 Empirical Information on the Use of Cellphones for Smallholders at the Global Level

Knowing that communication is a vital resource in the development process, many studies have been carried out globally to ascertain the use of innovative pathways in communication and dissemination of information to smallholder farmers. Empirical study in Malaysia revealed that the use of cellphones has been vital and benefit to fishermen in accessing information related to fishing location and market demands from their colleagues, agency officers and dealers in the fishing communities (Omar *et al.*, 2012). The same authors, Omar *et al.* (2012) noted that this innovative technology enhances the safety of fishermen and is pertinent in widening their network and access to several fish markets for improved market performance.

Similarly, research findings from a study conducted in Bangladesh have shown that cellphone technology in rural areas has been significantly used even by farmers in the low-income group (Islam and Grönlund, 2011). The evidence from the same research also shows that the use of cellphone technology helps to overcome barriers of time; location; access to market players; customers and improves productivity for smallholder farmers in the rural areas.

According to Abraham (2007) in the research conducted in India on the use of cellphones in the fishing industry, it was noted that fishermen were able to discuss the price of their catches with dealers in advance via cellphones hence access to better price opportunities and prevention of unnecessary catch wastes. Furthermore, a research in Nigeria has also shown that cellphones have been useful pathway that aid farmers in faster dissemination of information related to livestock market prices, weather, security and disease prevention advice during the emergency of outbreaks hence critical decision-making by beef cattle keepers (Kubkomawa and Salihu, 2010).

In Swaziland, cellphones have been reported to improve access to markets for beef cattle by enabling owners to trade their live animals effectively (Houghton, 2009). In addition, a study in Rwanda by Donner (2007) found that a rapid growth of micro entrepreneurs business is attributed by the link established between suppliers and their customers via cellphones. More studies on the use of cellphones among small-scale farmers in Uganda and Kenya revealed that cellphones have been used to access agricultural inputs, crop market information, to monitor financial transaction and coordinating the consultation with agricultural experts for different technical assistance (Martin and Abbott, 2011; Okello *et al.*, 2012). The above examples explain the development of this innovative

technology (cellphones) in promoting agricultural sector worldwide in terms of communication and dissemination of agricultural information mainly for the smallholder farmers.

2.7 The Use of Cellphones and Access to Agricultural Information in Tanzania

The Tanzanian economy still depends on agriculture as its support thus agricultural information is considered as a key factor for social-economic development of small-scale farmers in the rural areas. The research findings by Nyamba and Mlozi (2012) in the study conducted in Kilolo District, Iringa, Tanzania have revealed that the use of cellphones in accessing agricultural information have shown a positive economic impact. Results have shown that most of the farmers in Kilolo District valued cellphones as innovative communication pathway that is fast and convenient to access information related to their farming practices and crop markets. Thus, the adoption of cellphone technology in many rural areas of Tanzania can influence faster dissemination of variety of agricultural information to smallholder farmers for timely decision-making.

Equally, a study in semi-arid areas of Tanzania has shown that cellphones are preferred by smallholder farmers for communicating assorted agricultural information including climate, markets and agricultural inputs from local dealers for critical decision making at farm-level (Churi *et al.*, 2012). With climate change and variability, communication and dissemination of climate information to smallholder farmers are of paramount important for crop and livestock production in the rural areas. Hence, the use of innovative communication devices enables flow of such information to farmers at any time for critical information communication and knowledge sharing among smallholder farmers in the rural areas. However, the potentiality of cellphones use for communicating

agricultural information disseminated is constrained by the lack of reliable power in many rural areas of Tanzania (Sife *et al.*, 2010; Mwakaje, 2010; Churi *et al.*, 2012; Nyamba and Mlozi, 2012). With regard to the use of cellphones in communication and dissemination of agricultural information, the studies conclude that cellphone is one of the channels that could facilitate rapid access to information even to smallholder farmers in low-income group.

Generally, there are few documented prosperous on the use of ICTs including cellphones in relation to agricultural information sharing in Tanzania (Chilimo, 2008; Sife *et al.*, 2010; Mwakaje, 2010; Churi *et al.*, 2012; Nyamba and Mlozi, 2012). However, the information about the use of cellphones in accessing beef cattle market information for smallholders in the agro-pastoralists communities is still limited. Therefore, it is important to understand how this technology is used with regard to beef cattle market information sharing among the involved actors.

CHAPTER THREE

3 0 RESEARCH METHODOLOGY

3.1 Description of the Study Area

Mpwapwa District is among the six districts in Dodoma Region namely Kongwa, Bahi, Chamwino, Kondoa and Dodoma Municipality. The district is located to the eastern side of Dodoma Region about 120 km from Dodoma. It borders Kilosa District on its eastern part, Kongwa District on the northern side, Chamwino District on the western side and Kilolo District to the southern side.

Mpwapwa District is divided into four Divisions namely Mpwapwa, Mima, Kibakwe and Rudi, 30 wards, 93 villages and 430 sub-villages. About 90% of the population is engaged in agriculture. The traditional beef cattle population in the district accounts for 167 976 (URT, 2009). The research was conducted in Rudi and Mpwapwa Divisions. The reason that prompted this study to be conducted in Mpwapwa District is that, it is one of the catchment areas for beef cattle marketing in the country.

3.3.1 Quantitative data collection and instruments

The instrument employed to collect quantitative data in this study was a structured questionnaire (Appendix 1) that was used to interview individual beef cattle smallholders. The structured questionnaires contained both open and closed ended questions.

3.3.1.1 Sampling frame

The sampling frame consisted of all beef cattle smallholders in Rudi and Mpwapwa Divisions, in four wards namely Rudi, Chipogoro, Gulwe and Godegode where by four villages distinctively Chilendu, Gulwe Chipogoro and Godegode were surveyed.

3.3.1.2 Sample size and sampling procedures

Mpwapwa District, Rudi and Mpwapwa Divisions, four wards (Gulwe, Chipogoro, Rudi and Godegode) and four villages (Gulwe, Chilendu, Godegode and Chipogoro) were selected purposively based on the availability of cattle population and cellphones local network coverage. In addition, the study used systematic sampling to select 30 respondents from each village to get a sample of 120 respondents. The sampling unit was the individual beef cattle smallholder from the four villages concerned.

Table 1: Study locations and sample size

District	Divisions	Wards	Villages	Respondents
Mpwapwa	Rudi	Rudi	Chilendu	30
		Chipogoro	Chipogoro	30
	Mpwapwa	Gulwe	Gulwe	30
		Godegode	Godegode	30
Total				120

3.3.2 Qualitative data and instruments

Qualitative data were collected by using Focus Group Discussion (FGD) guide (Appendix 2) that steered the focus group discussions interview and the key informant interviews (KIIs) were guided by a prepared checklist (Appendix 3 and 4). The instruments were for beef cattle smallholders, cattle buyers, extension agents and local leaders respectively.

3.3.2.1 Focus group discussions (FGDs)

Thirty-two beef cattle smallholders were selected to take part in focus group discussion, thus eight participants in each of the four villages. This method enabled the researcher to capture extra information not captured in the quantitative method. The number of eight participants per session is the one recommended by (Barbour, 2011).

3.3.2.2 Key informant interviews

Key informants interview (KII) involved 12 participants including one ward executive officer, one cattle-buyer agent and one extension agent in each of the four wards. The selection of participants was purposive based on their positions and experiences regarding beef cattle marketing in the community. A prepared checklist was used to guide the interview.

3.3.2.3 Personal observations

Direct observation was employed to observe general setting of cattle smallholders and evidence on the available telecommunication towers to enrich information collected via questionnaire and checklists.

3.4 Secondary Data

Secondary data about primary and secondary cattle markets were obtained from the Village and Livestock District Offices as well as the Ministry of Livestock and Fisheries Development reports.

3.5 Quantitative Data Processing and Analysis

The quantitative data collected were coded, summarized and entered into a computer whereby the Statistical Package for Social Sciences (SPSS) was used to compute descriptive statistics including means, percentages, frequencies, multiple responses and cross-tabulations for specific objective one, two and three to obtain variability among different variables. Likewise, correlation analysis was used to establish relationship between some independent variables recorded at the ratio levels. In addition, specific objective two employed binary logistic regression to analyze the odds of some covariates indicating the use of cellphones in communication and dissemination of market information influencing the chances of market information access among beef cattle smallholders.

The formula for binary logistic regression that was used is:

$\text{Log} [P_i/1-P_i] = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \dots + \beta_n X_n$ (Agresti, 2002; Powers and Xie, 2000), where:

$\text{Log} [P_i/1-P_i]$ = Natural logarithm of the odds of some covariates indicating the use of cellphones in access to market information.

Y = 0 if a beef cattle smallholder didn't access market information via cellphone in the previous 12 months

Y = 1 if a beef cattle smallholder accessed market information via cellphone in the previous 12 months

β_0	= Constant of the equation
β_1 to β_n	= Logistic regression coefficients of the covariates
n	= Number of covariates
X_1 to X_n	= Covariates entered in the model
X_1	= Number of cattle owned
X_2	= Age of respondent
X_3	= Estimated income earned per year
X_4	= Approximate distance from home to the nearest cattle market place
X_5	= Ownership of a cellphone
X_6	= Access to market information about cattle sales volumes
X_7	= Access to information about beef cattle grades applicable

The dependent variable was a dummy of the use of cellphones in access to beef cattle market information, whereby access to beef cattle market information was 0 if an individual beef cattle smallholder did not have access to any cattle market information via cellphones in the previous 12 months. Conversely, access to market information was 1 if an individual smallholder had access to any type of cattle market information via cellphone in the previous 12 months. This dependent variable was regressed on the above seven covariates to find the influence of each of them on the dependent variable.

Moreover, inferential analysis was done by using Chi-square test at $p \leq 0.05$ concomitantly with cross tabulations to analyze associations between some categorical variables such as the use of cellphones in access to beef cattle market information and cattle buyers consulted/accessed to capture the extent of cellphones use for objective three. Likewise, Chi-square was used to test the associations between some categorical

independent variables and access to cattle market information via cellphones in objective one and two. The Chi-square model used is:

$$X^2 = \sum \frac{(o - e)^2}{e} \dots\dots\dots(1)$$

Where:

χ^2 = the value of Chi-Square statistics

o = Observed frequencies in the contingency table

e = expected frequencies in the contingency table

3.6 Qualitative Data Analysis

The qualitative data obtained were analysed thematically to highlight diversity among the individual experiences and results were reported concurrently with quantitative data.

CHAPTER FOUR

4.0 RESULTS AND DISCUSSION

4.1 Background Characteristics of the Respondents

The background characteristics of the respondents comprised age, sex, marital status, economic activities and education level.

Table 2: Background Characteristics of respondents in Rudi and Mpwapwa Divisions (n=120)

Age group	Frequency	Percent
Young age (21-34)	28	23.3
Active age (35-59)	80	66.7
Elderly (60<)	12	10.0
Total	120	100.0
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
Years of schooling		
0	15	12.5
1-4	13	10.8
5-6	2	1.7
7	84	70.0
8-12	5	4.2
13-15	1	0.8
Total	120	100.0

The characteristics of individual beef cattle smallholders have an influence on the use of cellphones in communication and dissemination of market information for beef cattle. Although identification of respondent's characteristics was not part of the research

questions, it was necessary to collect and present such information to provide a good insight on background characteristics of the respondents. The background variables such as age, sex, marital status, education and income generating activities performed by the smallholder beef cattle producers have upshot on the use of cellphones in access to beef cattle market information.

4.1.1 Distribution of respondents by age

Age has an influence on beef cattle keeping as well as on the use of cellphones as a new technology in the community. Thus, age of the respondent was considered an important factor in this study. As indicated in Table 2, the smallholder beef cattle producers in the study area were dominated by the active age group 35-59 years (66.7%), followed by young age group 21-34 years (23.3%), while elderly (60<) years comprised 10% of the respondents.

The average age of respondents was 43.8 years. This implies that in rural areas middle age people are engaged in livestock keeping more than people of other age groups because the activity requires people who are still very active to cope with hardships of cattle demands, including movement of cattle from one place to another, to fetch water and feed/pastures. These findings suggest that most of the respondents were in the active age group that was capable to undertake a range of economic activities including investments in the beef cattle farming and adopting new technologies. Related findings are also reported by Kubkomawa and Salihu (2010) from a study done in Nigeria that analyzed the role of information and technology in livestock industry.

4.1.2 Distribution of respondents by sex

The surveyed sample was dominated by males (96.7%) than females (3.3%) as shown in Table 2. This is usual in many local communities in Tanzania and Africa at large where males tend to dominate cattle production while females engage in other types of livestock keeping including poultry farming. The same observation was reported in other studies conducted in South Africa and Nigeria, which showed the higher percentage of males in cattle production than females (Montshwe, 2006; Kubkomawa and Salihu, 2010). In addition, males were more involved in beef cattle farming due to nature of the work, which is very tedious and needs a lot of capital investment. Generally, the greater proportion of males as opposed to females in beef cattle production may also be predisposed by good returns earned from this industry because males are very sensitive with well paying activities.

4.1.3 Marital status of the respondents

With regard to the marital status, the majority of the respondents (97.5%) were married, 1.7% were separated and 0.8% were widowed. Findings from this study revealed the clear situation of most rural areas in Tanzania where the majority of adults are married. The big percentage of married couples in beef cattle farming might be due to difficulty of the whole process of cattle production that needs many people to contribute labour. Some of the tedious cattle farming practices are cattle herding, calves husbandry where farmers cut and carry feeds to their confined young calves, cleaning of the calves' pens, cattle sheds, dipping and watering just to mention few. Therefore being more than one person in the family makes it easier to share some roles for reduced workload.

4.1.4 Years of schooling of the respondents

Regarding levels of education, the majority (87.5%) of the respondents had attended formal education. Nearly three-quarters (70%) of all respondents, had a primary school education (7 years of schooling) whereas one-eighth (12.5%) did not have any formal education; however, 1.7% of them were able to read and write. On top of that, one-tenth (10.8%) had a lower primary level while 4.2% had secondary school education, with respect to that, only (0.8%) had post secondary education mainly certificate level. In addition, 0.8% had attended training related to cattle selling that is methods for market information access.

The figure, which indicates 12% with no formal education, is below the nation-wide figure that indicates 24% of Tanzanians have no formal education while over half have completed formal education (NBS, 2009). Since the use of cellphone requires basic level of education to operate important functions, it shows that the literacy level of majority can enable them to make use of cellphone technology.

4.1.5 Main occupations of the respondents

The major economic activities carried out by the entire surveyed sample (n =120), which is more than two-thirds (68.6%) were crop and livestock production as shown in Table 3, based on the multiple responses given by respondents. This is due to the nature of the environment mostly characterized by agro-pastoralist activities. The higher figure divulges the fact that in Tanzania agriculture is the backbone of the country's economy and is primarily practiced in rural areas. Some farmers were also engaged in off-farm activities including petty trade 29.7%, self-employment 1.1% and paid employment

0.6%. The percentage of cases are as indicated in Table 3 whereby their total is greater than 100% because the respondent were allowed to give more than one answer.

The most common petty trade activities carried out include 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. The small proportion of self and paid employment highlights the general trend in Tanzania where most rural people sustain their life through subsistence farming and livestock keeping.

Table 3: Distribution of Respondents by Economic Activities Carried out (n=120)

Economic activities carried out	Count	Percent of responses	Percent of cases
Paid employment	1	0.6	0.8
Self employment	2	1.1	1.7
Crop and livestock production	120	68.6	100.0
Petty trade	52	29.7	43.3
Total	175*	100.0	145.8*

NB: *Multiple responses

4.1.5.1 Average income of respondents per year

Average income earned by an individual respondent has direct relationship with 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 average income of individual respondent for the past 12 months (September 2011 – September 2012) various sources of smallholder's income were examined, these include average net income from crop production; livestock production; cattle selling; trade of other items; rentals; remittances and other sources counting for making and

selling local beer; making charcoal and local manufacturing. The general results have shown that the minimum average income was TZS 75 000.00 and TZS 104 430 000.00 was considered as a maximum income per year per an individual livestock producer in the study villages. Therefore based on the presented statistics the mean of net income of an individual respondent for the past 12 months (September 2011- September 2012) was 5 758 762.02 with a standard deviation of 11 997 167.89. The big variation of average income earned per year is due to variation of an individual income sources including economic activities preformed and investments owned.

4.1.5.2 Access to electricity

In order to comprehend the socio-economic status of the smallholder beef cattle producers, the ownership of land and assets were assessed. In addition, access to electricity and number of cattle owned by the respondents were examined. The number of assets owned and monetary value of each asset were assessed through multiple-response questions. The findings in Table 4 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 at home place despite the availability of the national grid in Gulwe village; this is due to the high initial cost of instalment. This findings contrast the national-wide figure that indicates 2% of rural households were connected to the national grid (URT, 2010).

The lack of electricity entails that it was difficult for cellphone owners to charge their cellphone batteries at home places hence most of them were required to move from their residential area to the places where they can charge their cellphone batteries, which is cost and time consuming. This information meets part of the second objective, which

determines factors that influence smallholders to use cellphone to access market information disseminated for beef cattle. It implies that lack of reliable electricity like from the national grid may be one of the factors that hamper smallholders to-regularly use their cellphones and other innovative devices including radios and television sets hence the difficulty in communication and access to disseminated market information.

The findings also agree with findings of other scientists that explained lack of electricity in rural areas as a dictating factor in relation to the use of innovative communication devices hence information asymmetries (Chilimo, 2008; Mwakaje, 2010; Sife *et al.*, 2010; Jooste and Groenewald, 2012). Nonetheless, the survey sample might not be representative of the general rural population as the study was confined to the smallholder beef cattle producers only.

Table 4: Distribution of Respondents based on Access to Electricity and Land Ownership (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
Land ownership	119	99.2

4.1.5.3 Distribution of respondents by land ownership

Access to land is vital in any farming business including cattle farming. World Bank (2007) and Rich *et al.* (2009) reported that land is an essential resource and a crucial factor of production in facilitating subsistence farming and livestock systems setting for development. The high value attached to land shows the strong demand for quality and

quantity of land for agro-pastoralists to sustain their farming practices. However, access to land does not respond to the query concerning what to produce when and where to sell at a profit hence the aspect of technical and access to market information have to be put into consideration (Obi and Pote, 2012). Thus, findings in Table 4 show that 99.2% of respondents had access to land, whereas the size of land owned by smallholder beef cattle keepers is shared between crop production and cattle farming purposes. This implies that better life in rural areas depends much on the quality and quantity of land owned for agricultural production.

4.1.5.4 Amount of land used for beef cattle production

It is seen in Table 5 that the average size of land owned by respondents was 38.92 acres and the average amount of land set aside for beef cattle production was 12.39 acres. In discussion with respondents, the study revealed that respondents who had no access to land and those who did not have excess land for their beef cattle production suffered a lot during the dry season because they were not able to conserve livestock feed for future use. However, respondents were using different modes of land management whereby during rainy season a large amount of land was exploited for crop production to acquire crops and crop residues for cattle feeding in the dry season, at that period, beef cattle were grazed in the communal land that is less arable for crop production.

Swai *et al.* (2012) also report the same land practices in Kondoa and Bahi districts in central Tanzania. Therefore, landless respondents and those with large number of cattle in the midst of small pieces of land were forced to buy crop residues from fellow farmers to sustain their herds during the dry season when there is serious threat of shortage of livestock feed. The same observations were also reported by Komwihangilo *et al.* (2012)

in a study conducted in central Tanzania particularly in Mpwapwa and Manyoni Districts.

Table 5: Size of land, amount used for cattle production and number of cattle owned (n=120)

Volume (acres)	Minimum	Maximum	Mean	Std Deviation
Size of land owned	5.00	300.00	38.92	50.84
Amount of land used for cattle	1.00	100.00	12.39	20.93
Number of cattle owned	2.00	400.00	35.92	50.12

4.1.5.5 Number of beef cattle owned

The size of herd owned by smallholder beef cattle producers in Tanzania varies from one geographical location to another. As indicated in Table 5 the number of beef cattle owned in the surveyed sample ranged from a minimum of two cattle to a maximum of 400, with average of 35.92 cattle in each herd implying that smallholder with 400 cattle in the study area was considered as a small scale cattle producer. According to discussion with respondents, the majority contended that cattle producers with 400 – 800 cattle were ranked as medium scale, while those with 800 – 3 000 cattle were ranked as large-scale cattle producers who can also possess their own cattle farms. However, it was difficult to sustain such a big number due to incidence of disease out breaks, shortage of feed and cattle theft.

4.1.5.6 Strength of association among some socio-economic independent variables

In order to establish the strength of association among some socio-economic independent variables, bi-variant correlation analysis was computed. This is a statistical examination of the relationship between two variables, preferably recorded at the ratio levels

(O'Leary, 2004). The results in Table 6 present the correlation coefficients for each variable and their p-values. From the findings of correlation analysis indicated in Table 6 it shows that there is a positive and significant relationship ($r = 0.705$; $p = 0.000$) between the size of land owned by the respondent and amount of land used for cattle production. This implies that the respondents with a huge size of land were able to set a piece of land aside for cattle production to accommodate various cattle demands including grazing land and sheds.

Similarly, Table 6 shows that there is strong relationship among other socio-economic independent variables including the average income of individual per year; the number of cattle owned; number of cattle sold in the past 12 months; size of land owned and amount of land used for cattle production. This means that an increase to individual income per year gives an opportunity to an increase in the number of cattle owned, an increase to the number of cattle harvested per year, an increase to the size of land owned as well as the amount of land used for cattle production.

Table 6: Correlation between selected socio-economic variables (n=120)

Pairs of variables correlated	N	r-value	p-value
Size of the land owned	119	0.705**	0.000
Amount of the land used for cattle production	119		
Size of the land owned	119	0.474**	0.000
Number of cattle owned	119		
Size of the land owned	119	0.316**	0.000
Number of the live cattle sold in the past 12 months (September 2011 - September 2012)	119		
Size of the land owned	119	0.273**	0.003
average income per year	118		
Amount of land for cattle	119	0.644**	0.000
Number of cattle owned	119		
Amount of the land used for cattle production	119	0.363**	0.000
Number of the live cattle sold in the past 12 months (September 2011 - September 2012)	119		
Amount of the land used for cattle production	119	0.313**	0.001
Average income per year	118		
Number of cattle owned	119	0.583**	0.000
Number of the live cattle sold in the past 12 months (September 2011 - September 2012)	119		
Number of cattle owned	119	0.500**	0.000
Average income per year	119		
Number of the live cattle sold in the past 12 months (September 2011 - September 2012)	119	0.955**	0.000
Average income per year	118		

** . Correlation is significant at the 0.01 level (2-tailed).

4.1.5.7 Ownership of radios, bicycles, motorbikes and other assets

Figure 3 shows different assets owned by respondents whereby more than two-fifths (44%) had radio sets, about two-fifths (39.6%) had bicycles, nearly one-tenth (9.6%) had motorbikes while 3.6% had television sets. Other assets owned were satellite dishes 2.4% whilst only 0.8% of respondents owned a car. In addition, number of assets owned

ranged between one to six bicycles, one to two motorbikes, one to four radio sets and one to two television sets per respondent.

The ownership of devices such as radio and television are vital sources of information concerning price and various market opportunities thus the higher proportion of the radio ownership reveals that the interviewed respondents were concerned with access to information. Conversely, the ownership of television and satellite dishes was very low this can be contributed by various factors including lack of electricity to operate the devices. Likewise, findings in Fig. 3 show the higher proportion of the ownership of individual transport equipments particularly bicycles, which are vital in rural areas where access to public transport is limited.

The ownership of other transport facilities including motorbikes and cars were very few, it gives an insight that there were communication barriers whereby individual smallholder could not move fast from one point to another to seek profitable market opportunities. Similar findings were reported by Obi and Pote (2012) who argued that weak assets possession might be the cause of the smallholders not being able to access market opportunities even when such opportunities are available. Nevertheless, the use of cellphones can enhance flow of market information to smallholder beef cattle producers and reduce unnecessary movements on the issues that require little of face-to-face mode of communication.

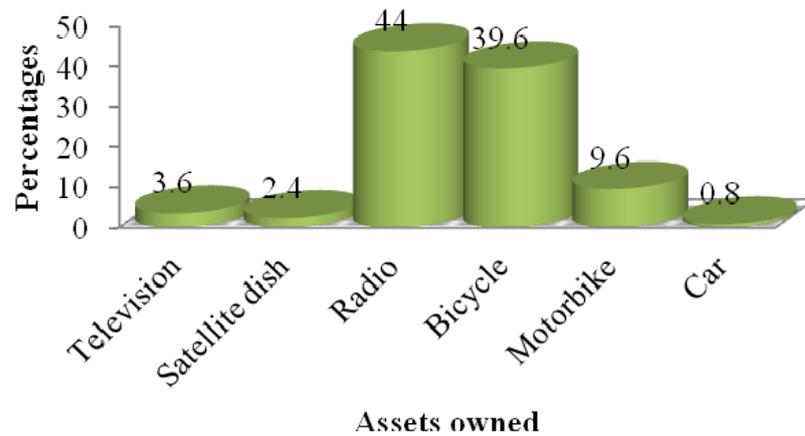


Figure 3: Types of assets owned

4.1.5.8 Monetary values of assets owned

Statistics in Table 7 show possible minimum and maximum monetary values, average and standard deviations of each asset owned by the respondents. Maximum monetary value of assets varied depending on the brand and number of assets owned by an individual. Moreover, place and the year of purchasing determined the price of assets owned since the early adopters always buy assets at the higher price than late adopters do.

Table 7: Monetary values of the assets owned by the respondents (n=120)

Asset	Minimum	Maximum	Mean	Std Deviation
Television	120 000.00	500 000.00	22 833.33	82 463.98
Satellite dish	120 000.00	300 000.00	11 666.67	48 978.36
Radio	6 000.00	700 000.00	68 825.00	95 471.99
Bicycle	42 000.00	270 000.00	131 925.00	107 850.83
Motorbike	1 200 000.00	2 800 000.00	329 583.34	688 363.54
Car	20 000 000.00	37 000 000.00	475 000.00	3 825 967.23

4.1.6 Ownership of the cellphones

Since the present study intended to establish the use of cellphones in communication and dissemination of market information for beef cattle smallholders, the ownership of the cellphones and related elements were examined in a separate sub-section to explore sufficient information for study overall objective. The study revealed that 83.3% of the interviewed respondents possessed and utilized their own cellphones. Of these, 15.8% had two or more cellphones. These findings are consistency with Masuki *et al.* (2010) in the study conducted in Uganda, which indicated that the use of cellphone by individuals who possessed their own cellphones was expanding rapidly. The findings in Table 8 show number of cellphones, SIM cards and monetary values of cellphones owned. However none of the interviewed respondent had access to landline at home place, this implies that the use of cellphones has outshined the diffusion of the landline technology in the study area.

The statistics in Table 8 show that the number of cellphones owned by the respondents' ranges from one to three, while that of SIM cards ranges between one and four SIM cards. However all SIM cards were not necessarily active at the same time. Normally one SIM card was used frequently and few respondents had access to the dual SIM cards type of cellphones where all SIM cards owned can be active all the time. On top of that, monetary value of cellphones is between TZS 20 000 and 300 000 depending on the type, year and place of purchasing as well as brand of the cellphone owned.

Table 8: Distribution of quantity and monetary values of cellphones owned (n=120)

Item	Minimum	Maximum	Mean	Std Deviation
Cellphones	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

4.1.6.1 Distribution of respondents based on types of SIM cards owned

In the study area, cellphone services are provided by Airtel, Vodacom, Tigo and Zantel. The available network connections assist farmers in dissemination of social and beef cattle market information in terms of grades applicable, sales volumes and prices quicker. Moreover, the available large number of cellphones service providers granted users with opportunity to choose the service provider they want. As Figure 4 shows Airtel had, the highest proportion of subscribers (48.2%) followed by Tigo 39.8%, Vodacom 8.4% and Zantel 3.6%. In contrast to TCRA (2011) report, which indicated that Vodacom is the leading and popular network connection with a large number of subscribers (11.6million), followed by Airtel, Tigo and Zantel 6.9, 5.4 and 1.5million respectively in Tanzania, the situation is different in rural areas particularly in Mpwapwa district where Airtel and Tigo are networks that are more popular. The disparities might be due to many factors including the quality of network connections, market competition among service providers, ability to penetrate remote areas as the first entry and call making costs.

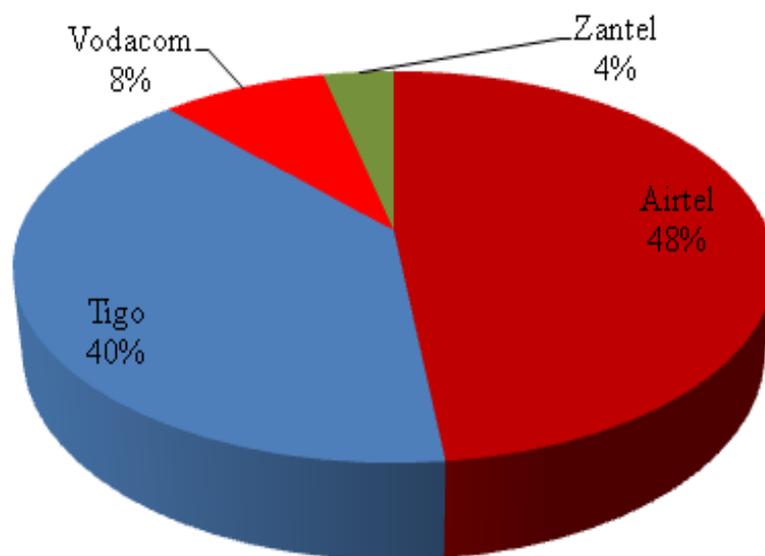


Figure 4: Types of SIM cards owned

4.1.6.2 Types of SIM cards used most often

Among the SIM cards owned by the respondents, Airtel was used most often by more than three-fifths (60.3%) followed by Tigo slightly below three-eighths (37.1%) whilst Vodacom was used by 2.6%. This is due to the level of network coverage and service charges whereby, Vodacom network connection in the surveyed villages was hardly reliable and concentrated in some few locations as compared to Airtel and Tigo network connections. Therefore, having more than one service providers in the study villages gave chances for cellphone users to choose the provider whose services are reliable and affordable.

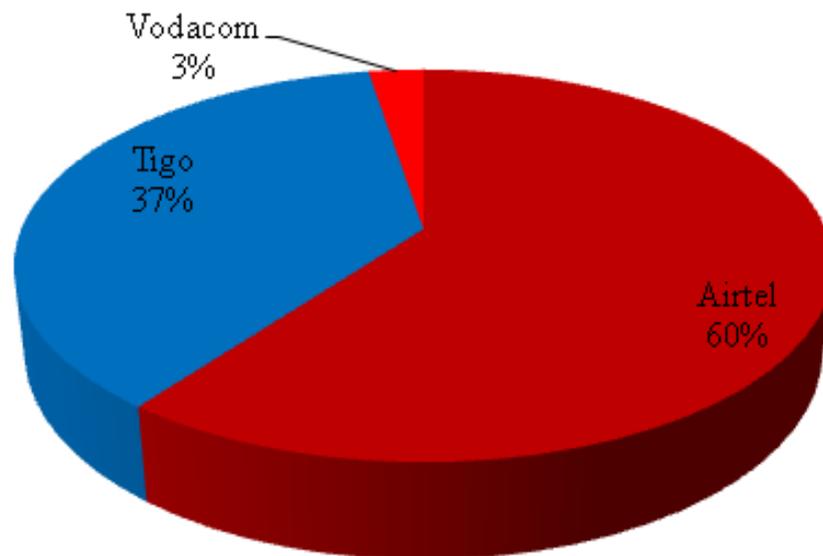


Figure 5: Types of SIM cards used most often

4.1.6.3 Reasons for using more than one SIM cards

The results in Table 9 show that, the smallholder beef cattle producers had assorted reasons for using more than one SIM cards, whereby more than two-thirds (34.2%) were using multiple cards for saving costs by making on-net calls. The findings also agreed

with findings of other scholars in the studies conducted in Babati, Kilosa and Mvomero districts in Tanzania on the contribution of cellphones to agricultural value chain and rural livelihood where results presented the same argument (Furuholt and Matotay, 2011; Sife *et al.*, 2010).

On top of that 27.4% were using multiple SIM cards in places where there is no service normally applied by the respondent; more than a quarter (25.6%) were using them whenever one service provider has network problem; while more than one-eighth (12.8) were using the cards to benefit from different promotions offered by their local network service providers. This implies that, lack of satisfaction based on cost and network coverage have forced cellphone users to use several SIM cards to lessen some cost by shifting to a service provider that lower charges with time. The percentage of cases presented in Table 9 exceeds 100% because each respondent was allowed to give more than one reason for using more than one SIM card.

**Table 9: 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*

NB: *Multiple responses

4.2 The Existing Communication Channels

The first objective aimed at identification of the existing communication pathways related to beef cattle market information for smallholders in the study area. In order to address this objective and its core research question, respondents were asked multiple-response questions about the existing market information pathways to establish insights on the communication pathways exploited by smallholder in rural areas, in relation to cattle market information sharing. The study revealed that the leading channel about three-eighths (36.1%) was face-to-face mode of communication which comprised home and market place visits, as well as livestock keepers group local meetings.

Another channel was the use of annual/monthly auction calendars 35.5%, the calendars were granted by the council in form of posters whereby many beef cattle keepers were familiar with various auction dates for different livestock market places. On top of that, findings revealed that 28.4% of respondents were using cellphones to obtain market information. This implies that the use of cellphones, which is a new communication technology in the rural areas and in the agro-pastoralists communities in particular, facilitates cattle market information sharing that coordinates routine interaction with various actors for increased bargaining power and timely decision-making. Likewise, the technology complements other traditional communication pathways including face-to-face and posters, which provide cattle auction dates in the community annually. Similar results were reported by Kubkomawa and Salihu (2010) along with Salia *et al.* (2011) in the studies conducted in the livestock and fishing communities, which indicated that 20% and 22% of surveyed sample were using cellphones for market price information sharing for better market coordination and prices alert.

Furthermore, Findings in Table 10 suggest that among the identified channels, face-to-face 55.9% and cellphones use 44.1% were able to facilitate feedback/two-way communication for the actors involved. This implies that, smallholders would like to obtain market information through channels that could facilitate feedback in the process of information sharing. Similar 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 producers and customers therefore, gathering and exchange of market information is a crucial skill.

Table 10: 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
Cellphones	93	28.4	78.2
Total	327	100.0	274.8
Channel that allows feedback			
Face to face	119	55.9	100.0
Cellphones	94	44.1	79.0
Total	213*	100.0	179.0*

NB*Multiple responses

4.2.1 Source of market information for beef cattle

It was found that the market information sharing was highly dominated by personal relationships. Nearly two-thirds (65%) of respondents reported that the source of market information for their beef cattle was their fellow livestock keepers, followed by middlemen (*Magalagaja in Gogo native language*) 27.7% and principle cattle buyers 7.3% these are the cattle traders from other regions. Related findings were also reported

in agricultural market information literature and findings of other scholars, which emphasised that smallholders in the rural areas normally rely on informal networks (friends, relatives and local traders) due to insufficient formal information systems. (FAO, 2004; Chilimo, 2008; Mwakaje, 2010; and Mittal *et al.*, 2010).

Similarly, findings in Table 11 indicated that, the most valid and reliable source of market information for the interviewed respondents were their fellow beef cattle keepers (91.7%), followed by principle buyers 5% because they considered weight of cattle as their price basis contrary to the middlemen/brokers who did not. It was revealed that respondents who dealt with principle buyers were willing to communicate with them via cellphones from various secondary cattle markets outside the district since it was time and cost effective. Few respondents (3.3%) reported to consult middlemen/brokers as their last alternative; this is due to their behaviour of price cheating.

This information got a support during the interview with key informants (cattle buyer) in Chipogoro village who reported that cheating of market price is a normal tradition for intermediaries because they want to make as big profit as possible from their cattle-trading mission. Nonetheless, there was no formal livestock information centres established in the district. This implies that smallholders in rural areas recognize the importance of seeking cattle market information prior cattle selling, however lack of regular and reliable formal source of market information constraints the application of that knowledge hence they may end up having doubtful information from their local networks. The other statistics and the percentage of cases are as presented in Table 11.

Table 11: 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*

NB: *Multiple responses

4.2.2 Types of market information shared

The types of market information shared by the interviewed respondents as indicated in Table 12 were market prices 42.4%, beef cattle grades applicable 25.1%, auction dates 15.5% and 17% sales volumes. Using the Chi-square test, findings in Table 12 revealed that there was significant association between access to beef cattle market information via cellphones and market prices exploration ($\chi^2 = 6.444$; $p \leq 0.011$); access to market information and beef cattle grades applicable ($\chi^2 = 10.704$; $p \leq 0.001$); 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 enthusiastic to use their cellphones in access to desirable market information that could guide them on 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 cellphones 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 cellphones and auction dates searching, this might be caused by the experiences of using monthly and annual auction calendars.

Table 12: 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*		

(NB multiple responses)

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

4.3 Factors that Influence Smallholders to Use Cellphones in Access to Market Information Disseminated for Beef Cattle

The study revealed various factors that significantly influenced beef cattle smallholders to use cellphones in access to beef cattle market information disseminated. Table 13 shows some factors including location; network coverage; access to mobile banking and the distance from home to market place whereas some respondents would prefer to sell their cattle at home places to save cost and time for other productive economic activities.

4.3.1 The use of cellphones and access to market information

The Chi-square test showed that there was a significant association between access to beef cattle market information and the use of cellphones ($\chi^2 = 10.085$; $p \leq 0.001$) indicating that rapid access to beef cattle market information depends on the use of cellphones. Furthermore, findings in Table 13 emphasise that more than seven-eighths (90%) who usually sell their cattle at home places were using cellphones in access to market information. Likewise the Chi-square test indicated that there was a significant association between access to market information via cellphones and selling of beef

cattle at home places ($\chi^2 = 10.085$; $p \leq 0.001$). This implies that the use of cellphones enabled smallholders to share instant market information about prices, volumes, and beef cattle grades applicable in the various market places hence increased bargaining power and reduced price-cheating customs when selling cattle at home places.

Similar observations were reported by Sife *et al.* (2010) as well as Nyamba and Mlozi (2012) who indicated that cellphones had enhanced the ability of smallholder's access to market information for better price thus reduced chance of being cheated by brokers. Additionally the Chi-square test confirmed the significant association between the use of cellphones in access to beef cattle market information and access to M-Pesa services ($\chi^2 = 8.386$; $p \leq 0.004$). This indicates that access to market information via cellphones is associated by the use of mobile banking, which enables smallholder beef cattle producers to overcome problem of cash theft after cattle sales and encourage savings among cattle producers in the rural areas. Of 27% respondents who responded to multiple responses enquiry more than one-fifth (22.5%) indicated the use of cellphones had increased their abilities in sending and receiving cash for various financial transactions including school fees for their children. The findings imply that the use of cellphones, which facilitates mobile banking services, could reduce risk of travelling with bulk cash in rural areas where bank facilities are not available.

4.3.2 The use of cellphones in access to market information and network coverage

The findings in Table 13 show that 45% of the interviewed respondents had access to moderate network connection whereas 39.2% had access to high network connection. The study revealed that there were telecommunication towers in Rudi and Chipogoro villages where most of the respondents indicated high network connections in contrast to

Gulwe and Godegode villages where there were no telecommunication towers but residents were able to access network connection through the nearby village's telecommunication towers mainly Msagali and Mpwapwa headquarters thus moderate network connection.

However, the network connection was considered favourable because 97% of cellphone users were able to communicate via cellphones throughout day and night by using both SMS and voice calling modes, the most reliable network being Airtel 54.2% and Tigo 23.3%. The Chi-square test showed the significant association between access to beef cattle market information via cellphones and level of network coverage ($\chi^2 = 4.587$; $p \leq 0.032$) indicating that access to beef cattle market information via cellphone depends on the level of network coverage in the area of residence. Similarly, the Chi-square test indicated that there is significant association between access to market information via cellphones and location of respondents ($\chi^2 = 4.473$; $p \leq 0.034$) this entails that market information searching were influenced by many factors including distance from home to the market places.

These findings agreed with the findings reported by Aker (2008) and Abel-Ratovo *et al.* (2010) who explained the distance as an environmental factor that increases the use of cellphones in access to market information for both sellers and buyers before travelling to distant market places. The distance from home to the nearest market place in the surveyed area ranged from 1-55km with average of 13.51km. Some of the most important cattle market places in the study area include Kibakwe; Chipogoro; Rudi; Fufu; Chogola; Malolo; and Mima. Other cattle market places are Iloilo; Msagali; Gulwe; Chisalu; and Chinyika. According to the Ministry of Livestock and Fisheries Development (2011) report, there are over 400 primary cattle markets in Tanzania

currently. These markets are under the jurisdiction of Local Government Authorities and most of them are held once per week.

Table 13: The use of cellphones and access to market information (n=120)

Number of variables	Frequency	Access to beef cattle market information		
		Percent	χ^2	P-value
The use of cellphone	79	65.8	10.085***	0.001
Selling cattle at home place	108	90.0	10.337***	0.001
Access to M-Pesa Service	27	22.5	8.386***	0.004
Level of network coverage				
High network connection	47	39.2		
Moderate network connection	54	45.0	4.587*	0.032
Division of residence				
Rudi	60	50.00		
Mpwapwa	60	50.00	4.473*	0.034

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

4.3.3 Reasons for using cellphones in seeking beef cattle market information

The study revealed that the beef cattle smallholders were using cellphones in seeking beef cattle market information for a number of reasons including minimization of travelling costs 24.4%; time saving 22.8%; consultation of many beef cattle buyers more quickly 20.2%; and searching diverse market places with varied prices as presented in Table 14. Similarly, findings from FGDs and key informants revealed that cellphones have been used to substitute cost of unnecessary travelling mainly for smallholders in Rudi and Chipogoro villages located about 97 and 100km from the district headquarters with average of TZS 10 000-bus fare per a single trip. Respondents reported that they could use cellphones for consultations and price crosschecking with cattle buyers, extension agents, and their fellow cattle keepers both locally and at significant distances instantly for only TZS 500 airtime. This implies that the use of cellphones is cost effective and it has resulted in social capital building since it enabled smallholders to

instantly call buyers, fellow beef cattle keepers and sometimes middlemen to confirm cattle market prices offered prior to cattle selling when need arose.

These findings confirmed earlier findings by Mittal *et al.* (2010); Masuki *et al.* (2010); Martin and Abbott (2011) which indicated the use of cellphones had enabled farmers to save valuable time and money in access to prices information in various market places hence the ability to negotiate and sell at a competitive price that is relatively higher. The findings also support the traders' search behaviour theory by Aker (2008) that highlights the use of the cellphones for reduced traders' search costs, which allows searching for the large number of markets more quickly.

Table 14: Factors motivate the use cellphones in seeking cattle market information (n=120)

Factors motivates	Count	Percent of responses	Percent of cases
Reduces travelling cost	75	24.4	97.4
Saves time	70	22.8	90.9
Enables to search large number of market	45	14.7	58.4
Enables to consult many buyers more quickly	62	20.2	80.5
Increases bargaining power and price assurance	55	17.9	71.4
Total	307*	100.0	398.7*

NB: *Multiple responses

4.3.4 The impact of using cellphones in communicating cattle market information

The findings revealed that cellphones had been useful for smallholders in many ways in terms of communication and dissemination of information related to beef cattle in the study area. Findings in Table 15 indicate that 22.1% were using the devices to share information with their fellow beef cattle producers on the existing prices in the various local market places. More than one-fifth 21.5% reported that cellphone saves time and

cost on the market searching process while about one-fifth (19.2%) said it enables beef cattle smallholders to secure better price. Similar findings from FGDs revealed that the price assurance increases bargaining power since information is power, thus smallholders may opt to sell their cattle whenever there is better price in the market. Furthermore, 18.9% said that the use of cellphones had simplified the dissemination of information in case of cattle theft hence it is easier to search stolen cattle now than it was in the previous time before the introduction of the technology and 18.3% reported that the interactions with many cattle buyers had increased because of cellphones using.

Several researchers including Jagun *et al.* (2008); Masuki *et al.* (2010); Rabayah and Qalalwi (2011) have indicated the same observations that the use of cellphones has increased cooperation within farmers, enables the reach of important customers and facilitates linkage between farmers and buyers in the rural areas. This implies that the use of cellphones has shown a positive impact in communication and dissemination of information among various stakeholders in rural areas. Generally, access to the knowledge about prevailing cattle market prices, quality and quantity demands prior cattle selling is a noticeable input of cellphones usage for beef cattle smallholders that enhances negotiation for better prices in a cost effective manner.

Table 15: Impact of cellphones for cattle market information sharing (n=120)

Positive impacts	Count	Percent of responses	Percent of cases
Helps in communication with fellow beef cattle keepers on the existing price in the different local market places	77	22.1	100.0
Increases interaction with many cattle buyers	64	18.3	83.1
Searching stolen cattle becomes easier by disseminating theft information via cellphones	66	18.9	85.7
Saves time and cost on the market searching process	75	21.5	97.4
Enabled cattle keepers to secure better price	67	19.2	87.0
Total	349*	100.0	453.2*

NB: *Multiple responses

4.3.5 Cellphones and access to beef cattle market information in the past 12 months

Findings showed that about two-thirds (65.8%) of respondents shared beef cattle market information from various localities via cellphones in the past 12 months that is from September 2011 to September 2012. Similarly, five-eighths (62.5) of respondents used their own cellphones in access to market information shared; while few respondents (3.3%) used friend's cellphones as follows, 2.5% used friends device without paying and 0.8% borrowed friend's/relative's phone and recharge airtime to access cattle market information. Similar study by Martin and Abbott (2011) also noted that 70% of farmers in Uganda rural areas used cellphones in access to market information from fellow farmers and buyers from distant different markets.

Furthermore, the study revealed that four-fifths (84.2%) of respondents preferred voice calling while only 1.7% prefer both voice calling and SMS modes of communication using cellphones. In discussion with respondents, various opinion were given out concerning the preference for voice calling to SMS first of all they said that voice calling allows rapid interactions with many actors involved in the process such as extension agents; cattle buyers and fellow farmers. Other reasons mentioned were the high SMS prices; visual disabilities; unfamiliarity; illiteracy; and inadequate skills on the use of SMS in rural areas.

These findings confirm earlier findings by Okello *et al.* (2010), Furuholt and Matotay (2011) in line with Abel-Ratovo *et al.* (2012) which indicated that the use of voice calling outweighed the SMS mode in the rural areas due to significant constraints on the use of SMS format as well as individual's two-way interaction preference. Implying that farmers prefer communication mode that provides two-way interaction for questions and clarification of information sought.

Table 16: Cellphones and access to market information in the past 12 months
(n=120)

Access to market information	Frequency	Percentage
Accessed	79	65.8
Own phone	75	62.5
Friend's phone	4	3.3
Mode of communication preferred		
Voice calling	101	84.2
Both voice calling and SMS	2	1.7

4.3.6 Cellphones and access to market information disseminated by Extension/ WEO/VEO officials

The study revealed that nearly three-fifths (57.5%) of respondents had access to beef cattle information disseminated by extension agents as well as ward and village executive officials on various aspects with time. Findings in Table 17 showed different types of information related to beef cattle disseminated by the government officials via cellphones for smallholders in the study area. More than two-fifths (41.1%) reported that they had received information concerning the outbreak of cattle diseases; about (39.9%) said that they had received quarantine information; while 15.5% said that they had received information concerning access to cattle movement permit documents. Other type of information disseminated via cellphones was beef cattle grades applicable in the market 2.4% and 1.2% information about the cause of un-conducive price based on the special requests.

Similarly, results of FGDs revealed that information related to dipping, vaccination dates, and livestock keepers meetings/seminars were disseminated by VEOs via cellphones. Furthermore, respondents reported that, one could call VEO to ask whether the cattle movement permits have already arrived in the village office from the district headquarters hence access to the service. Additional findings from chi-square indicate a significant association ($\chi^2 = 19.228$; $p = 0.000$) between the use of cellphones in access to beef cattle market information and access to other information related to beef cattle disseminated by the local government officials via cellphones. This entails that those who were using cellphones in access to market information were likely to have access to information disseminated by the government officials timely. These findings suggest that cellphones had enabled communication and dissemination of information related to beef

cattle farming instantly for immediate act particularly during disease outbreaks thus a number of animal deaths could be prevented.

Table 17: Types of information disseminated by Extension/WEO/VEO officials (n=120)

Information type	Count	Percent of responses	Percent of cases
Beef cattle grades applicable	4	2.4	5.7
Cause of un-conducive prices	2	1.2	2.9
Quarantine information	67	39.9	95.7
Disease out breaks information	69	41.1	98.6
Access to cattle movement permit documents	26	15.5	37.1
Total	168*	100.0	240.0*

NB: *Multiple responses:

Chi-square = 19.228 P = 0.000 ($p \leq 0.001$)

4.3.7 Odds of having access to beef cattle market information via cellphones

The odds of smallholders having access to beef cattle market information via cellphones were determined by using binary logistic regression for which the model and covariates presented in Section 3.5 were used.

One of the vital outputs of the binary logistic regression model was the Omnibus test of the coefficients of the model. The Omnibus test is a test of the capability of all predictors (independent variables) in the model jointly to predict the response (dependent) variable. If significance is found, it means that there is adequate fit of the data to the model and at least one of the predictors is significantly related to the response variable (Garson, 2008). Therefore, based on this description, and by looking at the results in Table 18, which indicate that there was significance at the 0.001 level ($p = 0.000$), the data entered in the

model adequately fitted the model, and at least one of the predictors is significantly related to the response variable.

Table 18: Omnibus test of model coefficients

		Chi-square	Df	Sig.
Step 1	Step	62.738	7	0.000
	Block	62.738	7	0.000
	Model	62.738	7	0.000

Likewise, the model summary, which is presented in Table 19 showing Cox & Snell R square and Nagelkerke R square, was chosen as an important output of the binary logistic regression model. The Cox-Snell R^2 and Nagelkerke R^2 are attempts to provide a logistic analogy to R^2 in Ordinary Least Square (OLS) regression; hence are called pseudo R^2 . Nagelkerke R^2 is a modification of Cox-Snell R^2 to assure that Cox-Snell R^2 varies from zero to one, as does R^2 in OLS regression. If Cox-Snell R^2 is not modified, its maximum value is usually less than one, making it difficult to interpret.

Table 19: Model summary

Step	-2 Log likelihood	Cox & Snell R Square	Nagelkerke R Square
1	83.992 ^a	0.418	0.582

Garson (2008) notes that Nagelkerke R^2 is normally higher than Cox-Snell R^2 and is the most reported of the pseudo R^2 estimates. Therefore, based on the results in Table 19, which show that Nagelkerke R^2 was 0.582, it means that the covariates entered in the model explained 58.2% of variance in the dependent variable.

The results of Hosmer and Lemeshow Test (Table 20) were another output of the model. The Hosmer and Lemeshow test, which is also called Hosmer and Lemeshow chi-square, is a test of goodness-of-fit of a logistic regression model, which works by comparing the observed and fitted counts of values according to the estimated probabilities of success. The Hosmer and Lemeshow goodness-of-fit test divides subjects into deciles (as seen in Table 20) based on predicted probabilities, and then computes a chi-square from observed and expected frequencies. If non-significance is found, it means that the model adequately fits the data (Hosmer and Lemeshow, 1980, cited by Agresti, 2002).

In this study, the value of the Hosmer and Lemeshow chi-square obtained was 8.630 and was not significant ($p = 0.374$), as seen in Table 20. Typically, in any case where the Hosmer and Lemeshow chi-square value is greater than 0.05, the goodness of fit is desirable (Garson, 2008). In such cases the implication is that, the model's estimates fit the data at an acceptable level (Garson, 2008). Garson (2008) adds that this does not mean that the model necessarily explains much of the variance in the dependent variable, but that it explains the variance to a significant degree. Therefore, according to the clarification above, the model used in this study, which contained seven explanatory variables and the response variable (access to beef cattle market information via cellphones), adequately fitted the data.

Table 20: Hosmer and Lemeshow Test

Step	Chi-square	df	Sig.
1	8.630	8	0.374

Table 21: Contingency table for Hosmer and Lameshow Test

		Whether the smallholder accessed any cattle market information via cellphone (No = 0)		Whether the smallholder accessed any cattle market information via cellphone (Yes = 1)		
		Observed	Expected	Observed	Expected	Total
Step 1	1	11	10.982	1	1.018	12
	2	10	9.367	2	2.633	12
	3	7	7.399	5	4.601	12
	4	2	4.924	10	7.076	12
	5	5	2.183	7	9.817	12
	6	2	1.415	10	10.585	12
	7	1	1.045	11	10.955	12
	8	0	0.559	12	11.441	12
	9	0	0.123	12	11.877	12
	10	0	0.003	8	7.997	8

Other vital outputs of the model were Wald statistics, which are presented in Table 22. The Wald test is an alternative test, which is commonly used to test the significance of individual logistic regression coefficients for each independent variable. The Wald statistic is the squared ratio of the un-standardized logistic coefficient to its standard error. Wald statistic corresponds to significant testing of β coefficients in OLS regression. Wald coefficients associated with individual independent variables help us realise the relative importance of each independent variable.

In other words, a Wald coefficient is a measure of the unique contribution of each independent variable in the context of the other independent variables and holding constant other independent variables. A bigger Wald statistic implies that the independent variable associated with it has high contribution to the occurrence of the

dependent variable, which in this case is access to beef cattle market information via cellphones for smallholders.

The effect, which can be negative or positive, of an independent variable on the dependent variable is denoted by the sign (negative or positive) of individual logistic regression coefficients (β values) for the independent variable that is generated concomitantly with the Wald statistic. A negative sign associated with a β coefficient shows that, that particular variable decreases the logit of the dependent variable (i.e. it decreases the probability that that event (in this case access to beef cattle market information via cellphones) will be realised, and vice versa. For example in Table 22, the age of respondents, and the number of cattle owned reduce chances of beef cattle smallholder's access to cattle market information via cellphones since their β values are associated with negative signs; their logistic regression coefficients (β values) were negative implying that they had negative effects on the dependant variable. The reason might be that elders were likely to cope with innovative technology slowly while smallholders with a little number of cattle were not influenced to use cellphones in cattle market information seeking since they had little to be sold.

The other variables increased chances of smallholder's access to beef cattle market information via cellphones since they had positive signs implying that they had positive effects on the dependent variable, but average income of individual smallholder per year had no effect on access to beef cattle market information via cellphones since its β value was 0.

Table 22: Variables in the equation

Covariates	β	S.E.	Wald	Df	Sig.	Exp(β)
Age of respondent	-0.028	0.025	1.260	1	0.262	0.973
Number of cattle owned	-0.025	0.014	3.096	1	0.078	0.975
Approximate distance to the nearest cattle market	0.057	0.018	10.088	1	0.001	1.059
Income per year	0.000	0.000	5.291	1	0.021	1.000
Access to information about beef cattle grades	0.429	0.682	0.397	1	0.529	1.536
Cattle sales volumes information	2.396	0.868	7.620	1	0.006	10.979
Ownership of cellphones	1.088	0.788	1.907	1	0.167	2.968

From the results in Table 22, approximate distance from home to the nearest cattle market had a significant impact on the likelihood of smallholder's access to beef cattle market information via cellphones ($p = 0.001$). Moreover, it is the same variable that had the biggest impact (Wald statistics = 10.088) of all other variables that were entered in the binary logistic regression model, followed by the use of cellphones in access to information about cattle sales volumes ($p = 0.006$) with a Wald statistic of 7.620. Average income per year had no effect on the response variable but showed a significant impact on the likelihood of smallholder's access to beef cattle market information via cellphones ($p = 0.021$) with a Wald statistics of 5.291. The other Wald statistics and their level of significance are as presented in Table 22.

The Wald statistics shown in Table 22 are also presented in Fig. 6 to illustrate the extent to which each of them contributed to the probability of smallholders in various settings having access to cattle market information by using cellphones.

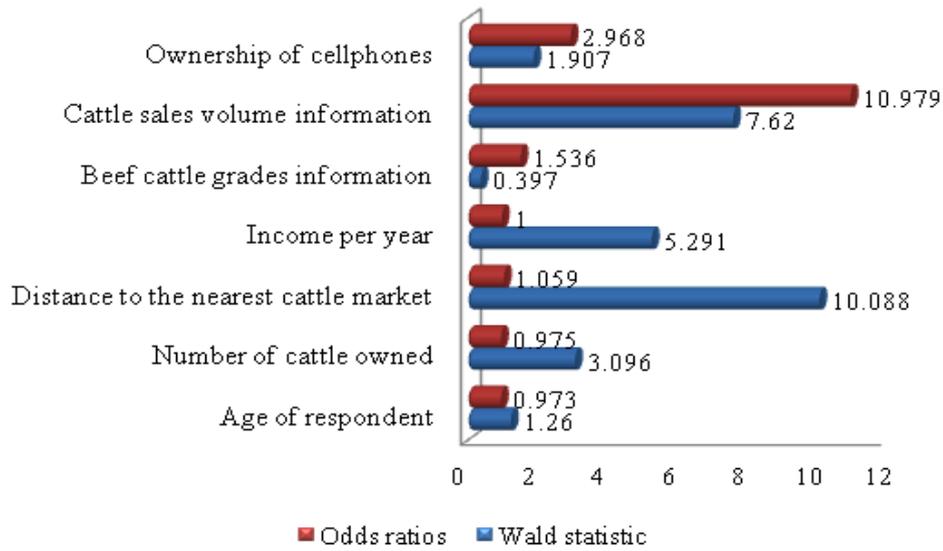


Figure 6: Contributions of independent variables to the odds of access to beef cattle market information via cellphones

According to the results presented in Table 22 and Fig. 6, the most important variables that contributed highly to the use of cellphones increasing chances of getting access to cattle market information were approximate distance from home to the nearest cattle market, access to information about cattle sales volumes, and average income earned by the individual smallholder per year. The magnitudes of effects of other independent variables on the dependent variable (access to cattle market information via cellphones) are as presented in Table 22 and Fig. 6.

In view of findings in Table 22, the chances of smallholders with different ages, income levels, distances, and different demands on the types of market information factors were not the same as indicated by the Exp (β), which measures the chances of access to beef cattle market information via cellphones among smallholders. The odds ratio is the natural log base, e , to the exponent, β , where β is the parameter estimate. The odds ratio is the predicted change in the odds for a unit increase in the corresponding independent

variable. Odds ratios less than 1.0 correspond to decreases in the odds; odds ratios more than 1.0 correspond to increases in the odds.

In addition, an odds ratio equal to 1.0 means that the respective independent variable has no effect on the dependent variable; and an odds ratio close to 1.0 means that the respective independent variable almost has no effect on the dependent variable (Wuensch, 2008). Therefore, based on the results in Table 22, there is enough evidence to support that an increase in the information obtained about cattle sales volume demands from the different market places, increases chances of getting cattle market information via cellphone by a factor of about 10.979, controlling for other variables in the model.

4.3.8 Cellphone and social rapport

Expanding and strengthening social networking was primarily the main purpose of using cellphones in the study area whereby about a quarter (24.7%) of respondents indicated that they were using cellphones greatly to communicate with families as well as dealing with various emergencies occurred. More than one-fifth (23.7%) indicated that cellphones had been useful in communication with friends thus strength in social relationship has increased concomitantly with reduction of time and cost for travelling this led to the use of time and cost saved to facilitate other productive activities in the family.

These findings agreed with findings of other scientists, which showed that cellphones had created a strong link in social networking particularly in family and personal ties (Donner, 2007; Goodman, 2007; Sife *et al*, 2010). Furthermore, 16.5% of respondents reported to use cellphones in communication with trade partners while more than one-

tenth (10.4%) indicated that they were using the devices to acquire new updates including news, sports and access to information on the availability of Mpwapwa breed technology from Tanzania Livestock Research Institute (TALIRI) located in the district thus to upgrade their flocks.

Similarly, findings from FGDs reported that, even a person with no cellphone in the village could borrow the neighbour's cellphone to report emergencies including a sudden illness or death thus the cost and time for travelling are saved. Furthermore, KIIs results revealed that there is social networking strength in the study area since many community members had contact with ward and village leaders, extension agents as well as their fellow community members. Generally, findings emphasize that cellphones had played a big role in daily lives of cattle keepers in the rural area as far as the social networking is concerned even for those who did not possess their own cellphones.

Table 23: The use of cellphones and social link (n=120)

Main purpose for using	Count	Percent of responses	Percent of cases
Communication with friends	96	23.7	95.0
Communication with trade partners	67	16.5	66.3
Communication with family	100	24.7	99.0
Communication in case of emergencies	100	24.7	99.0
Acquiring new updates	42	10.4	41.6
Total	405*	100.0	401.0*

NB: *Multiple responses

4.3.9 Cellphones and emergencies occurred in the past 12 months

The study revealed that smallholder beef cattle producers were using cellphones to deal with emergencies occurring in the family and community at large. Findings in Table 24

showed that in the past 12 months from September 2011 to September 2012 respondents were using their cellphones to share and report various events that occurred in the community. The multiple responses indicated 27.6% of respondents used cellphones to communicate about illness in the family; while 22.4% used cellphones for reporting cattle sickness; 18% used the devices to report cattle theft; and 15.6% used cellphones for regular herd's status checking. This means that cellphones enabled cattle owners to stay in touch with herdsmen in the different campsites with network connections thus it was easy to trace the flock movements.

These results tally with opinions from FGDs and KIIs who reported that cellphones were extremely important in dissemination of information in case of cattle theft and disease outbreaks. Since VEOs/WEOs were receiving information from livestock keepers about the signs of outbreak via cellphones, thus it was easier for them to report the incidence to the higher authorities for further measures. The same observations was also reported by Musemwa *et al.* (2008) who argued that involvement of communal farmers in the dissemination of information can play a critical role in access to cattle information including formal markets.

However, the FGDs emphasized that care must be taken when reporting cattle theft by using cellphones because thieves are also using cellphones to communicate with unfaithful friends in the village who can alert them to constrain the task of cattle searching. These findings then suggest that cellphones enabled smallholder beef cattle producers in remote areas of Mpwapwa District to communicate and disseminate information related to social issues and beef cattle farming episodes to various stakeholders for immediate act to rescue the situation.

Table 24: Cellphones and emergencies occurred in the past 12 months (n=120)

Emergencies	Count	Percent of responses	Percent of cases
Regular herd's status checking	46	15.6	47.4
Reporting cattle theft	53	18.0	54.6
Communication about illness in the family	81	27.6	83.5
Reporting cattle sickness	66	22.4	68.0
Reporting death cases (people and cattle)	48	16.3	49.5
Total	294*	100.0	303.1*

NB: *Multiple responses

4.3.9.1 Possible negative impact in beef cattle sales without access to cellphone services

The respondents were asked to indicate how they would be affected in their cattle investment if they were not able to access cellphone services. The multiple response findings in Table 25 indicate that 16.1% said that they would spend much time and cost for travelling to search the existing cattle price in the different market places and 16.1% indicated that without cellphones it would have been difficult to communicate cattle market information with fellow cattle keepers. Moreover, 14.6% indicated that decision-making on the time, quantity and the type of cattle to be sold would be difficult; likewise, 14.2% indicated that it would have been difficult to bargain price with cattle buyers and 14% indicated they would fail to disseminate information in case of cattle theft for stolen cattle searching. Also 13.2% reported that it would be difficult to have contacts with many cattle buyers whereas 11.7% of the respondents contended that they would lose cattle buyers. These findings give an implication that the use of this innovative technology has shown some benefits to the users hence it is hard for them to operate without it in the cattle marketing process.

**Table 25: Possible impact if respondents were unable to access cellphone services
(n=120)**

Possible negative impact	Count	Percent of responses	Percent of cases
Smallholders would lose cattle buyers	55	11.7	71.4
Much time and cost would be spent for price searching	76	16.1	98.7
Decision making would be difficult	69	14.6	89.6
Difficult to bargain price with cattle buyers	67	14.2	87.0
Not easy to share market demands	76	16.1	98.7
Difficult to have contacts with many cattle buyers	62	13.2	80.5
Not easy to disseminate information in case of cattle theft	66	14.0	85.7
Total	471*	100.0	611.7*

NB: *Multiple responses

4.3.9.2 Reasons for not using cellphones in seeking market information

It was also depicted in Table 26 that, some respondents had reasons for not using cellphones for market information seeking. The mentioned reasons were the lack of cellphone 40%; whereas two-fifths (40%) of respondent were not selling their beef cattle regularly due to small number of cattle owned thus they were not interested on the use of cellphones for market information seeking. Also 14.3% of respondents were not using cellphone because they resided closer to the secondary market mainly in Chipogoro village where they can access market information through market place visits. Few respondents 5.7% said they did not know the importance of seeking market information via cellphones however, most of the respondents in this group were curious to start the use of cellphones in market information seeking because they had seen others who had already benefited in access to market information from assorted locations instantly via cellphones.

This gives an implication that the short distance from home to the nearest market place, lack of cellphones, small number of cattle owned and inadequate knowledge on the importance of using cellphones in market information seeking were among the factors that influenced some smallholders not to use cellphones in access to cattle market information. Therefore, this study may unfold their knowledge on the importance of using the device in seeking market information for increased bargaining power and timely decision-making.

Table 26: Reasons for not using cellphones in market information seeking (n=120)

Reasons	Percent
Lack of cellphone	40.0
Not selling cattle frequently	40.0
Did not know its importance	5.7
Staying very near to the open secondary market	14.3
Total	100.0

4.3.9.3 Problems faced with regard to the use of cellphones

The study revealed that more than three-eighths (38.3%) were facing problems with regard to the use of cellphones owned. As Table 27, shows the major problems were network instability (38.2%) in some locations for some times based on the locality of the user. This was the case in the villages with no telecommunication towers including Gulwe and Godegode. About three-eighths (35.3%) reported that the price of airtime/recharging voucher was higher than the indicated prices where the price of one piece indicated TZS1000 went up to TZS 1200 per the same piece while that of TZS 500 ranged between TZS 650 and 700 per piece. However three-quarters (75%) of respondents said it was very easy to access airtime (voucher) to recharge their cellphones

even if the price was a bit higher because vouchers were broadly available in almost all local retail shops in the villages.

In addition, some respondents were unable to operate their cellphones due to illiteracy because they were unable to read and write, nevertheless, some of these people were using their children or neighbours who are literates to operate cellphones for them and some had crammed some indicators showing numbers, names and keys to make and end calls. Similar study in Bangladesh by Islam and Grönlund (2011) observed that most of the farmers without formal literacy were able to access cellphone services by memorizing signs and symbols displayed on the device to perform basic operations. Equally, the study revealed that some calls and SMS from unknown numbers disturbed users and sometimes could cause conflict between husbands and wives who had a notion that may be one has extra marital relationships.

Generally, these findings suggest that illiteracy; inadequate network coverage; price instability for airtime/vouchers; wrong calls and SMS allowed to pop in wrong numbers may hamper cellphone users from enjoying the cellphone services in communication and dissemination of information to its fullest in the rural areas. Findings are consistency with Gallakota's (2008) argument, which stressed that access to information alone is not enough to help farmers but other factors such as financial constrains need to be observed in order to update rural community in the use of innovative communication pathways.

Table 27: Problems faced by cellphone users (n=120)

Problem faced	Count	Percent of responses	Percent of cases
Sometimes network instability	26	38.2	57.8
Calls and SMS from unknown numbers	5	7.4	11.1
Difficult to operate due to illiteracy	13	19.1	28.9
The price of voucher is higher than normal price indicated	24	35.3	53.3
Total	68*	100.0	151.1*

NB: *Multiple responses

4.3.9.4 Problems faced with regard to cellphones charging

Although more than four-fifths, (83.3) said, it was easy to charge cellphones when the battery is low, findings in Table 28 revealed some problems faced by respondents with regard to the cellphone charging where 45.1% claimed to be out of reach at the time of cellphone charging. This implies that the contribution of cellphones in communication and dissemination of information related to beef cattle for smallholders all the time is not yet attained. This may be contributed by many factors including lack of reliable source of energy closer to the user's residential areas.

Other problems identified were long distance movements to the charging service centres 32.7%; high costs for a single charging service 15%; and cellphone accessories theft 7.1%. Likewise, respondents from FGDs reported that lack of national grid energy in the villages mainly Chipogoro Rudi and Godegode made the practice of cellphone charging difficult. It shows that although most of the smallholders were excited on the use of cellphones in access to variety of information, the cellphone's charging process, which goes together with cost, time and risk of accessories defeat are some of remarkable barriers that hinder the effective utilization of cellphones in the surveyed villages.

Table 28: Problems faced with regard to cellphones charging (n=120)

Problems	Count	Percent of responses	Percent of cases
Charging is expensive	17	15.0	29.8
Cellphone accessories theft/changed	8	7.1	14.0
Out of reach at the time of cellphone charging	51	45.1	89.5
Long distance to access charging service	37	32.7	64.9
Total	113*	100	198.2*

NB: *Multiple responses

4.3.9.5 Source of power/energy used for cellphones charging

Two-fifths (40%) of the respondents got cellphone's charging facility from solar power service providers as indicated in Table 29. More than one-eight (15%) got service from the national grid power service providers mainly in Gulwe village where there is access to the nation grid. Very few (11.7%) used their own solar power for cellphones charging, 10.8% got services from generator service providers, while 3.3% got services from car battery facilities and 2.5% were using their own diesel generators. The cost incurred for a single charging service varied from one service provider to another where it ranges between TZS 200 and TZS 500, with average of TZS 332.14. Generally, farmers said that the cost for cellphone charging was high especially for the cellphones that cannot retain charge for more than three days; this is another factor, which can hinder smallholder's access to market information via cellphones for sometimes.

Table 29: Source of energy used for cellphones charging (n=100)

Source of energy for charging services	Frequency	Percent
Generator service provider	13	10.8
Solar power service provider	48	40.0
Car battery service provider	4	3.3
Own solar panel	14	11.7
Own generator	3	2.5
National grid power service provider	18	15.0

4.3.9.6 Problems encountered with regard to the use of cellphones English menus

The study revealed that about three-fifths (59.2%) of interviewed cellphone users encountered problems regarding to the use of English menus presented in many cellphones, whereby more than (44.6%) said that it was hard for them to follow some instructions presented in English language. About two-fifths (39.5%) said it was not easy to understand English SMS sent by local networks when promoting some new programs while 15.9% who tried to set their cellphones in Swahili language said even some Swahili terms presented are also difficult to understand.

The same complains were also revealed during FGDs that English language presented in many cellphones menu is hard to many people due to their literacy levels and the technical Swahili terms need to be simplified for the sake of understanding. This gives an implication that language is one of the communication barriers that hinders the efficiency of cellphones use in the rural areas.

Similar studies in Uganda, Bangladesh and Tanzania Masuki *et al.* (2010); Lwasa *et al.* (2011); Islam and Grönlund (2011); Nyamba and Mlozi, (2012) also found the same challenges, these include poor signals; illiteracy; high cost on airtime; phone batteries

change; difficult in battery charging due to lack of national grid; unaffordable charging fee and language barrier.

Table 30: Problems encountered with regard to the use of English menus (n=120)

Problems	Count	Percent of responses	Percent of cases
Difficult to understand English SMS sent by local networks promoting some new programs	62	39.5	87.3
Not easy to follow some instructions presented in English	70	44.6	98.6
Some Swahili terms are also difficult to understand	25	15.9	35.2
Total	157*	100.0	221.1*

NB: *Multiple responses

4.4 The Extent to which Cellphones are used to Share Market Information for Smallholders

To examine the extent to which cellphones are used by smallholders towards access to market information the statement about the extent does cellphones enhance access to cattle market information was posed, whereby respondents had various opinions on the statement including “not at all; to a small extent; moderately and to a large extent”. The results in Table 31 showed that more than a half (55.8%) concurred that cellphones enhance access to beef cattle market information largely because most of them are not even going to the market places for cattle sales rather they do call buyers to buy cattle at their home places. Less than one-tenth (9.2%) reported that cellphones enhances moderately while only (0.8%) said it enhances to a small extent. It implies that many smallholder beef cattle producers were benefiting from the use of cellphones in market information sharing hence appropriate decision-making about the time type and volume of cattle to be harvested based on the market demands information shared. On top of that,

smallholders can decide whether to sell their cattle at home or to the distant market places through exchange of supply and demand information, hence they can save time and avoid unnecessary costs and travelling risks.

According to key informants mainly live beef cattle procurer who reported that, cellphones have contributed a lot on the market information sharing including access to information about the availability of cattle and price proposed by cattle owners before they travel for cattle buying in the villages. Thus even cattle buyers could make decision on whether they should go in the villages to buy cattle or they should wait for the cattle to be brought in the market places depending on the availability of cattle and the price proposed by the cattle owners.

In addition, cattle buyers agreed to be consulted by cattle producers to buy their cattle at their home places. Jagun *et al.* (2008) also indicated the same findings that, the use of cellphones have reduced risks, time and financial cost associated with information gathering since the device could coordinate discussion on the orders to avoid travelling risks. Therefore, the use of cellphones has been useful for both by complimenting such interactions since both sellers and buyers of cattle can directly trace the situation by crosschecking the price of cattle in various market places and discuss the suitable prices prior their decision-making.

Table 31: Extents that cellphones enhance access to market information (n=120)

Extent cellphones enhances	Frequency	Percent
To a small extent	1	0.8
Moderately	11	9.2
To a large extent	67	55.8

4.4.1 Types of market information communicated by using cellphones

Findings in Table 32 indicated that respondents were using cellphones to share different types of cattle market information particularly sales price (29.6%) and market demands including sales volumes and grades such as age of cattle and size applicable (23.1%). One-fifth (20%) reported to share information about the availability of cattle buyers; 17.7% were using cellphones to communicate auction dates; whereas about one-tenth (9.6%) used cellphones to share information about road condition inside and outside the district especially during rain seasons when many bridges are destructed, this was the case mainly in Gulwe, Rudi and Godegode villages.

In discussion with focused group, it was revealed that communication about availability of cattle buyers is very important because the experience has shown that when there are few buyers the price of cattle goes down as compared to when there are numerous buyers in place. Therefore, cellphones enabled smallholder cattle owners' benefit by selling when the price of cattle is favourable.

Table 32: Types of market information communicated via cellphones (n=120)

Types of market information	Count	Percent of responses	Percent of cases
Sales price	77	29.6	100.0
Seasonality and road conditions	25	9.6	32.5
Auction dates	46	17.7	59.7
Market demands (sales volume, age, size)	60	23.1	77.9
Availability of buyers	52	20.0	67.5
Total	260*	100.0	337.7*

NB: *Multiple responses

4.4.2 Markets and cattle buyers consulted in the past 12 months when need arose

According to discussion with respondents and observation made by the researcher it was revealed that most of beef cattle smallholders were not selling their cattle frequently rather they sold cattle when a critical need arises in the family. Some of the critical needs mentioned were school fees, long-term illness, food shortage, disease outbreaks and sudden death. Based on the chi-square results in Table 33, the number of buyers consulted and buyers accessed in the past 12 months when need arose were highly and significantly associated with access to beef cattle market information by using cellphones ($\chi^2 = 79.00$; $p \leq 0.001$). This shows the extent to which cellphones are used in access to instant cattle market information and the way this innovative device enhances rapid consultation and access to cattle buyers when crucial need arises in the rural areas.

However, there was no significant association between number of markets surveyed and access to beef cattle market information via cellphones probably because those who had access to buyers they were likely to sell their cattle at their home places when need arose.

Table 33: Number of markets and cattle buyers accessed via cellphones in the past 12 months (n=120)

Item	Access to beef cattle market information					
	Minimum	Maximum	Mean	Std Deviation	χ^2	P-value
Buyers consulted	1.00	30.00	4.15	4.80	79.000***	0.000
Buyers accessed	2.00	25.00	3.56	4.06	79.000***	0.000
Markets surveyed	1.00	8.00	2.56	1.82	12.685	0.123

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

4.4.3 Telephone numbers owned

The study revealed that beef cattle smallholders had telephone numbers, which enabled them to consult cattle buyers when the need arises. The buyer's telephone numbers owned by respondents ranged from a minimum of one to the maximum of 100 telephone numbers. The variation of telephone numbers owned by smallholders was due to the size of their herds whereby smallholders with big herds were likely to sell few cattle several times to meet needs of the remained beef cattle including veterinary services required thus they were likely to have many buyers telephone numbers. However, those with small herds would like to multiply their herds rather than reducing them by selling.

According to cattle-producers and key informants report small herd size in the study area ranges from 2 - 15 cattle. Further analysis revealed that there was significant association between buyer's telephone numbers owned and accesses to beef cattle market information ($\chi^2 = 85.262$; $p \leq 0.001$). Similarly, the chi-square results reveal a significant association ($\chi^2 = 79.000$; $p \leq 0.001$) between accesses to beef cattle market information and extent of calls received by beef cattle smallholders from cattle buyers who placed order of cattle per months. This implies that the smallholders with buyer's telephone numbers interacted with many cattle buyers and they were likely to receive many calls from cattle buyers who would like to place cattle orders thus it was easy for them to link buyers with their fellow cattle keepers once they do not have enough cattle for selling.

In addition, beef cattle smallholders also had access to their fellow cattle producer's telephone numbers ranging from 1-150 numbers; nevertheless, there was no significant association between access to cattle market information and the ownership of fellow cattle producer's telephone numbers. This was probably because smallholders had

various information to share with their fellow cattle producers rather than cattle market information sharing only.

Table 34: Telephone numbers owned (n=120)

Telephone numbers owned	Minimum	Maximum	Mean	Std Deviation	Access to beef cattle market information	
					χ^2	P-value
Buyers contacts owned	1.00	100.00	7.80	12.42	85.262***	0.001
Fellows contacts	1.00	150.00	18.99	23.87		
Calls received for cattle orders per month	1.00	30.00	4.01	5.86	79.000***	0.000

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

4.4.4 Stakeholders whom cellphone enables to stay in touch for cattle sales

The results revealed that more than three-quarters (76.7%) of respondent ranked cellphones as a very important tool that enables staying in touch with cattle buyers for future sales and that there is no way they could discontinue using the device in market information sharing among actors involved. However, very few respondents (3.3%) had no opinion about the importance of cellphones for future sales. This might be due to their little experience of using cellphones for market information sharing. Table 35 indicate stakeholders whom cellphone enables stay in touch with respondents for beef cattle sales. More than a quarter (26.6%) of respondents reported that cellphones enabled them to stay in touch with their fellow beef cattle keepers who were the most reliable source of their market information as it was pointed out earlier in section 4.2.1. Likewise more than a quarter (25.5%) said cellphones enabled them stay in touch with extension agents for veterinary services; more than one-fifth (23.4%) reported to stay in touch with VEO/WEOs for cattle movement permit documents; whereas 15.6% reported that cellphones enabled them to stay in touch with their village livestock keeper leaders (chair

person and secretary). Further findings indicated few respondents (4.7%) who reported that cellphones enabled them to stay in touch with veterinary stockist outside their villages; very few respondents (3.2%) reported to stay in touch with transporters while 0.8% said that cellphones enables them to stay in touch with auctioneers/market monitors.

The same observation was reported in Martin and Abbott (2011) who found that cellphones were used to stay in touch with extension agents, community members, local leaders and local dealers regarding the access to crop and livestock inputs. Similarly, respondents from FGDs reported that cellphones were very important on staying in touch with buyers not only for cattle sales but also for crops and small stock which considered as the first alternative for cash earning when need arises. Komwihangilo *et al.* (2012) in the study conducted in Mpwapwa and Manyoni districts in Tanzania also reported that small stock were often sold to solve problems when emergency occurred in the family.

Likewise, during the interview with key informants buyers reported to have an average of four telephone numbers ranging from 5-10 cellphone contacts from smallholder cattle producers thus they were using cellphones to place order of cattle one day before the market day to ensure the availability of cattle and price concurrence. Moreover, extension agents reported to frequently receive calls from smallholders for consultations with regard to the animal health and treatment for the sick animals. This implies that cellphones have created links among actors involved in the beef cattle subsector inside and outside rural areas.

**Table 35: Stakeholders whom cellphone enables to stay in touch for cattle sales
(n=120)**

Stakeholders involved	Count	Percent of responses	Percent of cases
Fellow beef cattle keepers	101	26.6	99.0
Village/Ward Executive Officer (VEO/WEO) for cattle movement permit documents	89	23.4	87.3
Transporters	12	3.2	11.8
Extension agent for veterinary services	97	25.5	95.1
Veterinary stockists	18	4.7	17.6
Auctioneers/Market monitors	3	0.8	2.9
Village livestock keepers leader	60	15.8	58.8
Total	380*	100.0	372.5*

NB: *Multiple responses

4.4.5 Cellphones and average airtime expenditures per week

The results in Table 36 indicate that the average expenditure for cellphones recharging airtime per individual was TZS 6 757.28 per week with a minimum of TZS 500.00 and maximum of TZS 40 000.00. The extent to which cellphones are used in rural areas made smallholder's expenditure on cellphones airtime relatively higher. One possible reason for this might be due to the feeling that access to information resource has numerous benefits to them. Furuholt and Matotay (2011) argued that despite the poverty level in rural areas of Tanzania, people were willing to spend significant amount of cash on cellphones airtime expenditure. Likewise, chi-square results (χ^2 11.725; $P \leq 0.032$) indicated significant association between the use of cellphones in access to cattle market information and cellphone's airtime expenditures per individual per week. This suggests that, smallholders were likely to use cellphones to communicate market and social information as a substitute for travelling cost.

Table 36: Cellphone's expenditure per week (n=120)

Item	Access to market information Expenditure
Minimum	500.00
Maximum	40 000.00
Mean (Average)	6 757.28
Standard deviation	5 947.43

Pearson chi- square = 11.725 P= 0.032 ($p \leq 0.05$)

4.4.6 Other services accessed by using cellphones apart from calling and SMS

Cellphone technology is a device that can allow variety of services to be utilized by the users apart from calling and short message services depending on the model of cellphone owned, individual capability and skills as well as preferences. To establish the use of other service applications enabled by cellphone, the study findings indicate that 17.5% of respondents had access to cellphone clock for time updates; 16.1% were using cellphone's calendar to access dates including cattle auction dates and 15.7% were using cellphone torch as source of light. Other cellphone applications utilized were the use of calculators 12.8%; access to radio 8.5%; access to music 7.2% and access to camera 5.8%. Few respondents had access to M-Pesa 5.6%; Tigo-Pesa 4.5%; games 3.1%; Airtel-money 2.5% and 0.8% had access to the internet services. All the above responses notify that cellphones enabled beef cattle smallholders to have access to other important services rather than just calling and SMS as Fig.7 indicates. This means that, having a single device one can exploit other services including mobile-banking; radio; camera; music player; clock; calendar; calculator for cattle sales; torch; games for entertainment and internet services.

These findings confirm earlier findings by, Sife *et al.* (2010); Masuki *et al.* (2010); Furuholt and Matotay (2011); Ogembo *et al.* (2012) and Ayo *et al.* (2012) which indicated that the use of cellphones had built confidence in the users regarding the use of extra services allowed by the devices. The application of mobile banking is one way, which enhances electronic inclusion for smallholders in the rural areas. However, percentage of respondents who used advanced application was relatively low; this is probably due to lack of knowledge and skills on how to operate the features; lack of appropriate device models; low level of literacy and the higher price of complex cellphone devices.

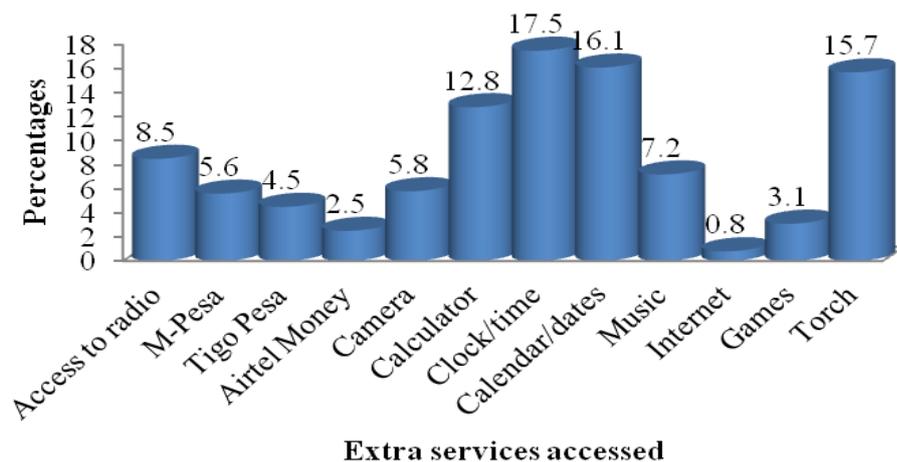


Figure 7: Proportion of smallholders using cellphones in access to other services apart from calling and SMS.

4.4.7 Methods used to communicate with fellow farmers

The study revealed that farmers had various methods to communicate with their fellow farmers to share some experiences and social issues. As indicated in Table 37 nearly a quarter (23%) of respondents was communicating with their fellow farmers through

home visits indicating that cellphones did not substitute face-to-face through home visits in rural areas rather had complement the technique. Moreover, 22% were likely to meet in the various market places; about one-third (19.6%) were likely to meet in the livestock keepers group gatherings held occasionally; 19.4% were communicating with their fellow farmers via cellphones; while 16% were likely communicate with them at the village local meetings. Generally, respondents claimed to use other mentioned methods of communication rather than home visits and cellphones on the issues that do not require urgent attention for decision-making. This implies that home visits (face-to-face) and cellphones are possibly reliable methods for communication that needs instant responses including the dissemination of information about illness, deaths and cattle theft. A study from Mittal *et al.* (2010) also reported that the cellphones did not totally substitute face-to-face in the community; however, face-to-face was highly needed for communication since it allows forth and back dialog among stakeholders.

Table 37: Methods used to communicate with fellow farmers (n=120)

Methods used	Count	Percent of responses	Percent of cases
Village local meetings	80	16.0	66.7
Cellphones	97	19.4	80.8
Livestock keepers group gatherings	98	19.6	81.7
Market day visits	111	22.2	92.5
Home visits	115	23.0	95.8
Total	501*	100.0	417.5*

NB: *Multiple responses

4.5 Beef Cattle Information Demanded Via Cellphones in Future

This research also looked for future information needs, which beef cattle smallholders would like to receive from Extension agents or WEO/VEO officials via cellphones in

future. Results showed that more than four-fifths (82.5%) of respondents reported that they would like to receive various information related to beef cattle. According to multiple responses indicated in Table 38, more than one-eighth (15.9%) said that they would like to have access to quarantine information during the notifiable disease outbreaks; 15.6% would like to receive information about beef cattle market prices available whereas 14.4% would like to receive information related to vaccination dates. Others information needs were information about livestock keepers group local gatherings (seminars/meetings) 13.9%; access to cattle movement permit documents 11.5%; beef cattle grades applicable in the market 11%; while few respondents 8.8% would like to receive information about the cause of un-conducive prices for beef cattle. This implies that information is essential resource for development of beef cattle subsector in the rural areas. It shows that apart from access to beef cattle market information, smallholders had interest on access to other type of cattle information via cellphones in future.

Table 38: Beef cattle information demands for future use (n=120)

Types of information demanded	Count	Percent of responses	Percent of cases
Beef cattle grades applicable	69	11.0	69.0
Beef cattle prices available	98	15.6	98.0
Cause of un-conducive prices	55	8.8	55.0
Quarantine during the notifiable disease outbreaks	100	15.9	100.0
Vaccination dates	90	14.4	90.0
Cattle dipping dates	56	8.9	56.0
Cattle keepers group gatherings (seminars/meetings)	87	13.9	87.0
Access to cattle movement permit documents	72	11.5	72.0
Total	627*	100.0	627.0*

NB: *Multiple responses

4.5.1 Opinions on the beef cattle market information desired in future

The study revealed that the nearly all respondents (95%) would like to have a regular source of assorted cattle market information in future. As multiple responses indicated in Table 39 about one-fifth (19.8%) of respondents would regularly like to receive information about quarantine during livestock disease outbreaks; about one-fifth (19.7%) again would like to receive information about cattle market prices; and (16.7) would like to access information about cattle movement permit documents. More information demands in future include information about reliable cattle buyers in place 16.6%, access to information concerning beef cattle grades applicable in the market 15.3% and information about auction dates 11.9%. Generally, access to relevant and accurate information from reliable source is one of the key solutions regarding the development of beef cattle subsector.

Table 39: Beef cattle market information demands in future (n=120)

Type of market information needed	Count	Percent of responses	Percent of cases
Reliable buyers in place	96	16.6	83.5
Auction dates	69	11.9	60.0
Sales price	114	19.7	99.1
Beef cattle grades applicable	89	15.3	77.4
Quarantine information during disease outbreaks	115	19.8	100.0
Access to cattle movement permit documents	97	16.7	84.3
Total	580*	100.0	504.3*

NB: *Multiple responses

4.5.2 Time interval and language preferred to receive market information in future

The results in Table 40 showed that more than two-thirds (66.7%) would like to receive cattle market information at the beginning of every month; more than one-fifth 22.5% would like to receive information on weekly basis whereas 3.3% would like to receive information daily. On the other hand, very few respondents 1.7% would like to receive information after three months and once per year as well. One reason for this is that some respondents had very little number of cattle so they are not interested on cattle selling unless when critical problem arises. Further findings in Table 40 indicated that almost all respondents (95.8%) would prefer to get cattle market information in Swahili language. This implies that even rural dwellers in Tanzania can understand the information well when presented in the national language, which is Swahili.

Table 40: Interval and language preferred to receive market information in future (n=120)

Interval preferred	Frequency	Percent
Daily	4	3.3
Weekly	27	22.5
Monthly (at the beginning)	80	66.7
After three months	2	1.7
Once per year	2	1.7
Language preferred		
Swahili language	115	95.8

4.5.3 Mode of communication preferred with regard to future information dissemination

The results in Table 41 revealed that more than a quarter (29.6%) reported that annual calendar is preferable mode for market information access in future mainly for auction

dates because the calendar is distributed in form of posters and they are readily available in VEO/WEO offices where the accessibility is easy. Another more than a quarter (21%) would prefer posters because at the time of livestock disease outbreaks the District Veterinary Doctor is mandated to impose quarantine in the areas with outbreaks in form of stamped letter/posters, therefore, the off-lines and those who do not have cellphones can have access to an urgent information.

In addition, more than a quarter (20.7%) once more would prefer cellphones via voice calling in access to cattle market information. Voice calling was preferred because of prompt feedback when quick decision-making is essential, some respondents reported that they prefer voice calling because even illiterates can access the information and that one can ask questions for more clarification. Other modes of communication preferred are cellphones SMS 14.5%, local village meetings 6.8%, face-to-face by extension agent/WEOs/VEOs 5.6% and radio 1.2%. The use of SMS was perchance preferable because it is a certain way of conveying information even when subscriber is out of reach. It is also useful to literate people and some illiterates who can seek assistant from their children and fellow literates because they can revisit the SMS to remind themselves on the contents.

However, some possible reasons for little preference on SMS mode include lack of knowledge and skills on how to deal with SMS, visual disabilities and the fact that SMS cannot be asked for more clarification in case of misunderstanding with regard to the received information. Generally, findings indicated little preference on other modes including local village meetings, face-to-face with extension agents WEOs/VEOs as well as radios in dissemination of cattle market information probably due to inadequate time,

insufficient personnel and timely coverage for the scattered grazing areas. Therefore, posters and innovative pathways including the use of cellphones could fill the gap not filled by extension agents, local meetings and radios modes in dissemination of cattle market information for smallholders in the rural areas to enhance the fast growing beef cattle sub-sector in meeting the high demand of quality beef in the country.

Table 41: Mode of communication preferred with regard to future information dissemination (n=120)

Communication mode preferred	Count	Percent of responses	Percent of cases
Voice calling	67	20.7	58.3
Cellphone SMS	47	14.5	40.9
Posters	70	21.6	60.9
Radio	4	1.2	3.5
Face to face by extension agents/WEOs/VEOs	18	5.6	15.7
Local village meetings	22	6.8	19.1
Annual calendar	96	29.6	83.5
Total	324*	100.0	281.7*

NB: *Multiple responses

CHAPTER FIVE

5.0 CONCLUSIONS AND RECOMMENDATIONS

5.1 Conclusions

The overall objective of the study was to establish the role of cellphones in communication and dissemination of market information for beef cattle smallholders in Mpwapwa district, Tanzania. Based on the study findings the following conclusions are drawn:

The results show that the majority of respondents in the study area possessed and used cellphones in market information sharing while complementing face-to-face and annual auctions calendar channels. The results also pointed out that, fellow livestock keepers were the main source of market information to beef cattle smallholders while technical information were disseminated by local government officials (extension agents, WEO and VEOs). This implies that the use of cellphone technology ensures rapid access to technical and cattle market information for beef cattle smallholders' hence timely decision making.

The study revealed significant association between access to cattle market information via cellphones and some factors, which influenced the use of cellphones in accessing cattle market information. The identified factors include approximate distance from home to the nearest cattle market places, types of market information demanded (cattle sales volume and beef cattle grades applicable), income per year and the ownership of the cellphones. This implies that smallholders who were located far from cattle market

places indeed demanded cattle market information to enhance their bargaining power for timely decision-making.

The results have shown that, the use of cellphones had increased the ability of beef cattle smallholders to deal with emergencies that occurred in the family and community at large. However, the study revealed some constraints, which faced smallholders with regard to the use of cellphones; these include network instability; higher price of cellphone's airtime; illiteracy; language barrier and calls/SMS from unknown numbers. Other challenges were difficulty on cellphones charging process and lack of full time communication ability. Thus, the identified challenges had negative implications on the efficiency of cellphones use in cattle market information sharing.

The findings further pointed out significant association between the numbers of buyers consulted, buyers accessed and the use of cellphones in access to beef cattle market information indicating the extent to which cellphones were used to access instant cattle market information at any time.

In addition, other factors including calls received for cattle orders per month, cattle buyer's telephone numbers owned and cellphone's airtime expenditures per individual per week also showed significant associations with the use of cellphones in access to market information for smallholders. This implies that, this innovative pathway enhances rapid consultation and access to cattle buyers when crucial need arises in the study area.

The study found that cellphones had created a strong link in social networking, and access to other advanced applications enabled by the cellphones including access to

mobile banking. This provides evidence that cellphones has a role to play in the day-to-day lives of beef cattle smallholders in the study villages.

The study findings revealed that cattle smallholders would like to receive information related to beef cattle via cellphones in future thorough simple Swahili terms, implying that smallholder cattle producers prefer Swahili language in access to constructive information to enhance their decision making for increased production performance.

5.2 Recommendations

Based on the conclusions of this study, the following are the recommendations.

5.2.1 Policy level recommendations

- (i) There is need to implement policies that encourage investment in cellphone infrastructures in rural areas that can contribute to both social and economic development.
- (ii) In addition, policy makers should put in place enabling regulations which will enable development planners to formulate strategies targeting on the use of cellphones as one of innovative communication pathways that have been adopted in the rural areas for sustainable market information dissemination hence increased bargaining power and timely decision-making for beef cattle smallholders in the study area.

5.2.2 District level recommendations

- (i) The district through few available extension agents and cattle market monitors should establish livestock information units at the ward levels where variety of existing cattle market information can be drawn and disseminated to smallholders by WEOs and VEOs via cellphones. This would serve as the most valid and reliable source of cattle market information, which can unfold smallholder's knowledge on the regular use of cellphones in access to desirable cattle market information prior selling.
- (ii) Agriculture extension officials should take note of information needs of the smallholder beef cattle producers to extend their services in these areas of need.
- (iii) Likewise, the district should accentuate the implementation of Rural Electrification Master Plan through Rural Energy Agency (REA) to enable access to national electricity grid in the rural areas at affordable price; this will facilitate the efficiency of innovative communication technologies including cellphones.
- (iv) Moreover, efforts should also focus on the distribution of solar panel as one source of electricity, which is relatively cheaper and needs no monthly bills settling to overcome the problem of electricity in the study area villages.

5.2.3 Beef cattle smallholder's recommendations

- (i) The beef cattle smallholders in general should establish the culture of cattle market information seeking before sales decision-making to avoid being cheated by unfaithful cattle buyers whose intention is maximisation of profit.

- (ii) Although smallholders primarily planned to use their cellphones in communication of social issues, the proper use of this innovative device can improve economic aspects in terms of access to market information and mobile banking for individual savings.
- (iii) Likewise, the use of cellphones in access to various cattle market information including cattle movement permit documents, sales-volume, market price and beef cattle grades applicable will prevent several risks including theft, disease transmission, and loss of weight by animals on long treks to and from market places when the market situation is unfavourable.
- (iv) Equally, literacy beef cattle smallholders who have benefited from the use of cellphones in accessing beef cattle market information and other cattle production information should help other farmers to acquire skills and abilities to seek such information for increased beef cattle performance.

5.2.4 Recommendation to cellphones service providers

- (i) Given the rapid growth of interest in smallholders accessing social and beef cattle market information, cellphones service providers should extend their services more in the rural areas of Mpwapwa district predominantly in Gulwe and Godegode villages where there is access to railway infrastructures and sub-stations used to trek cattle to other areas including Dar es salaam for easier communication.

- (ii) Likewise, they should plan for programmes that can convey market information to smallholders on monthly basis via voice messages in simple Swahili language in order to realize the efficacy of cellphones in beef cattle subsector's development.
- (iii) Furthermore, recognizing that people with low income in rural areas have become the biggest market of cellphones service providers, they should consider reducing of rate charges.
- (iv) Realizing that farmers are also interested on mobile banking services, the service providers should consider the establishment of mobile banking (M-Pesa, Tigo-Pesa and Airtel-money) agents with huge and sufficient amount to accommodate farmers' needs in the rural areas. The provision of convenient services will enable access to the mobile banking facilities within a short distance in the villages instead of accumulating service centres in the urban areas.

5.2.5 Recommendations for further research

- (i) Since this study covered only four villages in Mpwapa district located in the central Tanzania, similar studies can be extended to cover other agro-pastoralist areas in other zones of Tanzania hence more knowledge regarding the use of cellphones and access to market information by the smallholder cattle producers will be obtained.
- (ii) Seeing that the device had multiple roles to play in the community including financial transactions (mobile banking), further studies should focus on the

strength and weakness of these services in the community and come up with ideas of improving the service for beneficiaries.

Therefore, if the above recommendations are taken into consideration and adopted by all the stakeholders for the small-scale beef cattle producers the role of cellphones in communication and dissemination of market information for beef cattle in Mpwapwa and Rudi divisions, Mpwapwa district, Dodoma region and Tanzania at large will be greater thus information poverty will be lessened.

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APPENDICES

Appendix 1: Beef cattle smallholders' questionnaire

A questionnaire for the use of cellphones in communication and dissemination of market information for beef cattle smallholders in Mpwapa District, Tanzania

Number of questionnaire..... Respondent's name.....
 Village..... Ward.....
 Division..... Date of interview.....

SECTION A: BACKGROUND INFORMATION

1. Age of the respondent in years []
2. Sex 1 = [] Male 2 = [] Female
3. Marital status
 - 1 = [] Single
 - 2 = [] Married
 - 3 = [] Separated
 - 4 = [] Widowed
 - 5 = [] Divorced
4. Have you received any formal education?
 - 1 = [] Yes 2 = [] No
5. (a). If **YES** to **no 4**, state your level of highest formal education
 - 1 = [] Partial primary education
 - 2 = [] Primary education
 - 3 = [] Middle school (class eight)
 - 4 = [] Partial secondary education
 - 5 = [] Secondary education
 - 6 = [] Tertiary
 - 7 = [] Adult education
 - 8 = [] Others (specify)
 (b) Years of schooling []
6. If **NO** to **no 4**, do you know how to read and write?
 - 1 = [] Yes 2 = [] No
7. Have you ever attended any training related to the cattle selling?
 - 1 = [] Yes 2 = [] No
8. If **YES** to **no 7**, what kind of training did you attend?
 - 1 = [] Marketing of cattle
 - 2 = [] Methods for marketing information access
 - 3 = [] Methods for price bargaining
 - 4 = [] Others specify

SECTION B: ECONOMIC STATUS

9. Economic activities carried out
 - 1 = [] Paid employment
 - 2 = [] Self employment
 - 3 = [] Livestock keeping only
 - 4 = [] Crop production only

- 5 = [] Crop and livestock production
 6 = [] Petty trade
 7 = [] Others (specify)

10. (a) Do you have access to electricity at home? 1 = [] Yes 2 = [] No
 (b) If **yes**, mention the type of electricity accessed
11. Do you have landline telephone at home? 1 = [] Yes 2 = [] No
12. Do you own land? 1 = [] Yes 2 = [] No
13. If **YES** to **question 12**, how many acres []
14. How much of the land is under cattle production []
15. How many cattle do you own? (Number of cattle) []
16. Types of assets owned

Asset owned	Number/amount	Monetary value
Television 1 = [] Yes 2 = [] No		
Satellite dish 1 = [] Yes 2 = [] No		
Radio 1 = [] Yes 2 = [] No		
Bicycle 1 = [] Yes 2 = [] No		
Motorbike 1 = [] Yes 2 = [] No		
Car 1 = [] Yes 2 = [] No		

SECTION C: THE USE OF CELLPHONES

17. Do you have cellphone(s)? 1 = [] Yes 2 = [] No
18. (a) If **YES** to **no. 17**, how many cellphones do you own? [] (b) Monetary value
19. How many chips/lines do you own? []
20. Mention the types of line owned
 1 =.....
 2 =.....
 3 =.....
 4 =.....
21. What type of SIM card/line do you use most often (*tick all that applicable*)
 1 = [] AIRTEL
 2 = [] VODACOM
 3 = [] TIGO
 4 = [] ZANTEL
 5 = [] Others specify
22. Why do you use more than one SIM card?
 1 = [] Benefiting from different promotions
 2 = [] Saving costs by making on- net calls
 3 = [] Using whenever one service provider has network problems
 4 = [] Using in places where there is no service you normally apply
 5 = [] Others (specify)
23. What is the main purpose for using your cellphone?
 1 = [] Communication with friends
 2 = [] Communication with trade partners
 3 = [] Communication with family
 4 = [] Emergencies
 5 = [] Acquiring updates
 6 = [] Others (specify)

24. Emergencies, which occurred from Sept 2011 to Sept 2012 reported by using cellphone?
1 =.....
2 =.....
3 =.....
4 =.....
25. Do you face any problem with regard to the use of cellphone?
1 = [] Yes 2 = [] No
26. If **Yes to no 24**, please explain those problems
1 = []..... 2 = [].....
3 = []..... 4 = [].....
27. How easy is it to recharge your cellphone (to get air time/ voucher)
1 = [] Very easy
2 = [] Somehow easy
3 = [] Not easy at all
4 = [] Others specify
28. (a) Is it easy to charge your cellphone when the battery is low? 1 = [] Yes 2 = [] No
(b) Explain source of power/ energy used for charging.....
(c) Explain any difficulties experienced with regard to charging services provided.....
(d) How much it costs for one charge service.....
29. Do you encounter any problem with regard to the use of English menus presented in many cellphones?
1 = [] Yes 2 = [] No
30. If **YES to no 28**, please explain those problems
.....
.....
.....
.....
.....
31. How many network towers are available in your area ? []
32. What types of network connection service do you have access to, in your area?
1 =.....
2 =.....
3 =.....
4 =.....
33. What is the level of mobile telephony coverage in your village (*tick appropriate box*)
1 = [] No network connection
2 = [] Very weak network connection
3 = [] Moderate network connection
4 = [] High network connection
34. Which type of network is most reliable in your village?.....
35. What is favourable time for communication via cellphones in your village?
1 = [] Early in the morning
2 = [] In the evening

- 3 = [] At night time
- 4 = [] Throughout day and night
- 5 = [] Other times (specify)

36. What mode of communication is most favourable based on the network support in your area?

- 1 = [] Voice calling
- 2 = [] SMS mode
- 3 = [] Both

37. Do you survey the price of cattle and market requirements prior to selling?

- 1 = [] Yes
- 2 = [] No

38. If **YES to no. 36**, have you ever used cellphone to obtain market information?

- 1 = [] Yes
- 2 = [] No

39. If **Yes to no 37** which of the SIM cards do you use more frequently for your cattle marketing business

(Skip question 38 and go to question 39 if respondent is using cellphone)

40. If **NO to no 37**, explain reasons for not using cellphone in seeking market information.

- 1 = [] Difficulties in getting recharge voucher
- 2 = [] Lack of electricity
- 3 = [] Net work coverage is not reliable
- 4 = [] Doesn't have cellphone
- 5 = [] Others (specify)

41. If **YES to no 37**, what motivates you to use cellphone in seeking market information

- 1 = [] Reduces travelling coast
- 2 = [] Saves time
- 3 = [] Enables to search large number of market
- 4 = [] Enables to consult many buyers more quickly
- 5 = [] Other reasons (specify)

42. How many cattle buyers consulted via cellphone?

- 1 = [] Per day
- 2 = [] Per week
- 3 = [] Per month
- 4 = [] When need arose in past 12 months

43. Number of buyers searched/accessed by using cellphones

- 1 = [] Per day
- 2 = [] Per week
- 3 = [] Per month
- 4 = [] When need arose in past 12 months

44. Number of market places searched / accessed by using cellphones

- 1 = [] Per day
- 2 = [] Per week
- 3 = [] Per month
- 4 = [] When need arose in past 12 months

45. How has the use of cellphone been helpful in communicating market information for beef cattle? Explain

.....
.....
.....
.....

- 46. What are the types of market information communicated by using cellphones
 - 1 = [] Sales price
 - 2 = [] Seasonality and road conditions (during the rain seasons)
 - 3 = [] Auction dates
 - 4 = [] Market demands (sales volume, age, size)
 - 5 = [] Availability of buyers
 - 6 = [] Others (specify)
- 47. What mode of communication do you prefer with regard to cellphone
 - 1 = [] Voice calling
 - 2 = [] SMS (short text message)
 - 3 = [] Beeping
 - 4 = [] Both voice calling and SMS
- 48. How many cattle buyers' telephone numbers did you have during the last 12 months? []
- 49. How many times do buyers call you to place order of cattle 1= [] per day
2 = [] Per week 3 = [] Per month 4 = [] Any other time []
- 50. How many contacts do you have with fellow cattle keepers []
- 51. If you were unable to access cellphone services, what could be an impact on your cattle sales?
.....
.....
.....
.....
- 52. Is the cellphone important on staying in touch with buyers for future sales?
 - 1 = [] Very important
 - 2 = [] Not important
 - 3 = [] No opinion
- 53. Mention other stakeholders whom the cellphone enables you to stay in touch with for cattle sales.
 - 1 =.....
 - 2 =.....
 - 3 =.....
 - 4 =.....
- 54. Are you using other means of communication apart from the cellphone in communicating/seeking cattle market information? 1 = [] Yes 2= [] No (Mention them)
 - 1 =.....
 - 2 =.....
 - 3 =.....
 - 4 =.....
- 55. On average, how much do you spend to cellphone (voucher) per week? []
- 56. What other services does your cellphone allow you to access apart from calling and SMS 1 = [] Radio 2 = [] M-Pesa 3 = [] Camera 4 = [] Torch
5 = [] Others specify

SECTION D: COMMUNICATION MODULE

- 57. Where do you normally sell your cattle?
 - 1 = [] At home
 - 2 = [] At the open primary markets
 - 3 = [] Any other places (specify)

58. Do you search for market information prior to selling?
1 = [] Yes 2 = [] No
59. If **YES to no 57**, what are the main sources of information for your cattle marketing? (mention)
1 =.....
2 =.....
3 =.....
4 =.....
60. In your opinion, which source is most valid and reliable (mention)
1 =.....
2 =.....
61. What type of information does your source provide?
1 = [] Market prices
2 = [] Beef cattle grades applicable
3 = [] Dates for sales
4 = [] Sales volume
5 = [] others (specify)
62. What are the channels used to convey market information for cattle in your area?
1 =.....
2 =.....
3 =.....
4 =.....
63. Which channel allows a two-way communication/feedback?
1 =.....
2 =.....
3 =.....
64. Did you access any cattle market information via cellphone in the past 12 months? 1 = [] Yes 0 = [] No
65. If **Yes to no 63**, whose cellphone was used to access information? (*check all that apply*)
1 = [] Own phone 2 = [] Friend's phone 3 = [] wife's phone
4 = [] Relative's phone 5 = [] Cellphone kiosk
6 = [] Borrowed friend's/relative's phone and recharge airtime
7 = [] Others (specify)
66. To what extent does cellphone enhance access to cattle market information, (explain)
1 = Not at all
2 = To a small extent
3 = Moderate
4 = To a large extent
67. Do you receive any of the following information from extension officials/Village Executive Officers VEO via cellphone? (*check all that apply*)
1 = Beef cattle grades applicable 1 = [] Yes 2 = [] No
2 = Cause of un-conductive prices 1 = [] Yes 2 = [] No
3 = Quarantine information 1 = [] Yes 2 = [] No
4 = Access to cattle movement documents 1 = [] Yes 2 = [] No
5 = Other information specify

68. If **NO to no 66**, would you like to receive any via cellphone? (*Mention type of information that you would like to receive*)
- 1 =.....
 2 =.....
 3 =.....
 4 =.....
69. Estimate distance in kilometres from home to the near cattle market place []
70. How many live cattle did you sell in past 12 months? []

SECTION E: MARKETING INFORMATION IN FUTURE

71. Would you like to have a regular source of cattle market information in future?
 1 = [] Yes 2 = [] No
72. What type of cattle market information would you like to receive in future?
 1 = [] Reliable buyers in place
 2 = [] Auction dates
 3 = [] Sales price

 4 = [] Beef cattle grades applicable
 5 = [] Quarantine information
 6 = [] Movement permit document access
 7 = [] Others specify
73. How often would you like to receive cattle market information
 1 = [] Daily
 2 = [] Weekly
 3 = [] Monthly (at the beginning of a month)
 4 = [] Others specify
74. In which language would you prefer to get cattle market information?
 1 = [] Native language (mention your language)
 2 = [] Swahili
75. Mode of communication would you prefer to receive cattle market information
 1 = [] Voice calling
 2 = [] Cellphone SMS
 3 = [] Posters
 4 = [] Radio
 5 = [] Face to face by extension agents
 6 = [] Local village meetings
 7 = [] Annual calendar
 8 = [] Others (specify)
76. How do you communicate with other fellow farmers?
 1 = [] Local village meeting
 2 = [] Cellphones
 3 = [] Farmer group gatherings
 4 = [] Farm field school day
 5 = [] Market day
 6 = [] Home visits 7 = Others specify

77. Would you kindly tell me your income from various sources for the past 12 months (September 2011 – September 2012)

Source	Gross value	Costs	Net value
Crop production			
Livestock production			
Cattle selling			
Trade of other items			
Rentals			
Remittances			
Others specify(local brue, charcoal, manufacturing)			

Thank you for your cooperation.

Appendix 2: Focus group discussion guide

Name of the community/village..... Date of discussion.....

FGD No..... No of participants.....

1. Can you see any link between cellphones and access to beef cattle market information?
2. In your opinion, how can cellphones be used in communication and dissemination of beef cattle market information?
3. Knowing that your village is comprised of different socio-economic categories in terms of age, sex, economic grades, ethnic groups with different information needs, and occupations which groups do you think are benefiting more with the use of cellphones? (give reasons)
4. What is the role of cellphones in the day to day lives of cattle keepers
5. How important is the cellphone in strengthening networks in the community
6. Do you think surveying the price prior to sales increases bargaining power of the owner?
7. In your view, access to market information prior to sales can help on timely decision-making?
8. What are the major problems that this community is facing in the use of cellphones?
9. If you were to give advice to the government and other development partners to help the cellphone services to enhance market information sharing, what advice would you give them?
10. Is there any more contribution you would like to make?

Thank you for your cooperation.

Appendix 3: Key informants interview guide for cattle buyers

Name of participant..... Date of interview.....

Interview No..... Ward.....

1. Sex of respondent (*observe and tick the appropriate box*) 1= [] Male
2= [] Female
2. Age (years) of respondent []
3. Highest level of education attained
4. Main occupation
5. Years in beef cattle business
6. What is the link between the use of cellphones and access to cattle availability information?
7. Do you agree on the buying price before the market day?
8. Do you invite cattle producers in the price agreement meeting?
9. Do they get any price information before market day to enhance their decision-making?
10. Do you have any cellphone contacts from your cattle producer? Number of contacts []
11. Do you communicate with cattle owners via cellphone prior to purchasing time?
12. Apart from cellphones, what other means of communication do you use to get information for cattle business?
13. Before access to cellphone, what channels were commonly used to get information about cattle availability?
14. Is there any more contribution you would like to make?

Thank you for your participation.

Appendix 4: Key informants interview guide for leaders and extension agents

Name of respondent..... Date of interview.....

Interview No..... Ward.....

1. Sex of respondent (*observe and tick the appropriate box*) 1= [] Male
2=[] Female
2. Age (years) of respondent []
3. Highest level of education attained.....
4. Main occupation.....
5. Can you see any link between cellphones and access to beef cattle market information?
6. In your opinion, how can cellphones be used in communication and dissemination of beef cattle market information?
7. Knowing that your village is comprised with different socio-economic categories in terms of age, sex economic grades, ethnic groups with different information needs, and occupations which groups do you think are benefiting more with the use of cellphones? (give reasons)
8. What is the role of cellphones in the day to day lives of cattle keepers
9. How important is the cellphones in strengthening networks in the community
10. Do you think surveying the price prior to sales increases bargaining power of the owner?
11. In your view, access to market information prior to sales can help on timely decision-making.
12. What are the major problems that this community are facing in cellphones using?
13. If you were to give advice to the government and other development partners to help the cellphone services to enhance market information sharing, what advice would you give them?
14. Is there any more contribution you would like to make?

Thank you for your cooperation