THE ROLE OF MOBILE PHONE TECHNOLOGY IN THE EMPOWERMENT OF RURAL COMMUNITIES IN WESTERN PROVINCE, KENYA

BY

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A Thesis submitted to the School of Information Sciences in partial fulfilment of the requirements for the Degree of Doctor of Philosophy in Library and Information Studies, Department of Library, Records Management and Information Studies

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DECLARATIONS

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DEDICATION

I dedicate this thesis to my mother Rukiya Isalu and my father the late Juma Shitseswa as well as to my family members: Warda, Razia, Farid, Juma, Leyla, Naima, Nabil and Kawthar.

ABSTRACT

Mobile phone technology is one of the greatest developments of the modern society. The technology has immense potential of turning around the lives of people and communities all over the world. However, despite the rural communities constituting 80% of Kenya's population and hence being the customer base of mobile communication in the country, their needs have not been given adequate attention by mobile industry players. This is evidenced by the more sophisticated mobile network installations and support services concentrated in urban centres. This study aimed at investigating the contribution that the use of mobile phone technology had made towards enabling rural communities improve their lives and explore ways of maximising its development and application for a more empowered society. The objectives of the study were to: examine the extent to which current trends and developments in the mobile phone technology met the needs of rural communities; investigate the modes of empowerment of rural communities by mobile phone technology; identify key factors affecting access, development and use of mobile phone technology; determine the untapped potential of mobile phone technology that could spur higher levels of information sharing and empowerment and; explore measures to foster development and more innovative application of mobile phone technology. The study's conceptual framework was based on a model drawn mainly from the knowledge-gap hypothesis and the media-system dependency theories both viewed in the context of Schramm's model of communication. The study adopted a descriptive case study design using both qualitative and quantitative data collection techniques including interviews, questionnaires and documentary analysis. Based on the Kenya 2009 Population and Housing Census, a multistage sample of 400 rural households from selected districts of Western Province of Kenya was selected using randomly generated Global Positioning System (GPS) coordinates via the Google Earth Satellite System as the key respondents. A systematic random sample of 90 mobile phone dealers within the Province and a census of the managers of the provincial customer care shops of the 4 service providers (Safaricom, Airtel, Orange and Yu) were selected as informants. Descriptive and inferential data analysis techniques were used. Data presentation and interpretation was by descriptive methods using both qualitative and quantitative features including tables, charts, bars and graphs. The study found that the positive trends responsible for a 72% satisfaction rate in mobile phone technology were efficiency and cost effectiveness mainly associated with the internet, m-banking and money transfer, increased multimedia functionalities as well as reducing cost of airtime. The negative trends were increasing mobile crime, negative behaviour change and poor infrastructure. The modes of information sharing and empowerment which helped to improve the lives of people were communication, entertainment, internet and social media, mobile banking and money transfer, education and research. Factors affecting access, development and use of mobile phone technology were network failure, electrical power and charging problems, maintenance issues, e-waste disposal problems, long term cost of phones and airtime, insufficient user education, lack of proper user control guidelines, and theft. Unexploited areas that could spur more innovative and higher levels of information sharing and empowerment were greater use of mobile phone technology in human security and safety, integrating more computing and research functionalities in phones, integrating money transfer on the handsets, production of remote controlled handsets and increasing local content. The study concluded that, the rural communities had not attained maximum empowerment due to inadequate support given to them by mobile phone industry players including researchers who had failed to generate substantive knowledge resources to solve ensuing problems. The study recommends that users should form support groups to gain bargaining powers to demand for service as well as invest more in literacy initiatives to boost their knowledge and capacity to use the technology. Mobile industry players should indiscriminately conduct more user needs assessments especially in the rural areas to ensure that their products and services are more responsive and also develop communication infrastructure and more relevant services in the areas. The Government should lower mobile phone related taxes to reduce the cost of communication, invest more in rural electrification and research as well as provide incentives to promote the use of mobile technology in rural areas to foster empowerment and accelerate development.

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I, however, take full responsibility for any errors, omissions, and interpretations of the data presented herein.

Iddi Juma

ABBREVIATIONS AND ACRONYMS

The following acronyms have been used in this publication.

2G	Second Generation
3G	Third Generation
4G	Fourth Generation
5G	Fifth Generation
AMPS	Advanced Mobile Phone System
CCK	Communications Commission of Kenya
CDMA	Code Division Multiple Access
DELs	Direct Exchange Lines
DFID	Department for International Development
DNA	Deoxyribonucleic Acid
DSTV	Digital Satellite Television
EAC	East African Community
EASSy	East African Submarine Cable System
ETACS	Electronically Controlled System
EXTELCOMS	East African External Telecommunications Company
GDP	Gross Domestic Product
GoK	Government of Kenya
GPRS	General Radio Packed Service
GPS	Global Positioning System
GSM	Global System for Mobile Communications
IARC	International Agency for Research on Cancer
ICT	Information and Communication Technology

ILO	International Labour Organisation
IM	Instant Messaging
ITU	International Telecommunication Union
KAINet	Kenya Agricultural Information Network
KP&TC	Kenya Posts & Telecommunications Corporation
KSH	Kenya Shillings
KSSCGA	Kenya Small Scale Cereal Growers Association
MFIs	Microfinance Institutions
MMS	Media Messaging Service
MP3	MPEG-1 or MPEG-2 Audio Layer III
MPD	Mobile Phone Dealers
M-Pesa	Mobile *Pesa* (Money)
MPSP	Mobile Phone Service Providers
MPSP	Mobile Phone Service Providers
NFC	Near Field Communication
PC	Personal Computer
PDA	Personal Digital Assistant
RAM	Random Access Memory
RASCOM	Regional African Satellite Communications System
RF	Radio Frequency
RMPU	Rural Mobile Phone Users
ROM	Read only Memory
SEACOM	South East Asia Communication
US	United States

OPERATIONAL TERMS AND CONCEPTS

Code Division Multiple Access (CDMA); a competing mobile phone service technology to GSM, electromagnetic energy is spread to allow for a signal with a wider bandwidth thus allowing multiple people on multiple mobile phones to be "multiplexed" over the same channel to share a bandwidth of frequencies. Since more space is often allocated for data this standard is attractive high-speed Internet use.

Global Positioning System (GPS); a space-based global navigation satellite system that provides location and time information in all weather, anywhere on or near the earth, where there is an unobstructed line of sight to four or more GPS satellites.

Global System for Mobile Communications (GSM); originally Groupe Spécial Mobile, is a standard set and developed by the European Telecommunications Standards Institute to describe technologies for second generation (or "2G") digital cellular networks.

Empowerment; to give (someone) the authority or power to do something or make (someone) stronger and more confident, especially in controlling their life and claiming their rights.

Household; a main house and its occupants regarded as a unit. Occupant(s) may be a single family, two or more families, or any other group of related or unrelated persons living together and sharing basic living arrangements such as accommodation or meals. Household members who are temporarily absent on reference day are considered part of their usual household.

Information sharing; exchange of information between a sender and receiver. According to the Baldoni (2010: slide 3), the phrase gained popularity as a result of the

September 11 terrorist attacks Commission Hearings in the United States of America and its report of the US Government's lack of response to information known about the planned terrorist attack on the New York City World Trade Center prior to the event.

Mobile (cell) phone technology: the application of scientific knowledge in the development, operation and use of mobile phones.

Mobile phone; also called cell phone or handphone is an electronic device used to make mobile telephone calls and other applications across a wide geographic area, served by many public cells, allowing the user to be mobile. It need not be confused with a cordless telephone which is used only within the range of a single, private base station, such as a home or an office.

MPEG-1 or MPEG-2; more commonly referred to as MP3, is a digital audio encoding format using a form of lossy data compression.

M-PESA; (M for mobile, Pesa for money in Swahili language) is the product name of a mobile-phone based money transfer service for Safaricom, which is a Vodafone affiliate.

Near Field Communication (NFC); is a technology that allows for simplified transactions, data exchange, and connections with a touch. Many smartphones currently on the market already contain embedded NFC chips that can send encrypted data a short distance ("near field") to a reader located, for instance, next to a retail cash register in a supermarket.

Personal Digital Assistant (PDA); also known as a palmtop computer, or personal data assistant, is a mobile device that functions as a personal information manager.

Rural Community; a community is social group whose members reside in a specific locality, share government, and often have a common cultural and historical heritage.

For purposes of this study, rural community refers to population groups residing in areas designated by the Kenya 2009 Population and Housing Census Report as rural.

Smartphone; a mobile phone that is able to perform many of the functions of a computer, typically having a relatively large screen and an operating system capable of running general-purpose applications. It is has integrated computer and other features such as an operating system, Web browsing and the ability to run software applications.

Subscriber Identity Module or subscriber identification module (SIM); is an integrated circuit that securely stores the service-subscriber key used to identify a subscriber on mobile telephony devices (such as mobile phones and computers).

Technology; the application of scientific knowledge for practical purposes, especially in an industry. Machinery and equipment developed from scientific knowledge: Branch of knowledge dealing with engineering or applied sciences.

Western Kenya: in this research, this refers to the traditional Western Province of Kenya - one of the eight administrative areas under the jurisdiction of a Provincial Commissioner. Geographically, The Province borders Uganda on the western side, Rift Valley Province on the northern and eastern side and Nyanza Province on the Southern side. It was initially subdivided into eight districts namely Mount Elgon, Bungoma, Lugari, Teso, Busia, Mumias/Butere, Vihiga and Kakamega. The districts have since been consolidated into the original four larger districts namely Bungoma, Busia, Kakamega and Vihiga, currently referred to as counties in line with the new 2010 constitution (Government of Kenya, 2010: CAP. 11).

CHAPTER 1: INTRODUCTION

1.1 Introduction

Among the most significant innovations of the knowledge society, the mobile phone technology stands out as an exceptional development that has had a tremendous impact on the modern world. According to Zambrano and Seward (2012: 58), "no other technology has been in the hands of so many people in so many countries in such a short period of time." The mobile technologies are now opening new channels of communication between people and governments, potentially empowering people to have greater access to public information and basic services.

Unlike the traditional channels of communication such as the print media, radio, television, and the landline telephone systems which were the preserve of the privileged few mainly in urban centres, the new technology has been embraced in equal measure by people of all walks of life thus breaking the barriers and bridging the divides that separated the society before. The world over and Africa in particular, the mobile phone technology is now prevalent among the rich and the poor, the young and the old, and regardless of whether they are urban or rural. According to UNDP (2012: para 2) recent estimates indicate that ICTs could be accessible to everyone by 2015 through the mobile technology.

In Kenya, regional statistics show that the country's mobile phone industry is the leading in East and Central Africa and the continued improvements including downscaling of calling rates across all networks is expected to better this position. A study entitled *Digital Life* conducted by TNS Research International as quoted by Ouma (2011: para. 1) reports that "with four million users, Kenya is already leading other East African countries in access to internet services mainly through mobile phone technology".

According to the Communications Commission of Kenya (CCK, 2012:11), the Kenyan population under mobile coverage by the end of 2012 stood at 78% and statistical trends showed that this was likely to improve in future. Already, the mobile phone has become the technology of choice in most parts of the country and lately, its rapid diffusion among communities especially in the rural and marginalized areas, has been phenomenal. To these communities, the technology is a common denominator and a powerful resource whose use has had a direct and irreversible impact on their lives.

However, available evidence from a few researchers who have ventured in this area shows that the mobile phone industry has overbearingly focused on major urban cities at the expense of rural areas, when assessing the needs of clients and rolling out their products and services (Njenga, [2010]: 2). This phenomenon is not just unique to Kenya and to the mobile phone industry alone, but it also applies to many other industries and parts of the world. As observed by Viswanadham:

> "Investments in services and infrastructure tend to concentrate on urban areas. ... companies choose cities with good logistics and IT, educational and financial infrastructure, and power and water facilities ... As a consequence, investments for betterment of rural areas are generally done by governments" (Viswanadham, 2007:10)

This view is supported by one of the respected scholars in the field of mobile phone technology who asserts that:

> "Despite the growing demand for mobile phones in Africa in the last few years, the operators have continued to target urban areas even when their already saturated markets imply that the next generation of users can only be rural and low-income communities" Scott (2004:ii)

While sharing the same view in his comparison of Nigeria and Kenya with regard to the uptake of mobile phone services, Ogunlesi (2013:21) has made several recommendations to the mobile operators. One of them is that the operators should shift their focus from the country's "saturated urban areas and concentrate on the rural areas"

where more than 70% of the population lives.

In a study on *Access to and Usage of Information among Rural Communities in Kilosa District of Tanzania*, Mtega (2012: para. 11) observes that the communication and information infrastructure established by the Tanzanian Government has been largely concentrated in urban areas. He further notes that this so called "geographical isolation" has been one of the major barriers to effective communication and use of information in Tanzania.

In Kenya, the situation is not any different. According to Nyabuga and Booker (2013:19) "mobile phones are limited to mostly those in urban areas where the infrastructure is more developed and the facilities readily available either because of cost or proximity".

As a result of the foregoing scenarios, it is now common to see more sophisticated mobile communication systems, superior networks and more elaborate user support services concentrated around major urban centres. This marginalisation and non-responsiveness to rural communities and their consequences to the provision of mobile phone systems and services need deeper exploration to divulge underlying issues and find solutions to the challenges that they portend. For instance, Crandall et al (2012: 8) notes that marginalization of rural communities in the application of mobile phone technology in Kenya has led to underrepresentation in ownership levels.

Left unabated, these challenges are likely to continue slowing down the momentum towards the realisation of Kenya's Vision 2030 of creating a globally competitive and prosperous nation with a high quality of life (Government of Kenya, 2007: 2). Such an achievement requires an equitable society with a strong foundation for development whose hallmark is unlimited access to information and related basic services.

From the foregoing context, this chapter describes the reasons behind the thesis and the factors that informed the choice of "*The Role of Mobile Phone Technology in the Empowerment of Rural Communities in Western Kenya*" as the topic of this study. The chapter includes background information and problem statement. It also lays out the research goal and objectives, assumptions, research questions, scope as well as limitations.

1.2 Background

Kenya is structured in eight administrative units known as provinces. These are: Central, Coast, Eastern, Nairobi, North Eastern, Nyanza, Rift Valley and Western. Being one of the seven provinces outside Nairobi, Western Provinceis inhabited mainly by the Luhya ethnic community. The province's population according to the Kenya 2009 Population and Housing Census Report stands at 4,334,282 spanning 8,361 km² with its capital being Kakamega Town. Out of this population, 80% is considered rural which is the same as the national proportion thus making it a good sample for this type of study whose findings may not only be replicated at a national level but also at a global one.

Geographically, the Province borders Uganda on the western side, Rift Valley Province on the northern and eastern side and Nyanza Province on the Southern side as shown in Figure 1 below.

Figure 1: Map of Kenya

Source: Administrative Map of Kenya, Website: http://www.nationsonline.org/oneworld/map/Kenya_map.htm. Accessed on 22nd October 2013

The province is further subdivided into eight districts namely Mount Elgon, Bungoma, Lugari, Teso, Busia, Mumias/Butere, Vihiga and Kakamega. The districts have now been restructured into the initial four larger districts devolved into Counties in line with the new constitutional dispensation. These include Bungoma, Busia, Kakamega and Vihiga, as shown in Figure 2 below.

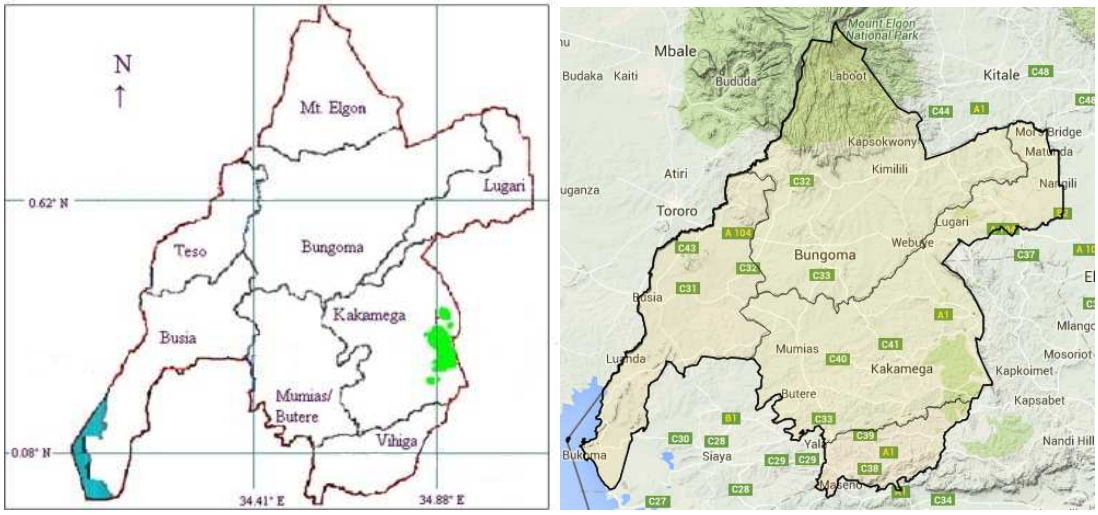

Figure 2: Maps of Western Province showing districts (left) and counties (right)
Sources: Lisouzaa, F. A., Owuora, Okinda P., Lalahb, Joseph O. (2011:9) (Website: http://www.sciencedirect.com/science/article/pii/ S0269749111001886)**.**
City Population (2015). http://www.citypopulation.de/php/kenya-admin.php

The prevailing geographic and climatic conditions, as well as social, cultural and economic factors, make the Province a good place for investment especially in the communication sector. For instance, the Province hosts Kenya's second highest mountain in Kenya. Mount Elgon, located in Bungoma County provides a vast elevated environment conducive for installation of advanced long and range communication systems. The Province also hosts the Kakamega Rainforest, which is an attraction to tourism and thus a major economic resource.

The climate of Western Province is mainly tropical, with variations due to altitude. Kakamega County is usually warm and wet most of the year while Bungoma County is colder but equally wet. Busia County is the warmest while the elevated and ragged

Vihiga County is the coldest. The entire province experiences very heavy rainfall all year round, with the long rains in the earlier months of the year. However, heavy rain has been associated with flooding and lightening which destroy electrical installations and cause electrical blackouts thus affecting mobile phone communication which is largely electricity-dependent (Kamau, 2012: para. 1). Flooding also causes displacement of populations and destruction of property which impact on people's livelihoods and to some extent, their communication capacities.

Farming is the main economic activity in the Province. Maize, millet and sorghum are grown for subsistence while sugarcane is the main cash crop. Fishing, dairy farming, poultry and quarrying are also widely practiced. There is a small but important tourist circuit, centring on ecological features such as the Kakamega Forest as well as cultural attractions predominantly the bull-fighting and biennial circumcision ceremonies.

Western Province has many large factories, including four sugar processing plants. The largest of these is Mumias Sugar, based in Mumias, to the west of Kakamega. This factory produces the dominant sugar brand in Kenya and is an economic success story (County Edition Kenya, 2014: para 8). Also in Western Kenya is the largest paper factory in Africa (Pan Paper Mills in Webuye) and chemical processors. Despite this, living standards are generally low and social amenities like running water and electricity are not available to the majority of the province's residents.

In terms of urbanisation, the Western Province of Kenya is largely rural. The Province is dominated by the Luhya Community, which according to *Countries and their Cultures* (2013: para. 21) is closely associated with chicken, bicycles and radios. Its hunger for tasty foods, thirst for adventure and passion for information and communication is, therefore, not in doubt. The radio, as the saying goes, 'has traditionally been used for listening to news and sharing of radio programmes such as

salaamu (Swahili word for peace and used as a form of greeting) to which the community is also a predominant subscriber. It can therefore be concluded that the rural folks in the Province are among the greatest enthusiasts and by extension, beneficiaries of the mobile phone revolution in the country. The ongoing integration of the traditional technologies namely print media, radio and television as well as photography and computing capabilities in the new phone handsets, provides a one stop shop opportunity for the rural communities that generally lack the economic advantage enjoyed by their urban counterparts. As such, they have continued to embrace the new technological experience with unrivalled degree of excitement.

Many studies have shown that the rural communities in Kenya play a vital role in the national development and cannot be ignored when it comes to facilitation and empowerment. Indicators contained in the Kenya Small Scale Cereal Growers Association (KSSCGA) (2010:para. 4) show the big role the rural communities play through agriculture - the backbone of the Kenyan economy and which is almost exclusively rural based.

On the other hand, the Kenya Agricultural Information Network highlights that:

> "Agriculture has, for many years, formed the backbone of Kenya's economy. Agricultural sector contributes about 30% of the ... (GDP) and accounts for 80% of national employment, mainly in the rural areas. In addition, the sector contributes more than 60% of the total export earnings and about 45% of the government's revenue, while providing for most of the country's food requirements. The sector is estimated to have a further indirect contribution of nearly 27% of GDP through links with manufactures, distributors, and other service related sectors" (Kenya Agricultural Information Network, 2009:5)

This observation is also compounded by Kenya Agricultural Information Network (KAINet) (2009:4) which asserts that agriculture is the mainstay of the Kenyan economy as the sector contributes 26% of the gross domestic product (GDP) directly, 27% through linkages to agro-based and associated industries and employs 80% of the

total labour force in the country. It generates 60% of foreign exchange earnings while providing 75% of industrial raw materials and controls 40% of government earnings.

Despite the foregoing development features of rural population applying to Western Province in relatively equal proportion, the size of the population in the Province that owns mobile phones is not clear. However, given that the 80% of its population is rural, this figure is likely to be somewhere below the national estimate of 63.2 in the Kenya 2009 Population and Housing Census Report.

The huge contribution that rural communities make to the national development through agriculture means that their role in the national growth of mobile phone technology cannot be taken for granted. For instance, according to the Republic of Kenya (2012:32), the mobile subscriber base increased from 20.1 million in 2010 to 25.3 million as at June 2011. During the same period, the number of mobile money transfer subscribers increased from 10.6 million in 2010 to 17.4 million in 2011. This momentous growth in the communication and mobile phone industry, therefore, can largely be attributed to the rural communities where the majority of subscribers reside.

1.3 Statement of the Problem

Despite the Kenya 2009 Population and Housing Census Report showing that rural communities constitute 80% of the Kenyan population and by extension, the customer base of mobile phone services in the country, mobile phone makers and service providers continue to selectively focus on urban communities who, as a result, already enjoy better technological installations that offer higher quality and more reliable services. It is not surprising to see in many parts of the world and Kenya in particular, more sophisticated communication systems, superior connections such as the higher generation networks and better user support services around major cities than in rural

areas (Njenga, [2010]: 2). This is despite the fact that telephone communication itself is a highly random and interactive process where those in urban and rural areas alternately and simultaneously play equally the role of sender and receiver. Furthermore, according to Stark (2011: para. 3), communication requires that the communicating parties share an area of communicative commonality at both ends and hence the lopsided investment in such installations in favour of urban areas is counterproductive and cannot give maximum benefit to society.

In the same vein, mobile phone market surveys and other needs assessment programmes in Africa, Nigeria and Kenya in particular have mainly targeted urban populations (Scott, 2004:ii). As a result, the actual mobile phone communication needs of rural communities are yet to be well understood. This means that services originally tailored to meet the needs of urban populations are imposed upon the rural communities. For instance, a good number of mobile phone features and services such as language options, games, music tones and battery charging provisions are generally in favour of the better-educated, more English speaking and more economically endowed urban communities thus disadvantaging the rural population whose lifestyle, culture and traditions are significantly unique. In essence, the low relevance of such services has continued to curtail their impact on empowerment and therefore, lowering the potential of rural communities to become better and more productive citizens.

The exclusion of rural communities in Kenya means that their capacity to use the mobile phone technology has not been maximised. It also means that their potential to contribute positive ideas and share information resources as a pathway to self-actualisation and effective participation in development initiatives at local and national levels has not been fully utilised (Crandall et al, 2012: 8). It is important, therefore, to understand the actual and potential value of the mobile phone technology

to these communities, find ways of addressing existing challenges that hinder its optimal uptake as well as explore various options to maximise its application.

Whereas Goggin *et al* (2012:3) agree that lack of extensive research in the area of mobile phone technology especially in Kenya has made it difficult to discern the actual problems affecting the rural mobile phone users, Galván (2013:1) on the other hand looks at the situation from an even dire perspective. He argues that even the few studies that have been conducted have focused a lot more on how using a mobile phones impacts the individual user rather than the more global and dynamic needs of communities. The Kenyan situation is worse given that majority of rural dwellers especially in Western Province are poor (IFAD (2015; para. 3). To fill the existing gaps, there is need for more studies to be conducted that are wide in scope and more inclusive in subject and content so as to generate more relevant knowledge that can steer the mobile phone technology in the desired direction.

The leading role Kenya is playing the mobile phone industry in East and Central Africa and the rapidly changing mobile phone technology compounded by the many emerging technical and behavioural factors, equally underscore the need for continuous and more rigorous investigation. This would make the technology better and more useful to the society (Ouma, 2011: para. 1). Thus, the spontaneity of technological changes in the mobile phone industry makes it imperative to explore the response behaviour of various communities of mobile phone users to enhance the possibility of improving phone features to give them better meaning and value. In essence, this would ensure a structured technological development approach and improved service delivery systems that are based on real life experience and well suited to increase the uptake of the technology and accelerate development.

1.4 Aim of the Study

The aim of this study was:

To investigate the contribution that the use of mobile phone technology had made towards enabling rural communities improve their lives and explore ways of maximising its development and application for a more empowered society.

1.5 Objectives of the Study

The study sought to achieve its aim through the following objectives:

i. Examine the extent to which current trends and developments in the mobile phone technology met the needs of rural communities
ii. Investigate the modes of empowerment of rural communities by mobile phone technology
iii. Identify key factors affecting access, development and use of mobile phone technology
iv. Determine the untapped potential of mobile phone technology that could spur higher levels of information sharing and empowerment
v. Explore measures to foster more innovative application and development of mobile phone technology

1.6 Research Questions

This research sought to answer the following questions:

i. What are the current trends and developments in mobile phone usage and awareness among rural communities?
ii. To what extent do existing mobile phone technology systems, services and features meet the needs of rural communities?

iii. What are the emerging factors affecting access, development and use of mobile phone technology?

iv. In what fundamental ways is mobile phone technology contributing to the empowerment of rural communities?

v. What are the unexplored areas and uses of mobile phone technology that could spur greater development of the technology?

vi. What measures can further promote more innovative use and development of mobile phone technology

1.7 Assumptions

This study was based on two key assumptions that made it possible to collect and analyse data within the available means and resources.

i. The first assumption was based on the social and economic dynamics of Western Province of Kenya. Despite the Province being a vast geographic and political block with diverse ethnic, cultural, social and even economic variables, the study assumed that these disparities did not have any significant bearing on the communication behaviour of its residents particularly in the rural areas. By subjecting all the sampled areas of study to the same research metrics, the areas were presumed to be at par in terms of mobile phone technological dynamics such as infrastructure, technical capacities and service provision. In essence, this was presumed to have given the communities equal opportunities to access mobile phone communication services.

ii. Secondly, at the time of planning this study, Kenya and Western Province in particular was undergoing a transition from the old to the new constitutional dispensation which was promulgated in 2010. As a result, there were a lot of debates regarding the existence and/or coexistence of the traditional administrative

structures including provinces, districts, divisions, locations and sub-locations alongside the new county structures. The study therefore presumed that, the new realignment notwithstanding, the traditional structures would still remain relevant for purposes of disseminating and implementing the findings of the study.

1.8 Significance of the Study

Although the world is abuzz with literature on this subject, much of the content is not relevant to developing nations and Africa in particular. Existing information theories are also not adequate in addressing the dynamics of modern communication inherent in mobile phone technology. This study therefore examines and moderates some of the traditional theories of communication whose application has long been overtaken by emerging trends and realities. Hopefully, this will help improve and expand the existing body of knowledge in information and communication.

In general, the significance of this study is summarised in Figure 3 below.

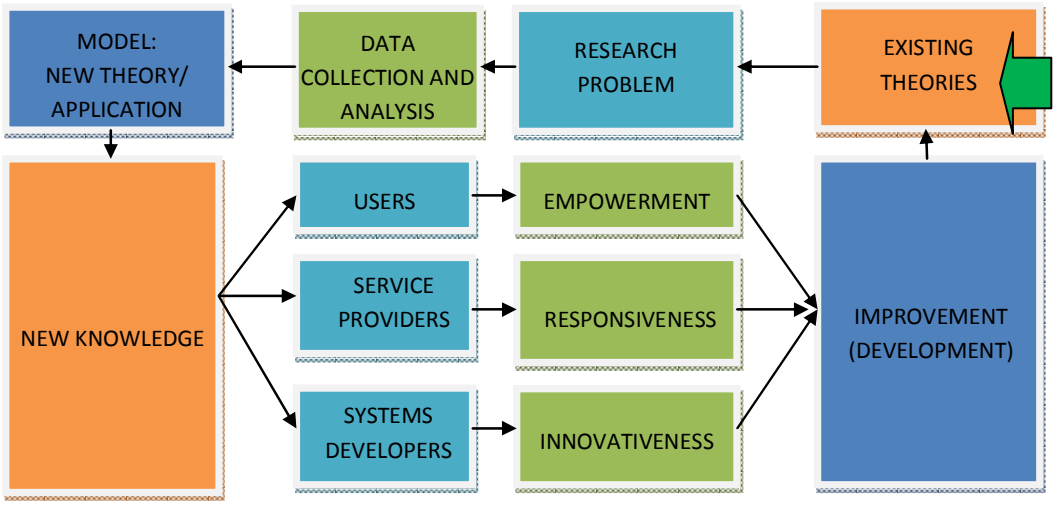

Figure 3: Significance of the Study

Source: Adopted from Routio (2007: para. 35)

Drawing from problems emanating from existing knowledge and experiences in the area of mobile phone technology, the study suggests solutions to solve the problems by

proposing new approaches which culminates into new knowledge.

The new knowledge will help mobile phone users improve their awareness about available technologies and improve their user capacity leading to further empowerment. Mobile phone operators on the other hand may use the new knowledge to understand the user needs and requirements thus improve their service delivery.

The findings will also provide insights to mobile phone manufacturers and software developers that will help in shaping their innovativeness and responsiveness. Already, there is a high proliferation of new products coming with more sophisticated features, which significantly add to their overall price yet they are not adequately used by disadvantaged groups such as rural communities (Scott, 2004:ii). Exploring the response behaviour of rural consumers will enhance the possibility of modifying such features accordingly to give them better meaning and value. As a result, we will have restructured technological development and improved service delivery systems which will increase the uptake of the technology and hasten the pace towards realising societal short-term and long-term goals.

The field of mobile phone communication is also developing at supersonic speeds and more and more research is required to understand and resolve emerging issues and challenges. It is hoped that some of the existing research gaps identified in this study will help upcoming researchers to focus on critical areas that require immediate attention.

All these are expected to lead to the development, empowerment and prosperity of the society. This assertion is put into proper perspective by Jacobs *et al* (1999: para. 3) who defines social development as the process of organizing human energies and activities at higher levels to achieve greater results.

Dyson *et al* (1994: para. 2) contextualises this definition by arguing that:

> "knowledge is the central resource in the economy of the information society... a single word broadly encompassing data, information, images, symbols, culture, ideology, and values – is actionable knowledge." Dyson *et al* (1994: para. 2)

It is evident therefore that the new knowledge in the findings of this study will generally help to enhance the capacities of various groups of people to better their activities, achieve greater results and live a better life.

1.9 Scope of the study

This study was confined within the geographic bounds and rural population of the traditional Western Province of Kenya as at July 2013. The main respondents were rural dwellers of the province who were legally authorised by the laws of Kenya to own mobile phones. The study, therefore, did not include members of the rural communities who were below 18 years even though they had mobile phones. Furthermore, because of lack of clear demarcations on the ground to delineate rural and urban areas, the study narrowed down to districts with the highest proportion of rural households of 90% and above to minimise sampling errors.

The sampled districts were Hamisi, Kakamega South, Samia, Kakamega East, Kakamega North, Butere, Mt Elgon and Lugari as shown in Table 2. Western Province was singled out because of its similarity with the national proportions of urban versus rural populations which stood at 20% and 80% respectively (Kenya National Bureau of Statistics, 2010). This made it the most ideal sample for replication at the national and even international levels.

The study was also more interested in the practical application of mobile phone technology in rural areas rather than in the scientific advancement aspects of it. For this reason, the study focused on how rural communities used the mobile phone technology

to better their lives rather than how the technology was progressing to higher levels merely for the sake of it. As such, the study was confined to the features of mobile phone technology that could be customised or reprogrammed to meet the needs of rural communities better and promote uptake.

1.10 Limitations of the study

One of the major challenges that the study had to overcome was the ongoing population realignment and particularly urban-rural migrations that were taking place at the time of data collection. This was in conformity with the devolved system of government in the new constitution. Because of this, the study anticipated that a number of residents would be a crossbreed of urban and rural communities.

Furthermore, being on the border between Kenya and Uganda, Western province was a beehive of cross border migrations, which had become commonplace with the realization of the revamped East African Community (EAC) and hence an important factor in the response rate. Closely related was the lack of clear boundaries separating rural from urban areas on the ground. As a result, distinguishing between local and non-local residents as well as rural and urban populations was a major challenge.

The province was also quite large with poor transport and communication infrastructure especially during rainy seasons. This made it difficult to reach all the targeted respondents within the projected time frame thus affecting the completion of the research project.

Furthermore, focusing on rural communities also meant dealing with a sample population with lower literacy levels compared with the urban population. In some instances, it was challenging to find a perfect translation of interview questions into some of the local languages spoken by rural natives thus equally affecting the

completion rate of the research.

At the time of conducting the study, the Kenya 2009 Population and Housing Census Report, which formed the basis of defining the study population and sampling for mobile phone users, was still undergoing the process of editorial refinement. It was not easy to identify the final version of the report without having to consult many other authoritative sources of information, a process that was quite time-consuming.

While all possible measures were taken to counter these challenges, a small margin of error may be expected. The measures included an elaborate household sampling approach, use of interviews and other proactive data collection methods and strategic scheduling of data collection in response to weather conditions and socioeconomic activities. The choice of methodology in particular was intended to put less pressure on the rural based respondents especially those with little or no literacy skills. By collecting data between July and December, it was also possible to take advantage of the school, college and other holidays within the period that helped to draw the rural population together.

1.11 Chapter Summary

This introductory chapter examined the background of the study by highlighting the importance of the mobile phone technology and how it has been used to turn around the lives of people in the modern society. The problem statement of the study has revolved around the fact that despite the potential of mobile phone technology to unite and enhance parity among communities and ultimately improve their lives, the mobile phone investors have concentrated most of their efforts and resources in urban and at the expense of rural areas.

As a result, this study sought to investigate the contribution that the mobile phone

technology had made towards the empowerment of the rural communities within the confines of the Western Province of Kenya and explore ways of optimising its development and application for a more empowered society. To achieve this, the study purposed to examine how the current trends and developments in the mobile phone industry address the needs of the rural communities, investigate prevalent modes of information sharing and empowerment, explore the untapped potential and provide mechanisms to foster development of the technology.

The chapter also analysed the envisaged significance of the study to various groups including the mobile phone users on one hand and mobile phone companies including dealers, agents as well as service providers on the other. In particular, the new knowledge from this study is expected to help mobile phone users raise their awareness about available technologies and services and improve their user capacity leading to further empowerment. Mobile phone companies on the other hand have insights that will be helpful in shaping their innovativeness and responsiveness. Major assumptions and limitations to this study have also been highlighted.

The next chapter highlights relevant issues and literary contributions to the topic of this investigation. Particularly, it discusses historical and recent developments that have taken place in the mobile phone industry leading to its exponential growth. It also highlights a number of research findings and emerging discussions that have continued to profile the evolution and uptake of the technology.

CHAPTER 2: LITERATURE REVIEW

2.1 Introduction

Generally, the subject of mobile phone technology has received considerable coverage in media and information domains. The aim of this chapter is to establish the theoretical framework and define key concepts as well as identify studies and models that support the research. Specifically, the chapter explores and analyses the critical points of current knowledge including substantive findings as well as theoretical and methodological contributions on the topic. Of particular interest are relevant theories of communication, elements of empowerment, challenges and trending factors that have influenced the rapid growth and uptake of the mobile phone technology. In addition, the chapter examines a number of research findings and emerging issues that have continued to shape the evolution and devolution of the technology.

This study adopted the meta-analysis type of literature review by systematically integrating statistical, theoretical, historical and empirical findings to enhance understanding of the research topic. This made it possible to draw relevant conclusions and detect patterns and relationships between findings (Cronin et al, 2008:38). This approach also helped to compare different theories of communication while providing a historical view as well as a synopsis of existing knowledge on mobile phone technology. To achieve this, the research relied mostly on a number of information sources including books, periodicals, journals, websites, databases and the views of professional experts available in both print and electronic forms.

The chapter is organised in five broad areas. They include a critical review of theoretical and conceptual frameworks, developmental aspects of the mobile phones, their impact on the people's lives, challenges affecting their application as well as

current and future trends that characterise the course of mobile phone uptake.

2.2 Theoretical Framework

Available literature indicates that only a handful of communication theories that address the emerging dynamics of communication in the modern sense and particularly regarding the media exist. Very few communication scholars have paid attention to media as an integral part of modern communication. This view is echoed by Agrawal who argues that:

> "The various traditions of social theory have tended to neglect the media and have failed to reflect on the fact that the media have become a central and quite pervasive feature of social life. This tendency can be traced back to the classical social thinkers of the nineteenth century, such as Marx, Weber and Durkheim, whose writings were virtually silent on the question of the media and their role in the development of modem societies. ... One is left with the impression that, for most social theorists, the media are like the air we breathe: pervasive, taken for granted, yet rarely thought about as such" (Agrawal, 2007:25)

As a result of this reality, this research found only a few communication theories relevant to the subject of the thesis. In Particular, the study was based on the knowledge-gap hypothesis first proposed by Phillip J. Tichenor, George A. Donohue and Clarice N. Olien in 1970 and the media-system dependency theory, first introduced by Ball-Rokeach DeFleur in 1976. The theories are further interpreted in the context of the Schramm's model of communication whose relevance to human communication typical of mobile phone technology is well appreciated.

The knowledge-gap hypothesis suggests that each new medium increases the gap between the information rich and information poor, because of differences in access to the medium, and control over its use, among other factors. It is believed that the increase of information in society is not evenly acquired by every member of society: people with higher socioeconomic status tend to have better ability to acquire

information. This leads to a division of two groups: a group of better-educated people who know more about most things, and those with low education who know less (University of Twente, 2000: para. 1).

As the infusion of more information into a social system increases, segments of the population with higher socioeconomic status tend to acquire this information at a faster rate than the lower status segments, so that the gap in knowledge between these segments tends to increase rather than decrease leading to what is popularly known as the digital divide.

Inasmuch as this theory is quite applicable to the traditional media such as the radio, television and newspaper, it largely relates inversely to mobile phone. Instead, the use of mobile phones and associated services such as the internet, email, SMS and voicemails has the potential to bridge the digital divide and reduce the gap between the information haves and have-nots if used well. The proliferation of free public WiFi connectivity across various counties in Kenya and many other parts of the world has given users open access to the Internet with the exception of unlawful activities such as streaming or downloading offensive or copyrighted content (Malakata, 2015: para. 2). With such provisions on the increase, both the poor and the rich can equally use a mobile phone to gain spontaneous and unlimited access to much of the internet and other digital libraries, which were initially the preserve of the rich and privileged members of society mainly in urban areas. Even where the internet content is controlled through subscriptions like is the case in most parts of Africa, the subscriptions are much cheaper in the long term and more convenient than the acquisition of their printed surrogates thus making them a better alternative.

Furthermore, the growth of open access services across Africa and the world at large as attested to by Redhead, Claire (2014: para. 1), means that in future, mobile phone users

will have access to much of the available knowledge resources more freely and conveniently.

On the other hand, the television, radio and other traditional media have many intermediaries who control the communication process such that even when one has access to the collection of information they disseminate, the user has very little say over its content. In contrast and unlike other channels which also act as ephemeral transmitters of information, the mobile phone is a transmitter, a library as well as an archival repository and any information accessed today will possibly be still available in the future. This feature is very important in bridging the knowledge gap, which often thrives on lack of standard procedures and to a large extent, variations in knowledge banks as well as preservation, delivery and acquisition processes.

The Media-System Dependency theory postulates that the capacity of individuals to attain their goals is contingent upon the information resources of the media system. According to Baran and Davis (2010: 288), the theory assumes that the more a person depends on having his or her needs met by media use, the more important will be the role that media plays in the person's life, and subsequently its influence on the person. Patwardhan (2003:58) also supports this theory by stating that in today's society, individuals have to rely on media information resources in order to attain their various goals.

This theory explains why mobile phones have made rapid inroads especially among poor people predominantly living in rural and other marginalized areas of the world. As the technology continues to develop and become more affordable, poorer people and particularly those in rural areas will continue to rely on it as their most convenient mode of communication. The phones have also revolutionized such media as the internet, emails, voicemails, and SMS, which are being widely used for generating and sharing

new knowledge and information around the world as well as in the provision of basic services such as mobile banking.

According to an analysis contained in the Communication Theory (2014: para 9), one of the best examples when this theory came into practice was during the 2011 Tōhoku earthquake and the subsequent tsunami that took place in Japan. Due to this natural disaster the whole communication was blocked and people were unable to know the exact effect. As a result, people's information needs were dramatically increased and they were all more dependent on media than ever before. However, the application of this theory was deficient in the sense that it could not address the actual power, value and effect of media dependency on users and it was also difficult to prove scientifically or experimentally.

Very few other theories have attempted to explain the phenomenon of communication in the modern context. One such theory is the medium theory by two Canadians, Harold Adams Innis and Herbert Marshall McLuhan as discussed by Agrawal (2007:25). They adapted the principles of economic monopolies to the study of information monopolies.

Using these principals, Innis argues that one way in which social and political power is wielded is through control over communication media (such as a complex writing system controlled by a special class of priests). However, according to Agrawal (2007:25) information monopolies can be broken, by new media. Innis suggests that the medieval monopoly over religious information was broken by the printing press. And just like the printing press which bypassed the scribes and allowed for the wider availability of the scriptures and other religious texts, the mobile phone technology has gained wider access thereby bridging the information gaps that existed before between the rich and the poor.

All these theories of communication have a better perspective when put in the context of Wilbur Schramm model of communication which as Narula (2006:31) puts it, captures the concept of human communication fairly well. Whereas his predecessors focused a lot on communication as an element of another field of study, Schramm is credited with pioneering the study of communication as an independent discipline. According to Croft (2004:4), one of the major contributions Schramm made to the theories of communication was to consider the fields of experience of the sender and receiver. According to this, the encoding of messages by the sender is determined by his/her field of experience, while the receiver's field of experience guides decoding. If there is no commonality in the sender's and receiver's fields of experience, then communication does not take place. The extent to which the signal is correctly decoded depends on the extent of the overlap of the two fields.

The models as shown in Figure 4 below apply well to telephone communication whose effectiveness is highly dependent on these commonalities. This is because in most cases, the sender and the receiver lack the visual advantage of enriching the communication process with non-verbal enhancements.

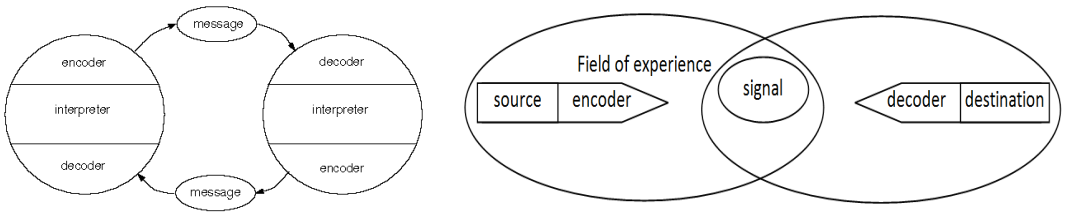

Figure 4: Schramm's Models of Communication according to Croft (2004:4)

However, the Schramm models are deficient in two ways. First, telephone communication is not exclusively a social affair. By insisting on the common field of experience between the sender and the receiver, the models make that assumption as they leave out completely the commonalities required in the mechanical contexts of

communication. Furthermore, communication is neither a static nor linear phenomenon. It is a cyclic process with both the sender and the receiver simultaneously playing alternate roles throughout.

2.3 Conceptual Framework

Mobile phone technology is a relatively new phenomenon. Its coverage in the traditional theories and models of communication is still not very exhaustive. The theories and models focus heavily on general principles, which have failed to harmonise the relationship between the human and mechanical aspects of communication.

This study was therefore based on the conceptual model derived from the media-system dependency theory, and the knowledge-gap hypothesis theory both viewed in the context of Schramm's model of communication.

Whereas the media-system dependency theory emphasises the reliance of people on media to achieve their goals, the media too must also depend on the people to reach its targets. This means that the starting point of any communication process should be the establishment of the need to communicate from the receiver's context. As already demonstrated by Scott (2004, ii) mobile phone service providers have continued to ignore rural areas when rolling out their services. To change this scenario, the service providers must conduct rigorous needs assessments to enable them provide services that are responsive to the requirements of clients.

On the other hand, the assumption of the knowledge-gap hypothesis theory that each new medium increases the gap between the information rich and information poor is too generic. A closer look at the mobile phone technology and as attested to by Agrawal (2007:25) for instance, shows that the gap is not automatic and that it all depends on

how the media is managed and used. The rapid diffusion of mobile phone technology in rural areas implies that the technology has been well received by rural communities much more than the traditional channels of communication and if properly managed, it could bridge rather than widen the gap between the information rich and poor.

In the context of Schramm's model, it is worth noting that communication is a means of equalising knowledge levels and is highly dependent on the relationship between the sender and the receiver. However, what Schramm refers to as the common field of experience fits well only in human contexts of communication. To give the model wider application both in human and mechanical contexts, an area of communicative commonalities is introduced instead. The sender and receiver must not only share some common field of experience to help them understand each other but the respective environments must technically enjoy some parity and compatibility in terms of systems and services. For instance, no matter how capacitated the mobile phone installations are on one side of the line, there can be no effective communication until the other side is brought to a similar level.

In a nutshell, therefore, the conceptual model advances the idea that all communicative areas whether rich or poor, rural or urban must be indiscriminately facilitated for the effectiveness of communication. Figure 5 puts this conceptual model into perspective.

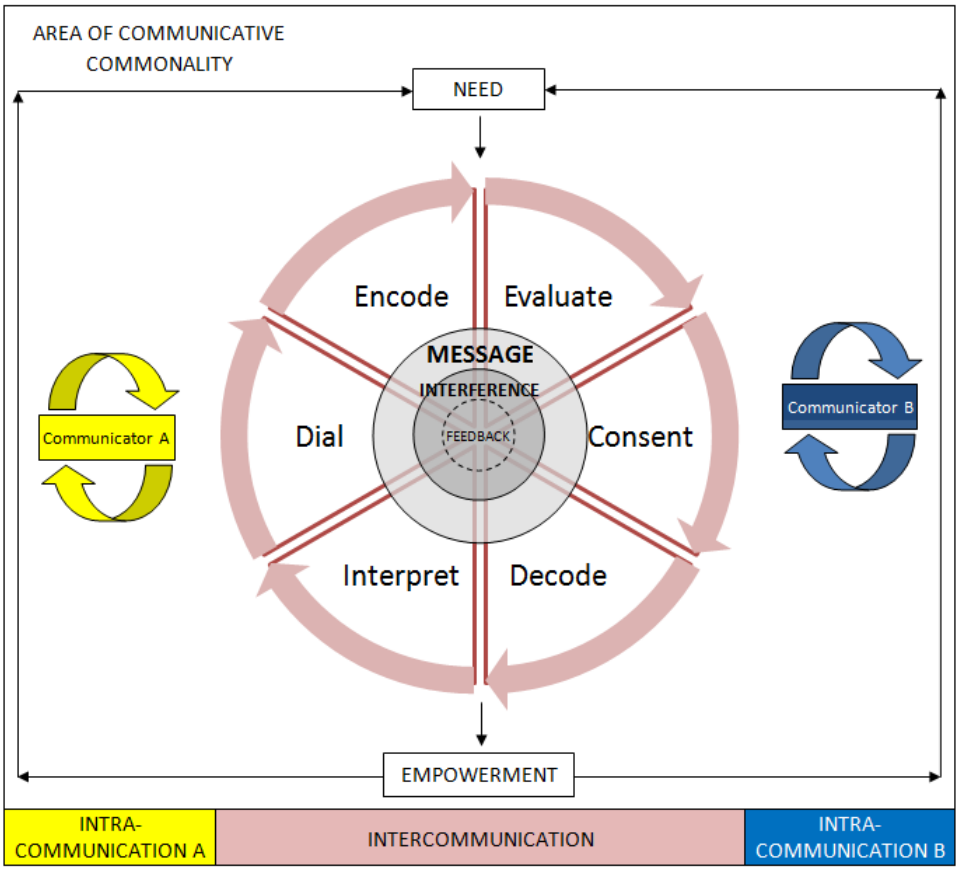

Figure 5: Conceptual model of communication adapted from Schramm Model of Communication

In the foregoing figure, communication is surrounded by an environment of communicative commonality where the communicators are on an even and compatible medium or platform to exchange messages as well as a common objective to bridge pre-existing gaps between them. The process, therefore, starts with the need to exchange some message. The communicators must always confirm this need before initiating any communication to make sure that the message is required and stands a chance of being received. Any communication process leads to some form of empowerment which increases the capacity and ability to communicate even more.

Lack of compatibility between communicators can be a major barrier to communication as the messages cannot be received and interpreted effectively. The schema imitates a gyroscope by providing moving forces in two different planes thus, the inter and the intra communication planes. Because communicators must possess

some degree of intelligence whether natural or artificial, communication takes place in the intra-communication plane within the communicators and in the intercommunication plane between the communicators. The effectiveness of intra-communication will greatly determine the effectiveness of the intercommunication.

One unique feature of this framework is the use of communicator A and B who could be either individual or group entities instead of the sender and receiver concepts respectively. This implies the equal and complementary roles played by both entities in the communication process rather that the active sender and the passive receiver relationship implied in the traditional models of communication.

In addition, the actual communication process takes a cyclical rather than a linear form. This begins with the communicator A dialling communicator B. The dialling may take any form that involves seeking attention by alerting communicator B to prepare to receive some message. Communicator B gives consent by for instance picking the handset and allowing communicator A to start encoding the message which is appropriately decoded by communicator B. Depending on the feedback which is inbuilt at the centre and featuring throughout the communication process, Communicator A further qualifies the message to encourage communicator B to interpret it correctly. This may practically happen through verification, amplification, repetition, clarification and any other form of value addition that aids communicator B to understand and interpret the message. At this point, the first phase of the process ends as communicator A (sender) becomes communicator B (receiver) and vice versa. Communication goes on until there is an internal or external force to compel it otherwise. This may include a natural equilibrium where communicator A has no more

to send or communicator B is completely saturated and cannot receive any more information.

It should also be noted that the message which could take the form of data, information and knowledge occupies a central position in the model. Interference which is synonymously referred to as noise in classical models is part of the message and refers to anything that negatively affects its being transmitted. Interference must always be less than the message or else it will not be heard by the other communicator. According to Devito (2009) interference could be physical, physiological, psychological or semantic.

One other unique thing about the model is that feedback is not isolated as a separate and distinct entity but embodied in the whole process of communication. This is because it is inherent and occurring in all the stages of communication shown by the inward pointers. It should be noted that the model shows that even though the roles of the entities in communication are alternate, they are interchangeable, simultaneous and complementary.

The foregoing proposed framework accommodates modern telecommunication better as it captures the ease, spontaneity, simultaneity and empowerment aspects found in mobile phone communication. It also captures both the human and mechanical aspects of communication as well as the parity and complementation of communicators that is associated with mobile phones. The equal and complementary role played by communicator A and communicator B signifies the need to give equal emphasis on both. This implies that a good communication signal from the sender going to a receiver with a poor reception is counterproductive. It further corroborates the need for mobile phone providers to indiscriminately invest their best technology in both urban and rural areas as both randomly and alternately play the roles of sender and receiver.

By capturing the modern aspects of telephone communication, the framework also puts into perspective the objectives of this study. As already pointed out, some of the most important aspects of mobile phone technology as captured in objectives one and two are ease, spontaneity and simultaneity of use as well as empowerment. These aspects are all represented in the framework. In addition, factors affecting access, development and use of mobile phone technology in objective three are captured in the message, feedback and interference. In essence, interference provides the much needed challenge to the whole process of advancing the mobile phone technology such that every new mobile phone model, technology and service strives to maximise communication by minimising interference as much as possible.

The fifth objective that sought to evaluate the untapped potential of mobile phone technology to spur higher levels of information sharing has been captured in the empowerment aspect of the framework. When people communicate more efficiently by virtue of mobile phones, they become more knowledgeable and ultimately empowered to generate the nececity for innovation and productivity.

2.4 The Growth of Mobile Phone Technology

In line with the second objective of the study which sought to examine current trends in the development and use of mobile phone technology the growth of the technology can be viewed from two perspectives thus, the international viewpoint which comprise Africa and the rest of the world as well as a national perspective which looks at the growth of the mobile phone technology in Kenya.

2.4.1 The Global Perspective

The global history of telecommunication began with the use of smoke signals and drums in Africa, as well as other parts of the world. In the 1790s the first fixed

semaphore system emerged in Europe; but it was not until the 1830s that electrical telecommunication system came into operation (Waburi, 2009: 10). In 1792, a French engineer, Claude Chappe built the first visual telegraphy (or semaphore) system between Lille and Paris. This was followed by a line from Strasbourg to Paris. In 1794 a Swedish engineer - Abraham Edelcrantz built a different system from Stockholm to Drottningholm using shutters as opposed to Chappe's system which involved pulleys rotating beams of wood. However the semaphore system suffered from the lack of skilled manpower and high operational expenses resulting in the closure of the service in 1880.

Now, many people around the world use mobile phones and it is hard to believe that more than eighteen years ago they were a rarity. These gadgets have enabled virtually everyone to talk to anyone on the planet from anywhere. Nowadays, mobile phones provide a large collection of functions, and new ones are being added at a fast pace. Depending on the mobile phone model, one can do many things such as: store information; make task or to-do lists; keep track of appointments and set reminders; use the built-in calculator for simple math. One may also send or receive e-mail; get information (news, entertainment, stock quotes) from the Internet; play games; watch TV; send text messages; integrate other devices such as MP3 players. But how does a mobile phone operation differ from an ordinary phone?

A mobile phone is simply a sophisticated radio (Brain *et al,* 2011: para. 3). It all started with the invention of the traditional telephone by Alexander Graham Bell in 1876. This was followed by wireless communication which is the mainstay of mobile phone technology that traces its roots to the invention of the radio by Nikolai Tesla in the 1880s (formally presented in 1894 by a young Italian named Guglielmo Marconi). Mobile phone technology developed from a combination of both inventions.

Dr. Mahlon Loomis of Virginia, a dentist, is credited for being the first person to communicate through wireless via the atmosphere in 1865 (Cellphones.org 2008: para. 3). Between 1866 and 1873 he transmitted telegraphic messages at a distance of 18 miles between the tops of Cohocton and Beorse Deer Mountains, Virginia. On the other hand, Ring (2004:1) claims that the first Radio-Phone hookup as it was earlier called begun in Colorado.

A number of scholars consider Dr Martin Cooper, the former general manager for the systems division at Motorola to be the inventor of the first portable handset weighing around 1 kg in 1973 (ArrayComm, 2014: para. 1). Bellis (2014) considers Dr Cooper to be the first person to make a call on a portable cellular phone to his rival, Joel Engel, Bell Labs head of research. Bell Laboratories introduced the idea of cellular communications in 1947 with the police car technology. However, Motorola was the first to incorporate the technology into portable device designed for outside of automobile use.

In the twenty years from 1990 to 2010, worldwide mobile phone subscriptions grew from 12.4 million to over 4.6 billion, penetrating the developing world and reaching the bottom of the economic pyramid. A good way to understand the sophistication of a mobile phone is to compare it to a walkie-talkie. Brain *et al* (2011, para. 8) infers that the walkie-talkies are half-duplex devices meaning that two people communicating use the same frequency, so only one person can talk at a time. A mobile phone is a full-duplex device. One uses one frequency for talking and a separate frequency for listening. Both people on the call can talk at once. Besides a walkie-talkie typically has one channel, but a mobile phone can communicate on 1,664 channels or more. On the other hand a walkie-talkie can transmit about 1 mile (1.6 km) using a 0.25-watt transmitter while mobile phones operate within cells, and they can switch cells as they

move around. Cells give mobile phones incredible range. Someone using a mobile phone can drive hundreds of miles and maintain a conversation the entire time because of the cellular approach. Each cell is typically sized at about 10 square miles (26 square kilometres). Cells are normally thought of as hexagons on a big hexagonal grid. Because mobile phones and base stations use low-power transmitters, the same frequencies can be reused in non-adjacent cells. Digital mobile phones are the second generation (2G) of cellular technology. They use the same radio technology as analogue phones, but they use it in a different way. This is the reason why many cable companies are switching to digital so they can fit more channels within a given bandwidth (Bhatti & Mohiuddin, 2013: para 8). Digital phones convert voice into binary information and then compress it. This compression allows between three and 10 digital mobile - phone calls to occupy the space of a single analogue call making them more efficient.

Although the 4th Generation (4G) technology is making inroads into the country according to Standard Media Group (2014: para 1), 3G is still regarded as the latest in mobile communications in Kenya. The 3G technology is intended for the true multimedia mobile phone - typically called smartphones. Its features include increased bandwidth and transfer rates to accommodate Web-based applications and phone-based audio and video files.

3G networks have potential transfer speeds of up to 3 Mbps. For comparison, it is estimated that the fastest 2G phones can achieve up to 144Kbps while 3G's high data rates are ideal for downloading information from the Internet and sending and receiving large, multimedia files. Phones with 3G capacity are like mini-laptops and can accommodate broadband applications like video conferencing, receiving streaming video from the Web, sending and receiving faxes and instantly downloading e-mail

messages with attachments.

2.4.2 The growth of mobile phone industry in Kenya

In Kenya, the history of telecommunication can be traced back to 1888 when submarine cables linking Zanzibar, Mombasa, and Dar es Salaam were laid by the Eastern & South African Telegraph Company to connect the country to the outside world. According to Tyler, et al (2002:1) the internal construction of a telegraph network began with a 200-mile coastal line linking the port city of Mombasa with Lamu. Expansion of the network into the mainland of the country began in 1896 which was done parallel with the building of the railway system, forming a dual "backbone" for Kenya's communications infrastructure. However, the telegraph line overtook railway construction, reaching Nairobi in 1898 and Kampala and Entebbe in Uganda in 1900. In 1908, the public telephone network rolled out services in Nairobi and Mombasa.

Tyler, et al (2002:1) argues that evolution of the institutional structure of Kenya's telecommunications was shaped by East Africa's political developments. During the 1920s and 1930s, the British colonial administrations in Kenya, Uganda, and the then Tanganyika, became closely linked. By 1933, the postal and telegraph services of the three countries had been fully merged with a single postmaster general to oversee their postal and telecommunications services. The joint operation continued until 1977, when the East African Community (EAC) collapsed and a separate Kenya Posts & Telecommunications Corporation (KP&TC) was established.

On the other hand, Kenya's international telecommunications services have a rather distinct history. In the colonial era, just like in other British colonies, the services were operated by the Cable and Wireless Company. However, in 1964, control of these services passed to the newly formed East African External Telecommunications

Company Limited (EXTELCOMS), jointly owned by the Government of Kenya (GoK) and Cable & Wireless. This continued as a joint venture until 1974 when KP&TC purchased the 40% share owned by Cable & Wireless and renamed the company KENEXTEL. In 1982, KENEXTEL was merged with KP&TC, which was now responsible for both national and international telecommunications (Okundi *et al*:1977).

Despite the collapse of the EAC, other forms of international cooperation took root as a result of Kenya being an active member of the International Telecommunication Union (ITU). In 1981, Kenya completed in time its national component of the ITU's PANAFTEL program, which involved the interconnection of African countries' national networks using new or extended microwave transmission routes. Kenya's PANAFTEL links were financed jointly by the World Bank and KP&TC. In 1994, KP&TC joined the Regional African Satellite Communications System (RASCOM), which had the goal of launching a dedicated African satellite system. KP&TC was also active in regional training programs, and Kenyan telecommunications specialists had played a major role in the international exchange of ideas over telecommunications planning and policy (Okundi *et al*: 1977).

Kenya became a member of the INTELSAT global satellite communications consortium in 1968, with EXTELCOMS (and subsequently KENEXTEL and ultimately KP&TC) which had the responsibility to operate earth stations to access INTELSAT's satellites. The first major earth station came into operation at Longonot in 1970. Regarding inland Telephone Network, Kenya was still in 1993, very weak with only 184,583 working exchange lines in use. However, Kenya's extensive rural network continued to grow rapidly. In many rural districts, telephone service was based on manual exchanges for a long time. Nevertheless, despite generous investments in

new automatic switches for rural areas, the number of manual exchanges in Kenya rose from 269 in 1983 to 338 in 1991. Later, a program was put in place to replace these exchanges with low-cost, small capacity digital switches.

In 1993, telephone penetration was higher in Kenya than in neighbouring Tanzania and Uganda, but was 65% lower than the penetration level in Botswana and 38% lower than that of Zimbabwe. In 1993, there were 426,000 telephone sets connected to the public network in Kenya, yielding a density of about 1.58 telephones per one hundred inhabitants. In 1992, 61% of Kenya's 126,539 exchange lines were business lines. Since 1983, the number of business exchange lines grew at an annual rate of 10 percent. In contrast, residential lines grew 7% annually between 1983 and 1992, reflecting the increasing telecommunications demand by the self-employed and home-based small businesses, the high demand for residential service, and the efforts made to clear a long waiting list. In 1991, the waiting list for residential lines (59,000) in Kenya was reported to be twice as high as for business lines (26,000) (Tyler *et al*, 2002:1).

The successive history of Kenya's network has been one of gradual but continued expansion. By 1980, there were 73,932 direct exchange lines (DELs) in use in the public telephone network; just over 84% were connected to automatic switching equipment and 75% had direct long-distance dialing or Subscriber Trunk Dialing (STD) capability. There were 1,228 telex lines and 50 leased data transmission circuits in use. The network of 1980 represented a firm basis for future expansion even though it had a lot of shortcomings. These included long queues and malfunctioning telephones which frustrated and wasted time on both residential and business payphone users.

Economic research in several countries has shown that many residential and business customers placed high economic value on payphone communications, were willing to pay for the service at a level at which the telephone operator could make a profit, but

were prevented from doing so by their country's low level investment. Thus, a properly implemented public telephone program can achieve high utilization, high profitability, and large social benefits. This potential is part of the reason behind the success story of mobile phone investment in Kenya and Africa at large (Tyler *et al*, 2002:1).

Despite the long history of telecommunication in Kenya, mobile phone industry in the country started with the entry of Safaricom, which begun as a department of Kenya Posts & Telecommunications Corporation, the former monopoly operator. It launched operations in 1993 based on an analogue ETACS network and was upgraded to GSM in 1996 with the license being awarded in 1999. Safaricom Limited was incorporated on 3 April 1997 under the Companies Act as a private limited liability company and was converted into a public company with limited liability on 16 May 2002. By virtue of the 60% shareholding held by the Government of Kenya (GoK), Safaricom was a state corporation within the ambit of the State Corporations Act (Chapter 446) Laws of Kenya, which defines a state corporation to include a company incorporated under the Companies Act which is owned or controlled by the Government or a state corporation (Safaricom, 2014:para. 1).

Until 20 December 2007, the GoK shares were held by Telkom Kenya Limited ("TKL"), which was a state corporation under the Act. The entry of Safaricom was quickly followed by that of Kencell in 1999 which has since changed hands and names to Celltel, Zain and eventually Airtel. The third and fourth companies were Orange Mobile and Essar Telecom Kenya Limited (yuMobile). They entered into the Kenyan market nearly ten years later in 2007 and 2010 respectively.

There have been efforts to completely privatize the mobile phone industry in the country following the offer and sale of 25% of the issued shares in Safaricom held by the GoK to the public in March 2008. In so doing, the GoK ceased to have a controlling

interest in Safaricom under the State Corporations Act and therefore the provisions of the State Corporations Act no longer apply to it. Compared to the fixed telephone connections, the growth of mobile phone subscription has been momentous as shown in Table 1 below.

Table 1: Growth of telecommunication sector in Kenya

Year	Mobile Phone Subscriptions	Fixed Phone Connections
1998/1999	10,000	290,000
1999/2000	23,757	296,400
2000/2001	340,731	321,482
2001/2002	944,128	328,116
2002/2003	1,590,286	328,358
2003/2004	2,546,157	299,225
2004/2005	4,611,970	278,867
2005/2006	6,484,791	293,364
2006/2007	9,304,818	263,122
2007/2008	12,933,653	527,064
2008/2009	17,362,257	696,501
2009/2010	20,119,304	460,114
2010/2011	25,279,768	379,301
2011/2012	29,703,439	262,761
2012/2013	30,549,422	216,469

Source: Compiled from Communications Commission of Kenya Annual Reports (1998-2013)

According to the foregoing table, the growth of mobile phone industry in the country outstripped that of the fixed line connections between 2000 and 2001 and has continued to outpace it by a very wide margin. This is an indication of the promising future of the mobile phone technology and a measure of its potential to turn around the lives of rural communities.

2.5 Penetration of Mobile Phone Technology in Rural Kenya

It is not long ago that the mobile phone was an unfamiliar item for the many people in rural Kenya. In less than a decade this has changed completely. In the beginning the mobile phone was considered as a luxury item but now more people than ever before own it. The phone has become very important for all people and it has turned to be a necessity especially in the rural areas as the number of subscribers is increasing tremendously. Eriksson (2008:2) argues that the arrival has turned out to be such an amazing transition happening since most people in the beginning did not reckon its capacity to gradually become a lifestyle choice. It has certainly changed the way people communicate and is becoming a natural necessity for the people of Kenya. This can be seen from the number of mobile phone units sold in the past years. Most recently, the mobile phones in Kenya have grown from 78% (30.7 million subscribers) in December 2012 to 80.5% (37 million subscribers) by September 2014. (Communications Authority of Kenya (2014:8).

While also acknowledging the revolutionary growth of mobile phones in the rural setups in Kenya, Arunga et al (2006:1) affirms that the phones have completely changed the way people communicate. He declares that, "the gadget once considered for the rich businessmen and tourists is now affordable to everyone".

In a qualitative research on *Cell Phone Use by People in Rural Kenya*, Eriksson (2008:2) observes that ever since the mobile phone technology made inroads into the rural areas, many people in Kenya have resorted to use the short messaging service (SMS) as the most cost effective way of communication given the high poverty levels in the settings. Furthermore, the M-Pesa function which enables users to make money transactions is also widely used since most people in these areas do not have a bank account. The mobile phone has literally "transformed the job market and has had a

tremendous impact on running a business and made it easier to be available when looking for jobs".

It is also widely believed that the advent of mobile phone technology has had a big impact on the way the rural population in Kenya conduct their businesses. In a study entitled *Mobile Phones Usage in Rural Kenya for Business: A Survey Study in Machakos District*, Wanjiku (2010:1) observes that mobile phones were not only the most popular form of ICT among the poor but were also supporting small scale business and peasant farmers in marketing and selling of their products thereby increasing the income levels of the rural community. "Mobile phone as an ICT tool is supporting the rural communities especially the women to get more customers and carry out business transactions effectively.

In the study, 88% of the women interviewed said that mobile phones increase business income and make it easier to carry out business in the rural areas, while 91% of the men interviewed said that the mobile phones were supporting rural people in Kenya to carry out business easily and they improve levels of income among the rural people. Noting that the mobile phone has been well received and is perceived as a tool that will enhance development the study recommends that it should be exploited to continue transforming the rural areas Wanjiku (2010:1).

On the other hand, Eriksson (2008:2) concludes his study by attesting to the fact that the mobile phone has brought practical, social and economical change and is contributing to be a cultural enhancement. There is however future needs as to solve the many problems experienced by the rural poor who lack basic amenities like electricity. For this reason, he notes that battery charging is a main problem that rural inhabitants have to deal with. The study shows that the penetration of the mobile phones in rural Kenya

is of great success. The mobile phone is a technology to bridge the gap between cities and rural areas in Kenya.

2.6 Current Trends in mobile phone technology

The growth of the mobile phone industry especially in the recent past has been phenomenal. According to MobiThinking (2011: para. 1), in 2010, there were 5.3 billion mobile subscribers (77 percent of the world population). The growth was led by China followed by India. Mobile devices sales rose with smartphones showing strongest growth and Nokia remained the most popular brand with a market share of 36.4 % followed by Samsung (19.5 %), LG (10.1%), Motorola (4.8 %) and Sony Ericsson (4.5%), Android was expected to become the top operating system for new smartphones. The top mobile network operator for subscribers and revenues is China Mobile (Tippin, 2010: para. 16).

Five Hundred Million people accessed mobile Internet worldwide in 2009 and the usage is expected to double by the end of 2015 as mobile overtakes the PC as the most popular way to get on the Web. Just in China there were 277 million mobile Web users. However, many mobile Web users are mobile-only, that is, they do not, or very rarely use a computer or tablet to access the Web. Even in the US with all its advancements in technology, 25 percent of mobile Web users are mobile-only (Maranda, 2014: para. 7). It has been estimated that over 85 percent of new handsets are able to access the mobile Web especially in US and W. Europe. Lots of new handsets support 3rd generation and nearly one in five global mobile subscribers have access to fast mobile Internet. In addition, the widespread availability of unlimited data plans have driven mobile media in Japan and the US but in W. Europe, lack of availability is holding up progress.

In 2011, Digital Buzz compiled statistics on the worldwide use of mobile phones and

concluded as follows:

> "Microsoft Tag has just released a neat infographic highlighting statistics on how people are using mobile phones in 2011... The infographic shows that over 1 billion of the world's 4+ billion mobiles phones are now smartphones, and 3 billion are SMS enabled (weirdly, 950 million mobile phones still don't have SMS capabilities). In 2014, mobile internet usage will overtake desktop internet usage and already in 2011, more than 50% of all "local" searches are done from a mobile device. 86% of mobile users are watching TV while using a mobile phone, 200+ million (1/3 of all users) access Facebook from a mobile device and 91% of all mobile internet use is "social" related" (Digital Buzz, 2011: para. 1).

Webster (2006:3) also acknowledges the displacement of the traditional media with the mobile phone in the provision of efficient information services especially during emergencies. Graphically, the future of mobile phone telephony looks good with numerous projections like the one in Figure 6 showing how it is likely to overtake other technologies like the internet desktop.

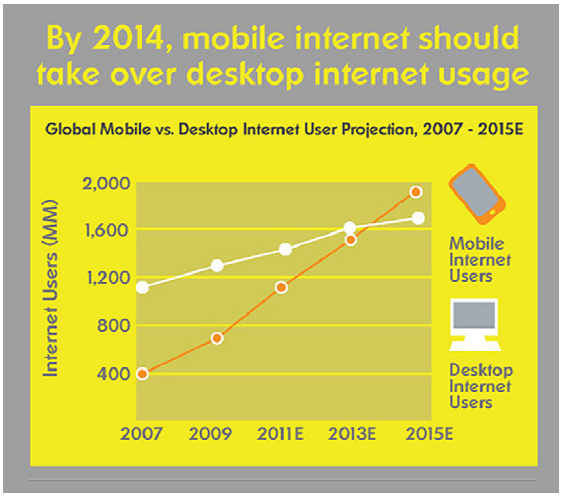

Figure 6: Projections of Mobile Internet Growth
Source: Digital Buzz (2011: para. 5)

The following statistics analyzed by MobiThinking (2012) also show that SMS is the king of mobile messaging as 7.8 trillion text messages were sent in 2011. But consumers are also embracing mobile email, Instant Messaging (IM) and Media Messaging Service (MMS) rapidly. It is also projected that application to person SMS (A2P) such as automated alerts from banks, offers from retailers, m-tickets is expected

to overtake person to person SMS by 2016.

Globally, it is predicted that mobile ad spending will skyrocket from US$3.3 billion in 2011 to $20.6 billion in 2015, driven by search ads and local ads. In the US over half of U.S. mobile ad spending is local while in Asia, Japan particularly continues to dominate global mobile ad spending. Google, with US$1 billion in annual mobile ad revenues is regarded the main recipient of mobile ad spend in the world. Statistics also show that different countries continue to respond differently to mobile marketing. For instance, in the UK and France opt-in SMS gets the best results while in Germany mobile Web ads get the best results. Available data also show that in terms of consumer behaviour, Japanese consumers are still the most advanced, using mobile Web, apps and email more, but US and Europeans text and play more games. Most popular mobile destinations are news and information, weather reports, social networking, search and maps. In all countries surveyed more consumers used their browser than apps and only a minority will use Web or apps exclusively. US consumers prefer mobile browsers for banking, travel, shopping, local information, news, video, sports and blogs and prefer apps for games, social media, maps and music. On the other hand, mobile searches have quadrupled in the last year, for many items one in seven searches are now mobile (MobiThinking 2012).

Although over 300,000 mobile apps have been developed in three years and downloaded 10.9 billion times, its demand is expected to peak in 2013. The most used mobile apps are games; news; maps; social networking and music Facebook, Google Maps and weather channels. Statistics show that there are more than 250 million active users with 50 percent currently accessing Facebook through their mobile devices and by the fact that on average these people are twice as active on Facebook as non-mobile users. These trends are augmented by the fact that the price of a mobile app is falling

rapidly on all vendor app stores, except Android. And 1 in 4 mobile apps once downloaded are never used again. Projections from current trends show that mobile payments will be worth US$240 billion in 2011 and could be over US$1 trillion by 2015. Purchasing digital goods is the largest segment ahead of physical goods, near-field communications (NFC), m-banking and money transfer. The biggest market today is Japan, but in the future could be China. Japan sets the precedent for m-payment with 47 million Japanese having adopted tap-and-go phones, but this trend is expected to take off elsewhere as the world adopts NFC. In China alone, there will be 169 million users of tap-and-go payments in 2013(MobiThinking 2012).

The role of the mobile phone in commerce cannot be taken for granted. M-commerce is predicted to reach US$119 billion in 2015, with Japan leading the pack. Top m-commerce retailers globally include: Taobao, Amazon and eBay. According to Digital Buzz, (2011: para. 1) consumers bought and sold over US$2 billion worth of merchandise via mobile in 2010 on eBay alone. The US m-commerce market will be US$31 billion by 2016. As a result, one in 8 mobile subscribers will use m-ticketing in 2015 for airline, rail and bus travel, festivals, cinemas and sports events. Other estimates also show that between 500 million and 1 billion people will access financial services by mobile by 2015. The MFS market will be dominated by Asian countries, driven by mobile operator-led initiatives in developing nations to bank the unbanked. Remittance/transfers by mobile are already growing three times faster than m-banking.

2.7 The Value of Mobile Phone Technology

The benefits of cell phones far outweigh the challenges associated with them. Given the solutions they provide for common problems or opportunities they create to make life easier. Most rural communities in Kenya are located far away from urban areas which enjoy better communication infrastructure. Before the advent of mobile phones, it was

necessary to make long trips to urban centres to make or receive phone calls thus spending huge sums of money. The most fundamental benefit of mobile phones, therefore, is its ability to keep people connected in any part of the world, anytime (Tech Acid, 2011: para. 1). With mobile phone technology, one can talk to loved ones living many miles away.

The use of SMS for instance has revolutionized the way we communicate nowadays. When the SMS was initially invented, it was not definite that it would work. The premise was that if people could make a call and talk, then why would anybody like to take the trouble of typing a message! But today the SMS has become one of the most widely used service across the world and particularly in impoverished communities mostly because of its affordability and reliability. There are many situations in which a person may not attend to a call thus necessitating the use of SMS.

Mobile phones have also become handy in getting people out of emergencies such as sickness or having a car break down in the middle of nowhere. One can contact help with the use of mobile phone easily. Besides, the gadgets can be used for navigation purposes in case one is stranded or lost. Mobile phones are constantly being upgraded with new technology and the recent phones are equipped with navigation and GPRS systems giving details of one's destination.

In rural areas with limited amenities such as electricity, computers are a rarity. In such environments, mobile phones are now being used as mini PCs. The latest ones are equipped with major operating systems and internet facilities. Instead of waiting for a newspaper, or living without one at all, one can simply access the internet on the mobile phone and get to know about the latest news, access e-mails, movie shows and more.

With the coming of mobile money popularly known as M-Pesa in Kenya, the mobile

phone technology has largely enhanced the way people transact and conduct businesses. One can promptly pay and constantly stay in touch with employees and get to know about crucial information of their businesses. In addition, mobile phone technology is widely being used for security reasons and provision of help in legal matters. It can be appreciated that many criminals are nowadays being tracked and apprehended by use of GPS technology on mobile phones. Also checking a mobile phone's call records gives important information to security agents about criminals (Freedom House, 2013:3).

Mobile phones are also largely being used for entertainment. One can play games, listen to music, and click pictures and even record videos. For instance, the partnership between Multichoice and mobile phone service providers in Kenya has enabled people with TV-enabled phones especially in rural areas to watch DSTV programmes including the popular English Premier League soccer matches on their phones.

Unlike in the past, it has become a lot easier to transfer data from one device to another through the mobile phone technology. Nowadays, mobile phones are equipped with infrared, Bluetooth and Wi-Fi technologies which allow networking and transfer of data from emails, pictures, music and even videos just in a span of seconds.

Lastly, mobile phones have also become objects of prestige, fashion and equality especially among the youth and poor communities. Whereas phones were once associated with the rich in urban centres, they have become commonplace among all generations and classes of people as well as being used in a myriad of ways as documented in a number reports. For instance, according to Freedom House (2013:3) the International Telecommunications Union (ITU), reports that by end of 2012, Kenya's mobile data and internet subscriptions stood at 8.5 million as of December 2012, with an estimated 17.4 million users, while 34 percent of the population accessed

the internet via mobile phones. However, even though, the CCK (2013:6) reports a decline in mobile telephony penetration between December 2012 and March 2013 from 78% (30.7 million subscribers) to 75.8% (29.8 million) the overall trends were positive. Furthermore, the decline was only temporary as a result of an estimated 2.4 million unregistered SIM cards which were switched-off during the SIM card registration exercise carried out during that period.

2.8 Mobile technology and Empowerment

The development of the mobile phone technology has greatly unlocked the potential of people to live better lives. In the report *Mobile Technologies and Empowerment: Enhancing human development through participation and innovation*, UNDP (2012:56) acknowledges that the mobile technology has opened new channels of communication between people and governments and potentially offering greater access to public information and basic services to both individuals and communities. This phenomenal achievement has partly been caused by the fact that mobile technologies offer portable, real-time communication and information access for people who previously had little to no access to affordable communication channels. Mobiles have relatively low physical infrastructure requirements and can reach remote areas in a more cost-effective fashion than the traditional ICTs such as fixed phone lines. In some places, mobile devices are the only option available. The mobile phone technology also require only basic literacy, making the barriers to entry much lower than with other modern ICTs.

UNDP (2012:19) indicates how mobile technologies are starting to have an indelible impact on human development, enhancing democratic governance and other development areas such as health, education, agriculture, employment, crisis

prevention and the environment. For instance, studies have suggested that increased mobile ownership is linked to higher economic growth (Vodafone 2005; Vodafone and ICRIER 2009). It is also likely to have twice as large an impact on economic growth in developing countries as in developed ones because the starting point of infrastructure in poorer countries is so much lower in terms of landlines and broadband access. Leapfrogging of traditional infrastructure requirements such as landlines is possible in low-income countries as mobile technologies have lower investment costs. Other benefits include increased telecom-based tax revenues, greater employment opportunities, and overall increased productivity, not to mention a thriving telecom industry that attracts foreign direct investment.

Within governance, mobile technologies can offer new means for empowering citizens and stakeholders by opening and enhancing democratic processes and mechanisms. M-governance initiatives that expand access to information and communications channels are creating new venues for people's participation and giving new voice to those who have historically been marginalized. What was once in the domain of official or large private, corporate media channels is now in the hands of anyone with a mobile or an Internet connection - flattening information and broadening the distribution of that information. This in turn can support wider stakeholder mobilization within a much shorter period of time, as witnessed during the so-called Arab spring of 2011 and other political mobilizations happening around the world today.

According to Zambrano and Seward (2012: 9), the simplicity of new mobile platforms requiring only a basic mobile phone with SMS capacity has allowed their adoption all over the world - from South Africa, to India, to Mexico - to monitor elections, track violence and crime, provide logistical support in natural disasters, and oversee inventories. They have become an important tool for civil society, enabling local

mobilization and networking among geographically dispersed people. Mobile technologies are also strengthening the demand side of governance by providing people with critical tools to engage with public institutions and demand more and better services. This fosters broader transparency and social accountability. Enhancing service delivery and reform within important governing institutions — from public administrations to parliaments to systems of justice — generates new possibilities for open government. The technologies enable citizens to bypass intermediaries who may take money for facilitating transactions, making service delivery more efficient and transparent.

Significantly for poor people and rural development, mobile technologies can help reduce information gaps and restrictions inherent in marketplaces where consumers and producers have little means of comparing commodity prices between distant markets thus making life more affordable. Mobiles also offer greater independence for women by opening new channels of information and affording greater personal privacy. Mobile phones also offer women greater security, not only as emergency tools, but also to report and monitor violence against women (Zambrano and Seward, 2012: 9).

Mobile applications are also being used to combat poverty by expanding service delivery possibilities in health care, agriculture, employment and education. In the health sector, there have been many pioneering mobile initiatives improving connectivity and information transmission in areas that are hard to access.

As emergency response tools, mobile technologies have helped establish networks of communication between citizens, organizations and government agencies in times of crises. According to UNDP (2012:33), mobile phones are also being used to educate and keep citizens and vulnerable stakeholders abreast of environmental and

energy-related issues, including weather patterns, climate change and responsible environmental stewardship. Mobile phones are catalytic tools for enhancing and broadening development programming. They open new channels for connecting the poor to services, new ways for citizens to have their voices heard, and new opportunities for civic engagement in larger governance processes. They are also offering marginalized people new ways to leverage their resources to enter the marketplace and demand public services.

2.9 Problems associated with mobile phones

Like all consumer electronics, mobile phones come with their share of problems. Kinder (2003: para. 25) attributes one of the typical problems to the non-repairable internal corrosion of parts which results if one gets the phone wet or use wet hands to push the buttons. This is a major problem in rural areas, which lack the technical expertise to handle this kind of problem.

Another problem is extreme heat which usually damages the battery or the phone electronics. Extreme cold on the other hand may cause a momentary loss of the screen display. Quite often, analogue mobile phones suffer from cloning where someone steals its ID numbers and is able to make fraudulent communication on the owner's account.

However, despite of all these negative aspects, mobile phones are depended upon by many people. Nowadays, they are used for many reasons including storing contact information, planning and scheduling of events, keeping track of appointments and set reminders, using the built-in calculator for simple math and sending or receiving e-mails. They are also used for getting information (news, entertainment, stock quotes) from the Internet, playing games, watching TV, sending text messages and setting clocks, alarms and reminders.

2.10 Emerging issues in mobile phone technology

As the majority of African's population enjoy their clutch to mobile phones to stay connected with loved ones, conduct business matters with ease, and derive maximum benefits from cheap telephony, there are ominous signs that this celebratory mood has turned out to be a mixed blessing. Many African countries now grapple with escalating mobile phone-assisted crime wave, which has led governments to require operators to register all existing and new SIM cards (Jentzschy, Nicola (2012:1). As a result of the free style approach adopted by the operators from the onset, many countries lack the much-needed national database of telephone users – an oversight that has provided a fertile ground for criminals to operate with impunity.

According to the International Telecommunication Union, a UN agency for information and communication technologies, there are around 5bn mobile phone subscriptions globally. For a long time, mobile phones were assumed to be harmless. However, recent studies have shown that these gadgets may carry a possible cancer risk. WHO has designated radio-frequency fields like those from mobile phones as 'possibly carcinogenic' (*Guardian*, 2011: para. 1). The declaration was based on evidence in published studies which suggest that intensive use of mobile phones might lead to an increased risk of glioma, a malignant form of brain cancer.

The conclusion made by the WHO's International Agency for Research on Cancer (IARC) relates to RF electromagnetic radiation in general, with more focus on wireless phones (Sample, 2011: para. 3). The findings were based on IARC meeting where 31 scientists from 14 countries assessed several published studies into the potential cancer risks posed by electromagnetic fields. The conclusion to the discussions suggested that there could be some risk, and therefore need to keep a close watch for a link between mobile phones and cancer. In designating radio-frequency fields as "possibly

carcinogenic", the WHO put them at par with around 240 other agents for which evidence of harm was still uncertain, including low-level magnetic fields, talcum powder and working in dry cleaners.

The IARC evaluated nearly 950 chemicals, physical and biological agents, occupational exposures and lifestyle factors where there was either evidence or suspicion that they may cause cancer. Nevertheless, the evaluation found no clear mechanism for the waves to cause brain tumours since the radiation from mobile phones was too weak to cause cancer by breaking DNA, leading scientists to suspect other, more indirect agents.

The meeting, therefore, recommended that in view of the potential implications for public health, there should be more research on long-term focusing on heavy use of mobile phones but in the meantime, it was important to take pragmatic measures to reduce exposure such as by using hands-free devices or texting.

There are also issues relating to psychological stress associated with mobile phones. Thomée *et al* (2011: para. 3) conducted a study on the mobile phone use and stress, sleep disturbances, and symptoms of depression among users. The research was inspired by the quick development and widespread use of mobile phones, and their vast effect on communication and interactions, which had made it imperative to understand their possible negative health effects. The aim of the study was to investigate whether there was any association between psychosocial aspects of mobile phone use and mental health symptoms among users.

These results found cross-sectional associations between high compared to low mobile phone use and stress, sleep disturbances, and symptoms of depression for the men and women. When excluding respondents reporting mental health symptoms at baseline,

high mobile phone use was associated with sleep disturbances and symptoms of depression after 1 year follow-up. All variables had cross-sectional associations with mental health outcomes. In prospective analysis, overuse of mobile phones was associated with stress and sleep disturbances for women, and high accessibility stress was associated with stress, sleep disturbances, and symptoms of depression for both men and women.

Thomée *et al* (2011) concluded that the high frequency of mobile phone use at baseline was a risk factor for mental health. The risk for reporting mental health symptoms at follow-up was greatest among those who had perceived accessibility via mobile phones to be stressful. Public health prevention strategies focusing on attitudes could include information and advice, helping users to set limits for their own and others' accessibility.

The fact that the person who is dialling to a mobile phone cannot have the information as to where exactly the other person is has led to an increase in cases of infidelity and unfaithfulness among couples leading to serious problems and even break-ups in relationships. Closely related is the fact that talking over the mobile phones especially while driving can be a huge safety risk. People are unable to concentrate fully on the road and often cause serious accidents.

Prolonged use of mobile phones has also been blamed for addiction especially among youths and teenagers. In order to get up-to-date, most people tend to change their mobile phones too often making them spend unnecessary large sums of money on mobile bills. These habits often have led to financial impoverishment since users are unable to make any significant savings for their future. Improper use of mobile phones on the other hand has raised privacy and legal concerns. Some people have used integrated devices such as cameras, Bluetooth and audio recorders to illegally access

and transfer data, record conversations or even take pictures of their correspondents without their consent.

According to Horst & Miller (2006:9), privacy has become one of the most outstanding impacts of the mobile phone to the internal relationships of the family. They go further to argue that the intrusive nature of mobile telephony and the relationship between privacy and the dissolving boundaries between the public and private sphere remain an important contribution which in turn leads to a consideration of etiquette that has developed around the use of the mobile phone.

Cyber bullying and cyber-crimes including hacking and viruses have also raised legal and ethical considerations. More and more criminals are now on the prowl gaining more sophisticated skills in hacking into people's phone databanks and stealing vital and private information which give them undue access to their private property including their homes and bank accounts. New mobile phone technologies need to pay more attention to these worrying trends to mitigate their full impact in the future.

In the recent times, many governments the world over are exerting more controls over the use of mobile telephony with varying effects. In Kenya, such controls were more evident in the run-up to the 4th March General Elections as captured below:

> "Kenya's first general election, under the new 2010 constitution ... saw citizens and politicians alike using ICTs to disseminate information and prevent electoral violence. Fearful of election-related unrest, the Government blocked thousands of allegedly inflammatory text messages, mandated bulk texts be pre-screened, and hired a team to proactively monitor social media for inciting language. Service providers were required to install internet traffic monitoring equipment ... to detect cyber threats, such as online hate speech." Freedom House (2013:1)

Although these controls are necessary in certain circumstances, they could seriously curtail information and communication related freedoms that are enshrined in most constitutions across the world if not well executed.

On the other hand, several scholars have also perceived the mobile phone era as a transitional period that will lead to some other technologies and services. Hartmann, Rössler and Höflich, (2008) in their book *After the Mobile Phone?* assert that*:*

> "the end of mobile phones was not necessarily what we had meant... instead, we had a rather open mind concerning the ongoing changes in the uses of mobile phone. We were seeing (and further anticipating) a move from the mobile phone to a more general mobile phone media device as well as a move from certain uses and discourses to yet others." (Hartmann, 2008:7)

From these views, it is important that mobile phone users, manufactures and service providers look beyond the mobile phone era so as to continue accommodating the current and future communication requirements. This would ensure sustainability in the development of mobile phone technology and continued empowerment of user communities to enhance uptake levels.

2.11 Empirical Studies on Mobile Phone Technology

Currently, there are numerous experiential studies going on in the area of mobile phone technology. Incidentally, the studies are mostly health oriented and generally depict both the short and long term effect of mobile phone use on various health related parameters. However, there are a few others focusing on other pertinent issues such as education and road safety.

One of the studies in the area of education conducted by Baran (2014:7) has explored the potential of mobile phone technology within teacher development. The study addresses trends and gaps observed in the literature regarding the integration of mobile learning into teacher education. The study found six emerging issues in this area namely: there is an increasing trend in integrating mobile learning in teacher education contexts; theoretical and conceptual perspectives are scarcely reported; variations exist in perceptions, attitudes and usage patterns; engagement with mobile learning and devices is primarily reported as being beneficial; challenges in the use of mobile

technology were scarcely reported; and several pedagogical relationships support mobile learning integration into teacher education settings.

These findings have been interpreted to determine their implications on the development of mobile learning experiences in teacher education, including programmatic directions for integration and study. Further studies in this area can greatly spur innovativeness in the use of mobile phone technology particularly in marginalized areas where education resources are scarcer.

In the area of safety, McEvoy *et al* (2005:5) conducted a study to explore the effect of drivers' use of mobile phones on road safety. A sample of 456 drivers aged ≥ 17 years who owned or used mobile phones and had been involved in road crashes necessitating hospital attendance participated. The study concluded that when drivers use a mobile phone there is an increased likelihood of a crash resulting in injury. Interestingly, the use of hands-free phone devices was found to only generate false confidence and do not reduce the risk levels at all. The significance of this study is that even though it was conducted several years back, its findings are still relevant today and possibly will remain so for a long time to come. Another study conducted in 2009 confirms this by asserting that text messaging increases the risk of a safety-critical event, such as a crash or near-crash, by 23 times over a driver who wasn't distracted (Virginia Tech Transportation Institute, 2013: para. 2).

Another research focused on major depressive disorder and bipolar disorder which are both the common psychiatric illness for which smartphone application research has greatly expanded in the recent past. The study reviewed a wide range of literature on smartphone applications for major depressive and bipolar disorders in order to better understand the evidence base for their use, current research opportunities, and future clinical trends. The study identified 1065 studies. Ten studies on major depressive

disorder and 4 on bipolar disorder were included. Nine out of 10 studies on depression related smartphone applications featured active data collection and all 4 studies on bipolar disorder featured passive data collection. Depression studies included both diagnostic and therapeutic smartphone applications, while bipolar disorder studies featured only diagnostics. No studies addressed physiological data. Torous & Powell (2015:169) conclude that while the research base for smartphone applications is limited, it is still informative. The study identified numerous opportunities for further research especially in the use of passive data for major depressive disorder, validating passive data to detect mania in bipolar disorder, and exploring the use of physiological data. As interest in smartphones for psychiatry and mental health continues to expand, it is important that the research base expands to fill these gaps and provide clinically useful results.

Concerned about the possible effect of mobile phone radiation on the users, the U.S. Food and Drug Administration (FDA) nominated the National Toxicology Program (NTP) to study cell phone radiofrequency radiation to discern this relationship. This was necessitated by widespread human exposure and the current exposure guidelines being based largely on protection from acute injury from thermal effects. In addition, there is little known about potential health effects of long-term exposure to radiofrequency radiation yet, data from the past and ongoing studies are inconsistent and quite often contradictory. The National Institute of Environmental Health Sciences (2014:1) concludes that whereas current scientific evidence has not conclusively linked cell phones with any health problems and additional research is needed to confirm this, concerned users must continue to take possible precautionary measures. The measures include reducing the amount of time spent using the mobile phone and use of speaker mode or a headset to place more distance between the head and the cell phone. These

measures are very important especially among communities that cannot access medical help easily.

A number of studies have also focused the behavioural aspects including the addictive nature of mobile phone use especially among the younger generations and its adverse effect on job performance. Goodrich, Terry (2014:para. 1) in a Baylor University study on cell phone activity published in the Journal of Behavioral Addictions found that Women college students spend an average of 10 hours a day on their cellphones and men college students spend nearly eight, with excessive use posing potential risks for academic performance, according to a Baylor University study on cellphone activity published in the Journal of Behavioral Addictions. The study concludes that it is imperative to identify the activities that push mobile phone use from being a helpful tool to one that undermines our well-being and that of others,"

If pursued further, the ongoing studies can provide a good platform for additional research and more innovations that are needed to spur greater and faster development of mobile phone industry in line with the objectives of this study.

2.12 The Future of Mobile phone technology

Mobile phone technologies and services are literally exploding and it is often hard to keep up. The race is on especially among the various service providers to deliver more voice, video and data communication services to a captive consumer audience which is becoming more and more passionately attached to mobile phones. Since the landing of the three fibre optic cables in Kenya namely TEAMS, EASSY and SEACOM, the country has experienced unprecedented levels of development in the data industry giving way to innovative trends which have revolutionised the communication platform.

Top on the list of these innovations is the mobile money transfer system popularly known as M-Pesa. This product was entirely developed by Kenyans and was initially sponsored by the UK-based Department for International Development (DFID) from 2003 to 2007 (ILO, 2010: para. 2). The initial concept was to create a service which allowed microfinance borrowers to conveniently receive and repay loans using the network of Safaricom airtime resellers. This would enable microfinance institutions (MFIs) to offer more competitive loan rates to their users, as there would be reduced cost of dealing in cash. The users of the service would gain through being able to track their finances more easily. But when the service was tried out, customers adopted it for a variety of alternative uses and has since been re-focused and launched with a different value proposition sending remittances home across the country and making payments.

Crammond (2010: para. 4) acknowledges the presence of numerous other trends on a global scale including projection capabilities of mobile phone technology. This capability though still in rudimentary stages among Samsung products, soon, it will be possible for people to sit down in a conference room and simply view a presentation or video without waiting for laptops to be plugged in. Besides, a lot of developments are also taking place in advanced imaging. Every new camera phone released tends to be a 'compact camera replacement' but with the proactive advancements made in the camera industry they rarely live up to their mark. However, upcoming models are coming with professional attributes including higher resolution and megapixel sensors as well as Carl Zeiss optics. There are also huge advances in video recording with high definition capture.

Augmented reality is yet, another projected feature that we are going to experience more with time (Reardon, 2010: para 2). With this trend, one can look forward to true location awareness, which enables clients to view couriers' progress in real-time, air

rescue for emergency services, showing the location of victims of crime or accident by their cellular signal and many other greatly useful applications to make our professional lives more efficient and safer. There are also attempts to replace traditional methods of human input, ranging from projected keyboards and touchpads to eye-dialling the phone via a heads-up display while driving.

As processor manufacturers continue developing smaller, efficient and increasingly powerful products the traditional desktop computer edges nearer and nearer to its extinction. A number of tablets have already been given almost complete desktop functionality in the palm of our hand. The successors to those devices will be empowered by multi-core processors, advanced graphic processing units and more RAM and ROM enabling users to carry out every task they could want on their handheld, and decentralising the workplace in ways not seen since the introduction of the World Wide Web (Crammond (2010: para. 6).

Along with the power and flexibility of tomorrow's devices we should see cloud computing extended to the mobile market. With smaller, more powerful devices having the lion's share of their hard work done remotely, users could expect to have all the power that they need easily. Also, the decentralised storage of documents, photographs and other data would enable users to work seamlessly with colleagues and even share devices without loss of data (Valecha, 2010: para. 19).

The arrival of 4G is already a reality and with it comes a new array of functionality and speed to enhance our mobile lives. More powerful hardware and improved network infrastructure will provide businesses with a fast and stable data connection, and the next generation of applications, will run smoothly. With a new mobile generation coming around roughly every 10 years, we can expect to see 5G implemented fully by 2020, and following current projections will likely see peak data speeds (Crammond,

2010: para. 7).

As mobile devices evolve into more than just communications tools, security becomes ever more paramount. Priceless data has been lost and the potential loss of revenue from such an oversight could be huge. Some companies have already begun rolling out fingerprint based biometric security and in the near future voice or even inner-ear activated devices will be widely available, allowing corporations to protect their data fully when it is not in use (MacRumors, 2011: para. 21).

Mobile phone specific operating systems are now on the rise. Current mobile operating systems are almost incomparable to the basic user interfaces of a few years ago. With every release, Google's Android is becoming faster and more stable and Apple strives to add more powerful features to its cleanly designed iOS (Crammond, 2010: p 4 para. 5). Wrist watches and long, pen-like devices have been seen on the market before but with evolving technology allowing manufacturers to squeeze in everything a user needs they are likely to open up in shape and size. Tablets are expected to get thinner and tougher, with higher resolution displays and longer life batteries.

Environmental awareness initiatives may not have taken complete shape yet but the implications of sourcing a product from sustainable, fully recyclable and non-toxic materials are far greater than anyone can currently see. There are also concerns of demand far outstripping supply when it comes to the materials used to build important devices. A number of manufacturers such as Sony Ericsson have taken steps towards a range of eco-friendly devices such as GreenHeart initiative, which promises lower carbon emissions, reduced paper usage and between 50 and 100 per cent recycled plastics used in production (Crammond, (2010: p 5 para. 6).

As mobile phone technology evolves to unimaginable levels, one of the hyped future

possibility is telesensing. This is where besides the traditional mobile phones uses, handsets may soon be taking one's pulse, keeping tabs on ailing parents and warning cops about criminals hiding behind walls. Researchers at Lucent Technologies' Bell Labs are crafting ways to read mobile phone signals bounced off the body. These reflections can reveal respiration rates or the pulsing of blood against the skin to indicate a heartbeat. Telesensing might be used in special crib monitors, to ward off sudden infant death syndrome. It also could help diagnose sleep apnoea, a potentially deadly condition of obstructed breathing during sleep. Bandage sensors could convert body temperature into a signal that mobile phones could read, for tracking fevers (Coughlin 2006: para 4).

2.13 Chapter Summary

This chapter has provided a critical analysis of current knowledge and literature on the subject of this thesis including major research findings and contributions to the topic. It has presented a theoretical framework based on the media-system dependency theory, first introduced by Ball-Rokeach DeFleur in 1976 and the knowledge-gap hypothesis theory first proposed by Phillip J. Tichenor, George A. Donohue and Clarice N. Olien in 1970. However, due to the inadequacies of the traditional communication theories to apply to the modern communication practices, a Conceptual Framework has been defined. The framework provides for communication as a spontaneous process that relies on the intelligence and parity between the communicating entities and must therefore be equitably facilitated.

Judging from the large-scale adoption of mobile phones the world over, the impact that has been created by the technology may by far exceed that of both the agrarian and industrial revolutions combined. Although much of the existing literature focuses more

on marketing and promoting the technology's endless list of new products, current trends clearly show that the technology is slowly but surely taking over the role of PCs and other computer related systems. Their unparalleled portability, affordability as well as the capacity to be used longer in areas without electricity, explains why the technology has become popular with rural and marginalised populations.

The chapter has also highlighted the local as well as the global perspectives of the historical development of mobile phone technology with a specific focus on the development of telecommunications industry. Problems and benefits associated with the mobile phone technology have been discussed together with current trends and emerging issues in the mobile phone industry. The trends have shown that the world must remain prepared for the future where mobile phones are going to be used in every sector of the economy including health, security, entertainment, banking, education and research, retail trade and industry as well as in communication. The world now needs to focus a lot more on supporting and refining existing developments so that as the phones become even more 'intelligent', the technology can reach the widest population possible and reduce any disparities that exist in the current world.

The next chapter discusses the methodological procedures and processes that were followed to conduct this study. The chapter covers a number of topics including research paradigm, research design, study population, sampling method, research methods and data collection, presentation, and analysis and interpretation.

CHAPTER 3: METHODOLOGY

3.1 Introduction

This chapter describes the research paradigm that guided this study as well as the study design, methods, tools and instruments that were used to accomplish its aim and objectives. It also discusses the methodological steps that were followed to answer the listed research questions. The focus was largely on three main stakeholders in the mobile phone industry namely: the rural mobile phone users, mobile phone dealers and the mobile phone service providers. The discussions on research techniques, tools and instruments used detail how and where they were administered and what kind of data was collected and analysed. In particular, the chapter covers research paradigm, research design, study population, procedures for data collection, sampling method, research methods, data collection, validity and reliability of the study, data organisation and entry, data presentation and data analysis and interpretation.

3.2 Research Paradigm

Weaver and Olson's (2006: 460) defines research paradigm as "patterns of beliefs and practices that regulate inquiry within a discipline by providing lenses, frames and processes through which investigation is accomplished". Musa (2013:41) on the other hand views a paradigm as a belief, values, and assumptions that communities of researchers have in common regarding the nature and conduct of research and allows researchers to argue and present data from an underlying philosophical perspective. To contextualise the structure of inquiry and methodological choices of this study, an understanding of the paradigm adopted and the justification behind it is important.

Although there are a number of research paradigms that can fit well in social science oriented studies like this one, positivists paradigm that adopts a quantitative

methodology and interpretative paradigm which adopts a qualitative approach are the most influential in library and information sciences research (Musa, 2013:43).

Due to the dynamic nature of the research topic, none of the two paradigms could on its own satisfactorily deal with all of the required aspects of investigation. Therefore, the researcher found it necessary to combine the quantitative/positivist paradigm with the qualitative/interpretive paradigm. The blending of both paradigms provided the researcher with the ability and flexibility to statistically analyse data that was collected whilst also taking into account relevant underlying issues.

By nature, mobile phone technology is a combination of both products and services. Whereas uptake of phone products is generally looked at in quantitative terms, the analysis of related services is mostly done in qualitative terms and hence the need to combine the quantitative/positivist paradigm with the qualitative/interpretive paradigm in this study.

3.3 Research Design

In this descriptive case study, qualitative and quantitative data collection techniques were used including; face to face interviews, telephone interviews, questionnaires and documentary analysis. The choice of the descriptive case study was informed by the fact that the mobile phone telephony is a rapidly developing technology with many emerging dynamics. As argued by Man (2006: 72), this type of study enabled the researcher to objectively collect and evaluate data. It also enabled the contextualization of the findings and helped to address existing gaps in the continued development of the technology. It is also hoped that the findings of the study will not only be replicated to the country but also to Africa and the rest of the world for a more empowered society.

3.4 Study Population

The study was based on Western Province and hence guided by the political structures, geographic features as well as demographic factors that defined the province as highlighted in the profile of Western Province given in Chapter 1. The main target population of the study was within-the-household community members residing in the rural areas of Western Province of Kenya, aged 18 years and older. For legal reasons, the study was confined to this age group because it was the minimum age required by the Kenyan Law for one to own an identification card and hence a mobile phone account in the country. For this category, the sampling frame entailed a list of randomly generated GPS coordinates which were used to select the nearest households in rural areas of the Province to participate in the study. In addition, mobile phone dealers and service providers' within the Province were used as informants to provide supportive evidence that was useful in evaluating the findings. Lists of these agencies whose services covered the sampled areas were used as the respective sampling frames.

3.5 Sampling

This study was more about the rural communities rather than individuals and as such, study instruments for the mobile phone users were administered to households as basic units of families and communities at large. To determine the number of respondents from the mobile phone users who were the main respondents, a stratified multi-stage random sample was used, with specific households picked from randomly generated GPS coordinates. The choice of this sampling method was necessitated by lack of up to date lists of households. In addition, the method is being used widely in household surveys and is quickly emerging as one of the most innovative and cost effective sampling techniques Gibson, John (2007:2). Shannon *et al* (2012:1) also recommends this kind of method to be used when data on the population is limited to avoid bias.

In this case, the stratum was the Western Province while the primary sampling units were the districts within the Province. The secondary sampling units were the sub-locations while elementary units were households. The final units were the individual respondents.

To determine the actual respondent from among the rural mobile phone users, a list of household members and their respective birthdays was sought and the next birthday rule used to select a respondent. For mobile phone service providers who were only four at the time of the study, a census was used while for the mobile phone dealers, a systematic simple random sample was used.

3.5.1. Sample Size

Sample size for the three categories of respondents was determined using the following formula:

$$n = \frac{N}{1 + N(e)^2}$$

Formula 1: Source Israel, Glenn D. (2009: para. 20)

In the above formula *N* is the population while e is the acceptable margin of error. The formula assumed a confidence level of 95% (1.96) a margin of error of ±5 and estimated standard deviation of 5.

3.5.2. Sample of mobile phone users

To determine the sample size of respondents among the rural mobile users, the Kenya 2009 Population and Housing Census Report by Kenya National Bureau of Statistics (2010: para. 1) was used. According to the report whose highlights are in the table below, Western Province had 78.5% (710,067/904,008) households falling under rural category as shown in Table 2 below.

Table 2: Urban Rural Population in Western Province by Districts

	RURAL				URBAN				RURAL PERCENT		
District	**Male**	**Female**	**Total**	**Households**	**Male**	**Female**	**Total**	**Households**	**Total**	**Households**	**Average**
Hamisi	**70,469**	**77,790**	**148,259**	**32,096**	**0**	**0**	**0**	**0**	**100.0**	**100.0**	**100**
Kakamega S.	**49,260**	**55,409**	**104,669**	**23,144**	**0**	**0**	**0**	**0**	**100.0**	**100.0**	**100**
Samia	**44,267**	**49,233**	**93,500**	**19,395**	**0**	**0**	**0**	**0**	**100.0**	**100.0**	**100**
Kakamega E.	**75,699**	**81,476**	**157,175**	**33,661**	**1,110**	**1,190**	**2,300**	**516**	**98.6**	**98.5**	**99**
Kakamega N.	**97,351**	**102,925**	**200,276**	**39,404**	**2,365**	**2,525**	**4,890**	**1,231**	**97.6**	**97.0**	**97**
Butere	**109,084**	**120,551**	**229,635**	**51,518**	**5,998**	**6,782**	**12,780**	**2,923**	**94.7**	**94.6**	**95**
Mt Elgon	**81,232**	**81,068**	**162,300**	**30,165**	**4,887**	**5,190**	**10,077**	**2,296**	**94.2**	**92.9**	**94**
Lugari	**131,855**	**139,845**	**271,700**	**54,680**	**9,968**	**10,483**	**20,451**	**4,796**	**93.0**	**91.9**	**92**
Sub Total	**659,217**	**708,297**	**1,367,514**	**284,063**	**24,328**	**26,170**	**50,498**	**11,762**			
Bunyala	28,617	31,545	60,162	13,535	3,101	3,460	6,561	1,710	90.2	88.8	89
Busia	134,705	148,809	283,514	58,210	21,385	22,953	44,338	10,571	86.5	84.6	86
Bungoma W.	102,129	107,157	209,286	40,157	16,439	17,810	34,249	7,491	85.9	84.3	85
Teso S.	53,929	57,833	111,762	21,346	12,700	13,462	26,162	6,026	81.0	78.0	80
Bungoma S.	152,157	161,988	314,145	61,280	46,556	47,897	94,453	22,015	76.9	73.6	75
Emuhaya	63,402	72,321	135,723	31,382	23,734	25,612	49,346	11,648	73.3	72.9	73
Bungoma E.	81,861	86,202	168,063	31,961	30,516	31,674	62,190	13,973	73.0	69.6	71
Bungoma N.	108,417	114,156	222,573	41,915	47,354	50,373	97,727	19,571	69.5	68.2	69
Mumias	115,328	125,744	241,072	50,730	57,691	60,618	118,309	27,955	67.1	64.5	66
Kakamega C.	98,023	105,490	203,513	41,352	47,257	46,624	93,881	23,769	68.4	63.5	66
Teso N.	35,403	37,415	72,818	13,491	22,015	23,114	45,129	9,941	61.7	57.6	60
Vihiga	45,400	51,135	96,535	20,645	59,711	65,048	124,759	27,576	43.6	42.8	43
Grand Total	**1,678,588**	**1,808,092**	**3,486,680**	**710,067**	**412,787**	**434,815**	**847,602**	**194,008**			

Source: Kenya 2009 Population and Housing Report, P174-193

For purposes of sampling, the list of districts in the Province were sorted in numerical order according to their proportion and size of rural as opposed to urban population. In this respect, Hamisi District with the highest proportion of rural population was placed at the top while Vihiga District with the lowest proportion was placed at the bottom. To minimise sample errors in selecting rural households in this situation where there were no clear geographic boundaries demarcating rural and urban areas, the study focused on districts with the highest rural population of 90% and above in line with the features of the sample size. As per table 2, the full list of sampled districts were Hamisi, Kakamega, Samia, Kakamega East, Kakamega North, Butere, Mt. Elgon and Lugari with a total of 284,063 households indicated in bold.

However, because of the small variance of this total which was extracted from the main census report, with that of 295,825 resulting from the sub-location by sub-location summation extracted from supplementary lists of the report as listed in Appendix 1, the latter was preferred for the study population. This was done to make the population blend well with the type of sampling method used in this study where the sub-locations formed the secondary sampling units. The larger population also gave a more representative sample thus making the findings more reliable.

Using the stated formula under Section 3.5.1 $\left(n = \frac{295{,}825}{1+295{,}825X\,(0.05)^2} = 385\right)$, 385 households were determined as the sample size of rural mobile phone users. The figure was rounded off to the nearest 100 to give a sample of 400 households. This was intended to minimise any possibility of further errors emanating from response rate.

i. Selection of households

Four Hundred households were selected from the 8 districts at the sub-location level which was the smallest identifiable administrative block. However, to further

determine the number of households *(h)* from each of the 268 sub-locations (see appendix 1) the number of households in each *(H)* were multiplied by 400 and divided by the total household population of 295,825 as shown in the formula below.

$$h = \frac{H\ x\ 400}{295{,}825}$$

Formula 2: Determining number of households per sub-location

The figures were rounded off to the nearest whole number. Hence, only sub-locations with 0.5 and above were selected. Those with less than 0.5 were rounded off to zero and thus left out.

ii. **Use of Random GPS Coordinates in household selection**

The study used randomly generated GPS coordinates in the order of degrees, minutes and decimal seconds (see appendix 2) in combination with Google Earth Maps to select the nearest household on the ground. To generate the random coordinates, the map of Western Province in Figure 7 was used.

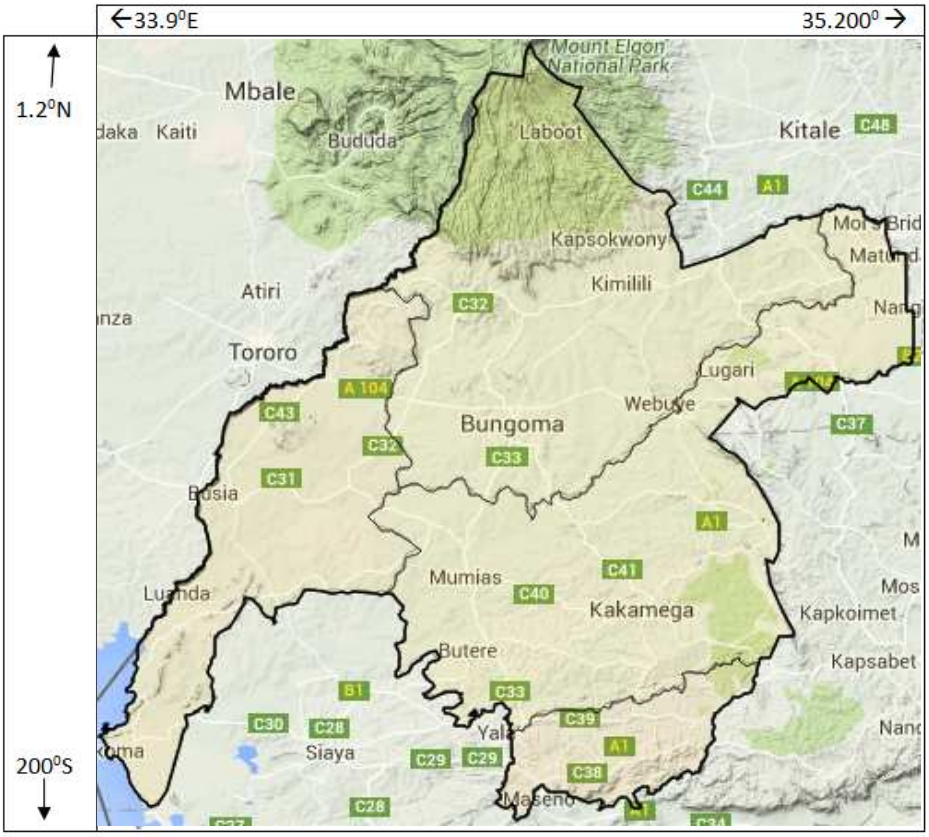

Figure 7: Map showing geographic position of Western Province Kenya
Source: City Population (2015). http://www.citypopulation.de/php/kenya-admin.php

By first determining the range of longitudes (33.9°E to 35.2°E) and latitudes (0.2°S to 1.2°N) within which the Western Province lies, Microsoft Excel formulas =RANDBETWEEN(33900,35200)/1000 and =RANDBETWEEN(-200,1200)/1000 were used to independently generate unique coordinates to describe specific positions within the province (See Appendix 2). The former formula gave the easting or *x* coordinates while the latter gave the northing or the *y* coordinates. The first coordinate to fall within a specific sub location was used to select the nearest household. Where applicable, the second and third coordinates were used to select the second and the third households respectively. If a relevant coordinate within the sub location was not found in the table, more random coordinates would be generated until one was found. The actual pinpointing of the respective position followed the following two steps.

Step 1: Identifying the geographic position of household

This step involved logging into Google maps in the satellite view at https://maps.google.com. Entering the pair of coordinates such as (0.441, 34.56) generated in the list in Appendix 2, Google maps would pinpoint the unmagnified satellite image of the position on the ground. This unmagnified image was useful in assessing the general location and accessibility of the position by analysing the surrounding roads and towns or shopping centres. This image, a sample of which is shown in Figure 8 was saved in the memory of the computer and a copy of it printed out for reference.

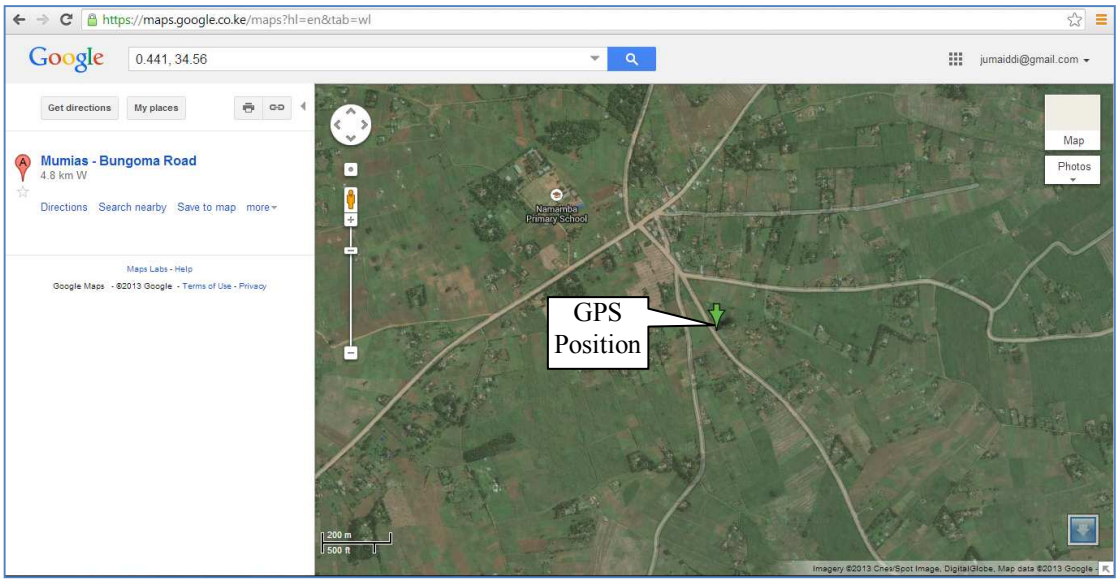

Figure 8: Position of randomly selected GPS coordinates on Google Satellite Map

Step2: Magnification of the specific house

This step involved zooming in on the unmagnified satellite picture to get a clearer image and other geographic details of the specific position as shown in Figure 9 below. A pair of compass was used to draw concentric lines to determine the nearest residential house. The house was marked and the picture was also saved in the memory of the computer and a copy of it printed on the verso side of the corresponding image in step 1.

The two back to back pictures were given to the research assistants to aid them in locating the specific households with the help of mostly local *Boda Boda* (Bicycle or Motorbike taxi operators) who were used for transport.

Figure 9: Position of selected sample house on Google Satellite Map

iii. **Selection of the respondents**

After identifying each sample household element, a within-the-household member to celebrate the next birthday was selected as the main respondent to be interviewed on behalf of the entire household. This was done to avoid the natural bias of selecting the most aggressive or talkative member of the household. However, the other members of the household were allowed to provide any additional information or clarifications relevant to the study either directly through face-to-face contact or through telephone conversation.

3.5.3. Sample of Mobile phone dealers

Because it was not possible to find a predetermined list of mobile phone dealers in the districts under investigation, mobile phone users were during the interviews asked to give names or descriptions of mobile phone dealers they knew who provided at least two of the three main mobile phone related services. These were sales of mobile phones

and accessories, Mpesa and phone repair services. After repetitions were removed, a list 116 mobile phone dealers was compiled and served as the sampling frame. Applying formula 1 on this universe, a systematic random sample of 90 was selected King'oriah (2013:22). The manager in charge of each shop was interviewed. Those who were not immediately available had their telephone contacts taken and subjected to a telephone interview.

3.5.4. Sample of Service Providers

Applying formula 1 on the list of four mobile phone service providers namely Safaricom, Orange, Airtel and Yu, returned a sample of 4 thus making it a census and subjecting all of them to participate in the study. Managers of their provincial customer care shops were issued with questionnaires. These tools were used instead of interview because the managers were found to be too busy and setting time for an interview was not possible.

3.6 Data Collection Methods and Instruments

In order to take care of the multisectoral and multidisciplinary nature of the mobile phone industry, a number of data collection methods and instruments were used.

3.6.1. Interviews

Face to face interview was the most predominant method of collecting data. This method did not only allow collection of in-depth data and information particularly from the rural communities where levels of literacy were lower but also ensured a very high response rate (Kothari and Garg, 2014:92). The method also enabled the researcher to get additional nonverbal information directly from the respondents.

On the other hand, telephone interview was applied where a face to face interview was not possible after three unsuccessful attempts. It was particularly applied to mobile phone users. In such cases, the contacts of the respondents were taken by the interviewers and a telephone interview arranged using the same instrument. Both closed and open-ended questions were used to collect quantitative and qualitative data respectively.

3.6.2. Questionnaires

Questionnaires were administered as a backup method of data collection. They were applied only in cases where face to face or telephone interviews were not possible within the set timelines. The choice of this method helped to avoid losing the selected sample thus maintaining the integrity of the study.

3.6.3. Documentary analysis

Apart from the primary data collected directly from the field, the study also relied on secondary data from relevant studies conducted earlier. In particular, publications relating to the 2009 Population and Housing Census conducted by the Kenya Bureau of Statistics were instrumental in sampling and data analysis. In addition, quarterly statistics from the Communications Commission of Kenya especially on the development and current trends of mobile phone use were considered. Relevant records and information published by the various service providers were also used to fill any gaps in the literature review. Documentary analysis was therefore important in avoiding duplication of findings hence making the study more cost-effective. Furthermore, the documents used were from major statutory, corporate or research institutions thus lending more credibility to the study.

3.7 Research authorisation

To meet legal requirements of conducting this study, the researcher acquired a research authorisation letter and a permit from the National Council for Science and Technology (see appendix 6 &7) upon submitting two copies of the research proposal and paying the necessary fees. To allow data collection within Western Province, another research authorisation letter from the Western Provincial Commissioner's office was required (see appendix 8). While in the field, the researcher also sought the consent of all the sampled respondents before involving them in the study. This was done over and above the assurance that their responses would remain confidential and used solely for the purpose of this study.

3.8 Data Collection Procedure

The study collected data from 400 within-the-household adult respondents aged 18 years and above on voluntary basis. Upon locating and reaching the sampled household, an introduction was made stating clearly the aim, objectives and confidentiality of the study. Interviews were administered spontaneously except in cases where the respondent required prior appointment. Unless an outright refusal occurred, the interviewer made up to three attempts to survey the sampled household. The third attempt involved administration of questionnaire.

To increase the probability of contact and completion, the interviewer made attempts at different times of the day, and when possible, on different days. If for any reason the research assistant could not obtain any response at the initial sampled household, he or she used a simple substitution method and selected the nearest house or the next available respondent. To maintain the integrity of the sample, a maximum of two substitutions were made within the locality before declaring the sampled area

nonresponsive. Where necessary, questions were translated into Kiswahili or mother tongue. Hence, eight research assistants familiar with English and the spoken dialects in the study areas were trained on the necessary research and data collection skills.

Prior to collection of data, a pilot study was conducted to test the effectiveness of the instruments. Gaps encountered in this exercise were used to improve the instruments. Largely, the research used face to face interviews as the main data collection method. This enabled a large and diverse amount of data to be collected because of the high response rate. Besides, other tools that were administered included telephone interviews and questionnaires in cases where face to face interviews were not possible within the study timelines. Observations were also made to pick obvious details such as the gender of the respondents or additional information that could not come out directly through interviews and questionnaires.

Data was collected from three main players in the mobile phone industry namely: mobile phone users from the rural communities, mobile phone dealers who served the sampled rural communities, and mobile phone service providers within Western Province. Data collection process followed a rigorous schedule which spanned six months. Qualitative data was mainly generated from the structured questions while qualitative was from the open ended questions especially towards the end of the instruments.

3.9 Response Rate

The study set out to collect data from 400 rural mobile phone households, 90 mobile phone dealers and 4 mobile phone service provider agents in Western Province. With initial response rates of 384/400 (96%), 83/90 (92%) and 4/4 (100%) for the three categories of respondents respectively, substitution sampling was used to fill the

sample balance so as to eliminate nonresponse errors (Nishimura, Raphael (2015:16). In this process, the sample unit nearest to the non responding one but not in the original sample list was selected as a substitute.

Nonresponse was mainly in the form of noncontact occasioned by unoccupied houses and three cases of refusal. This was compounded by a number of challenges encountered during the data collection process. These included the poor state of roads especially in the rural areas. The survey took place during the rainiest season in the study area and coupled with the ragged terrain in a number of the remotest villages, it was quite challenging to reach some of the areas. To overcome these challenges, the researcher paid for transport to and from every data collection point and also gave mutually agreed monetary incentives to the research assistants for every successful interview conducted. Every respondent particularly from the rural setups was given mobile phone airtime popularly known as *Bamba Fifty* as incentive to participate in the study. In the few cases where language barrier was an issue, the research assistants who were appointed partly on the basis of their fluency in English and the dialects spoken in the respective areas of coverage helped to translate questions to help the respondents answer them effectively.

3.10 Data Organisation and entry

After collecting all the filled in questionnaire/interview schedules, they were organized in one place and checked for completeness and accuracy. To help in data entry, citation, cross-referencing and comparative analysis, the filled schedules were assigned unique identifiers. The identifiers were particularly helpful in qualitative analysis where quotation of a selected number of answers from specific respondents was necessary. Data entry was largely by computerised means. To enhance efficiency in the data entry,

Ms Excel was used for entry of simpler data while SPSS was used for more advanced datasets that required complex statistical operations.

3.11 Data Presentation

Two major types of data are presented in this study; Quantitative data is presented mainly by use of graphs, charts and tables reflecting frequencies, percentages, means, modes, medians and rankings. Qualitative data is presented mainly by observing recurring themes in the responses, categorising them and picking out critical issues presented in tabular or textual form. In several instances, live quotations captured directly from the respondents have been featured.

3.12 Data Analysis and Interpretation

In the context of this study, data analysis refers to the computation of certain measures along with searching for patterns of relationship that exist among data-groups (Kothari, 2014:122). The process involved editing, coding, classification and tabulation of collected data so as to make them amenable to analysis. Classification of responses especially from open-ended questions helped to reduce into homogeneous groups to get meaningful relationships.

Two major types of analyses were used namely descriptive and inferential. Presentation and interpretation of data was done using descriptive approaches integrating both qualitative and quantitative means including tables, charts, bars and line-graphs. This enabled the study to create a balance between objectivity and depth of coverage.

To avoid mix-ups and unnecessary delays in data analysis and interpretation, the collected data was coded and stored spontaneously and analysed using modern statistical computer packages mainly MS Excel which was preferred for simpler

analytical calculations and SPSS which was preferred for analyses that required more in-depth statistical operations. This helped to guarantee accuracy and reliability. Copies of the interview schedules and response results were also digitised as a backup for long term storage and efficient reference.

3.13 Validity and reliability of the study

Validity in the context of this study refers to how well a test measures what it is purported to measure (Phelan & Wren 2005: para. 11). This study was likely to be affected by human errors due to the huge sample units as well as possible weaknesses in documentation and data storage. As such, the research team ensured that data was accurately collected and that all the accompanying details and notes were captured on real-time basis. In addition, the data was immediately coded while the accompanying notes were preserved as complementary evidence. The data sheets were digitised, indexed and stored in electronic format for quick reference. The validity of the results was also ensured by discussing the findings with some of the respondents and particularly the academic supervisors to iron out any possible errors.

Reliability on the other hand refers to the consistency of assessment scores (Moskal, B. M., & Leydens, J. A., 2000: para 23). This was measured by conducting a comparative analysis of the results of the pilot study which was conducted prior to data collection. It was observed that with the exception of the questions that required moderation, there was similarity between the data collected during the pilot and the main study. However, because of limited time, it was not possible to replicate the study as many times as possible to prove the consistency of the results. Further evaluations will be conducted during dissemination of the findings. Some of the respondents will be allowed to read through the thesis to acquaint themselves with the recommendations and make their

own suggestions.

3.14 Chapter Summary

This chapter has explained the various methodologies used to respond to the aims and objectives of this study as well as answer related research questions. This is more so because of the expanding horizons of mobile phone technology and the volume of literature being generated on day today basis and available to dynamic and heterogeneous populations. This requires a combination of research techniques and methodologies that can generate appropriate data for meaningful interpretation.

The mixed approaches employed in this research combining both quantitative and qualitative methods were necessitated by the desire to maintain an objective focus and at the same time decipher the core and depth of the matter under investigation. The use of mainly face to face interviews was intended to enable the research not only to read but also to hear, see and feel the responses in real-time. Complications arising from low response rate were also minimised thus making the findings of the study more consistent and accurate.

CHAPTER 4: FINDINGS

4.1 Introduction

The study on *The Role of Mobile Phone Technology in the Empowerment of Rural Communities in Western Kenya,* aimed at investigating the contribution that the mobile phone technology had made towards enabling rural communities improve their lives and explore ways of maximising its development and application for a more empowered society. It involved a multistage sample of 400 rural households across the Western Province of Kenya which was identified using randomly generated Global Positioning System (GPS) Coordinates and searched on the Google Earth Satellite System as the main respondents. Managers of the provincial customer care shops of the four major service providers and 90 mobile phone dealers within the Province were involved as informants.

Data was collected by means of Interviews, questionnaires and documentary analysis and analyzed by both qualitative and quantitative means as per each objective and respective research questions. Related data from both the respondents and informants have been integrated for comparison and critical analysis. Close ended questions were categorised according to the provided answers while open ended were categorised according to recurring broad themes.

This chapter descriptively presents the data collected during the study. For statistical purposes, all responses from the phone users were based on the sample size of four hundred. In open ended interview questions where all respondents gave fewer than four hundred responses all the responses were considered. However, where the total number of responses was more than four hundred, only the first four hundred were tallied.

The topics in the chapter have been arranged according to the order of objectives in chapter 1 namely: The status and trends of mobile phone technology among rural communities; Basic modes of using mobile phone technology; Factors affecting the development and uptake of mobile phone technology among rural communities; Untapped potential of mobile phone technology and User Recommendations on better usage of mobile phone technology.

4.2 Data Presentation

To meet the objectives of this research, the study helped to answer six fundamental questions. Each question was related to a specific objective while all the responses relating to a particular question were grouped together to give a more complete picture and clearer analysis.

4.3 Trends and developments of mobile phone technology and their role in meeting information needs of rural communities

For this first objective, there were two research questions that sought answers relating to it. The first research question sought to establish the general trends in mobile phone usage and awareness among rural communities while the second question sought to establish the extent to which the existing mobile phone technology systems, services and features met the needs of rural communities. To answer the questions, this section provides findings to the following aspects: The state of mobile phone service provision, mobile phone dealership; gender composition of phone users; phone penetration rates; awareness and usage patterns; promotion services and user education; ownership and acquisition patterns; locked and unlocked handsets; pre and post-paid subscriptions; available phone systems services and features; internet and money transfer services; prevalence and redundancy of phone features; information needs satisfaction; network

signal strength, calling and expenditure patterns and emerging issues and their effect on usage.

4.3.1 The state of mobile phone service provision

According to the responses received from the service providers and the CCK statistics on mobile phone usage in Kenya, the growth of mobile phone in the country was as per Table 3 and Figure 10 below.

Table 3: Establishment of mobile phone companies in Kenya

Company	Year of Establishment
Safaricom	1997
Airtel (Formerly Kencell)	1998
Orange Mobile	1999
Essar Telecom Kenya Limited (yuMobile)	2010

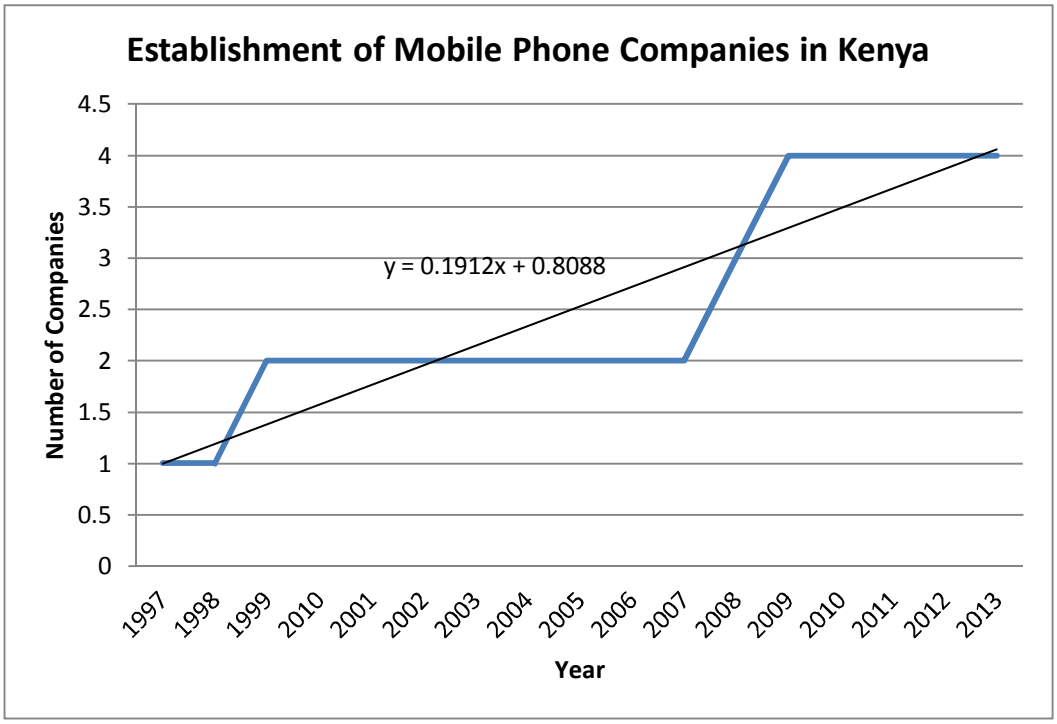

Figure 10: Cumulative pattern of mobile phone companies established in Kenya between 1997 and 2013
Source: Communications Commission of Kenya Annual Reports

According to Table 3 and Figure 10 above, the growth of mobile phone industry in

Kenya begun with the entry of Safaricom in 1997 followed by Airtel (formerly Kencell) in 1999. The third and fourth companies thus, Orange Mobile and Essar Telecom Kenya Limited (yuMobile) entered in 2007 and 2010 respectively. Though the emerging growth pattern is wavery signifying a lack of a strategic approach in the establishment of the phone companies, the overall trend shows a steady rise implying that the future of mobile phone industry in Kenya was getting brighter.

4.3.2 Mobile phone dealership in Western Province

In order to understand the level of service provision from the mobile phone dealers, the pattern of establishment of dealers who work hand in hand with the service providers were also examined. The data was collected from the 90 mobile phone dealers who responded to the study by stating the year when they first came into operation. The dealers were sampled from the list of the dealers who served the mobile phone users under review as shown in Figure 11 below.

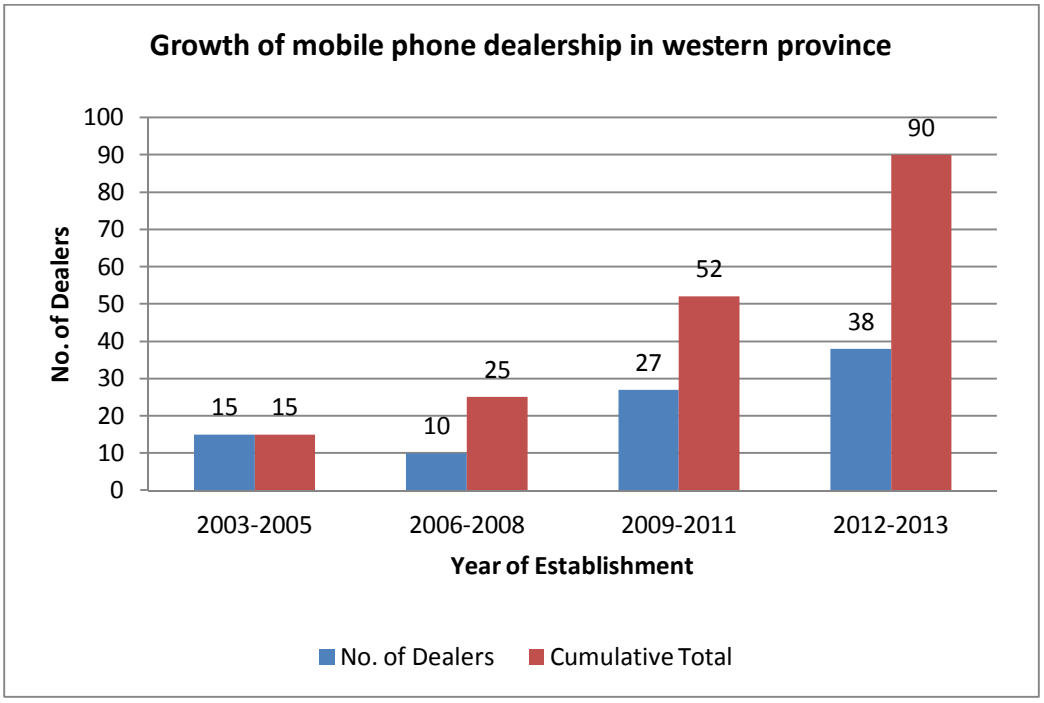

Figure 11: Chart showing establishment of mobile phone dealership in Western Province

The graph above also show that mobile phone dealership in Western Province mainly started between 2003 and 2005 and was growing exponentially. Whereas the growth of mobile phone dealership started off gradually, the most recent developments have been phenomenal. This is generally a reflection of how the mobile phone technology itself had continued to develop at accelerated speed and further proof that the mobile phone industry had a brighter future ahead.

4.3.3 Gender composition of mobile phone users in the rural areas

Among rural communities gender as a cultural dynamic plays an important role in the day-to-day life. To appreciate the role that gender plays in the use of mobile phones in the rural areas, the study established the ratio of male to female to be 192 to 208 as shown in Table 4 below.

Table 4: Gender Composition of Mobile Phone Users as

Mobile Phone Users	Frequency	Percent
Male	208	52
Female	192	48
Total	**400**	**100**

The results in the foregoing table show that mobile phone communication among the rural communities at August 2013 was slightly dominated by the male population at 52% (208/400) as opposed to the female population at 48% (192/400). This means that the male population had an upper hand in sharing information and consequently influencing decision making in society.

4.3.4 Mobile phone penetration in the rural areas

Mobile phone penetration rate in the rural areas was determined by the number of household members who owned mobile phones as shown in Figure 12 below.

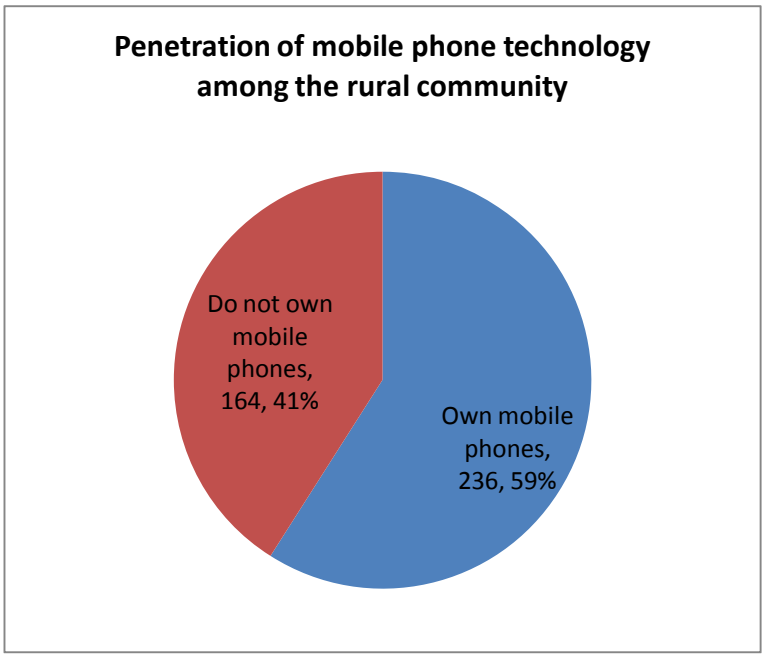

Figure 12: Chart showing penetration of mobile phone technology among rural communities

According to the foregoing chart, it was established that 59% (236/400) of the rural community owned mobile phones while 41% (164/400) did not. This implies that only 59% of the rural community could easily communicate directly with their mobile phones without the need borrow one. On the other hand 41% could only do so on the good will of those who had phones.

4.3.5 Mobile phone awareness and usage among rural communities

To establish mobile phone awareness and usage among rural communities, the phone users were asked to rate their knowledge of how to use the mobile phones. Their responses were on a scale of 1 (very low) to 5 (very high), summarised as shown in Table 5 below.

Table 5: Rating of knowledge of mobile phone use among rural communities

Rating of level of knowledge (x)	Frequency (f)	fx
1	23	23
2	86	172
3	218	654
4	56	224
5	17	85
Total	400	1158
Mean	$\bar{x} = \frac{\Sigma fx}{\Sigma f} = \frac{1158}{400} = 2.9/5 = 57.9\%$	

The results in Table 5 above can be interpreted better using the scatter diagram in Figure13 below:

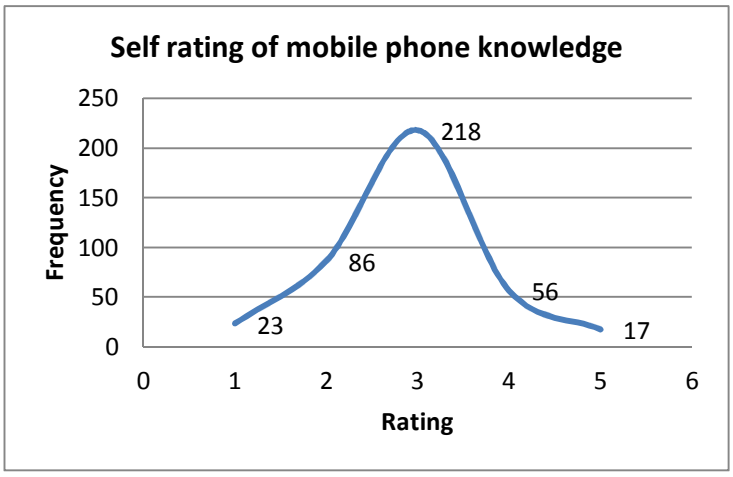

Figure 13: Scatter diagram showing self rating of mobile user knowledge by rural usaers

The table shows that the mean rating of the knowledge of mobile phone users ($\bar{x}$) was 57.9% (2.9/5) which was regarded as fair (neither low nor high). However, the modal rating of 3 in the scatter diagram implies that the largest group of users had an average rating of 60% (3/5) which was also within the bracket of neither low nor high.

Similarly, when asked to rate on a scale of 1 (very low) to 5 (very high) the competence of mobile phone users who were their clients in using available phone systems and services, the mobile phone dealers responded as per Table 6 below. Unlike the

knowledge rating which was based on what the mobile users themselves felt, the level of competence referred to what the dealers observed as the users made efforts to utilise their phones.

Table 6: assessment of mobile phone users' competence by Mobile phone dealers

Level of competence (x)	Frequency (f)	f x
4	64	256
5	26	130
Total	90	386
Mean	$\bar{x} = \frac{\sum fx}{\sum f} = \frac{386}{90} = \frac{4.3}{5} = 86\%$	

According to the results in the foregoing table, the mobile phone dealers' ratings were between 4 (high) and 5 (very high). On average however, the level of competence of mobile phone users was 86% (4.3/5) which was regarded as high. Comparatively, this was much higher than the self assessment of 57.9% (2.9/5) made by the rural mobile phone users. This disparity was because the mobile phone dealers were not just restricted to providing their services to rural communities alone, hence their rating included that of urban munities which was evidently higher.

4.3.6 Promotion of mobile phone services and user education

The dealers were also asked to state the various strategies they employed to try and reduce existing knowledge gaps in the use of mobile phone technology among their clients. Their responses were grouped in broad categories as per Table 7.

Table 7: Strategies used by mobile phone dealers to promote the use of mobile phone technology

Promotion Strategies	Frequency (f)	Percent
User education	57	63.3
Phone variety	14	15.6
Change of phone settings	9	10.0
User support phone calls	8	8.9
Not sure	2	2.2
Total	90	100

The foregoing table shows that 63.3% (57/90) of mobile phone dealers used user education to promote the use of mobile phone technology among their clients. As the most predominant promotional strategy, user education included adverts, road shows, mobile clinics, demonstrations, customer visits, posters and murals. On the other hand, 15.6% (14/90) sold a wide range of phones so that their clients could get the phone of their choice and which they could operate with ease. Furthermore, 10% (9/90) of the mobile phone dealers helped their clients by reconfiguring the settings of their phones to suit their needs and level of understanding and convenience hence making it easier to operate them. The least used promotion strategy was user support phone calls which were used by 8.9% (8/90) mobile phone dealers to help their clients. Only 2.2% (2.2/90) of the dealers could not specify the strategy they used to either reduce the knowledge gaps of their clients or raise the use of their phones. This small percentage reflects the proportion of dealers who did not have proper knowledge and experience in the business of mobile phones and hence did not actively contribute to the use of mobile phones. Besides, when categorised under broader themes, it is clear that the strategies ranged between those that focused on raising usage as well as the knowledge levels such as user education and user support while, the rest focused on raising usage only.

To assess the effectiveness of user education methods, mobile phone users were asked to state the various strategies they used to acquire the knowledge they used to operate

the mobile phones. Although the responses were diverse, they were broadly categorised as per the Table 8 below.

Table 8: Mobile phone user education strategies among the rural communities

Learning Strategy	Frequency	Percent
Trial and error	151	37.75
Peer education	130	32.50
Use of manuals	87	21.75
Taught by supplier	32	8
Total	400	100

The results in the table above show that 37.8% (151/400) of rural mobile users relied on trial and error to gain the necessary knowledge and skills to operate mobile phones. This method was followed closely by peer education whereby 32.5% (130/400) of the mobile phone users said they relied on their fellow users to teach them how to operate mobile phones. Generally, it is evident that nearly all users except 8% (32/400) relied on self education as a means of acquiring their knowledge and experience of using mobile phones.

The study went further to investigate the strategies used by users to cope with the resultant knowledge gap with regard to the use of mobile phones. Table 9 below shows the findings of this investigation in order of prevalence from the highest to the lowest.

Table 9: Strategies for bridging the knowledge gap in mobile phone use

Strategies	No. of responses	Percent
Continue learning from customer support	146	36.5
Continue with trial and error	142	35.5
Use manuals	67	16.8
Consult users with similar phones	24	6
Take no action	8	2

In the foregoing table, 36.5% (146/400) of the mobile phone users said that they coped

with their knowledge gap relating to mobile phones use by continuing to learn from customer support facilities and services available to them. Most of these services were freely available on mobile phones through dialling a set of numbers given by the various service providers. This group was closely followed by 35.5% (142/400) who said they coped with the knowledge gap by continuing with trial and error.

Documentation of mobile phones was also found to play a big role in mobile phone user education as 16.8% (67/400) of the mobile phone users said they used user manuals to learn how to use mobile phones. Nevertheless, 6% (24/400) of the mobile phone users said they preferred to consult users with similar phones while 2% (8/400) took no action at all. This percentage reflects the proportion of users who lacked proper sensitisation of available means of educating themselves on the use of mobile phones.

4.3.7 Mobile phone ownership patterns

To understand the usage of mobile phone technology among rural communities, the study investigated the pattern of phone ownership among the various age brackets. Mobile phone users were asked to provide their own mobile phone ownership details as well as those of their other household members. Table 10 below shows the results of this investigation.

Table 10: Pattern of mobile phone ownership by age bracket

Age bracket (yrs)	Range (yrs)	No with phones	Percent	Av. per year
<18	18	104	9	0.5
18-27	10	209	18	1.8
28-37	10	302	26	2.6
38-47	10	278	24	2.4
48-57	10	209	18	1.8
57 - 61	4	58	5	1.3
Total	62	1160	100	10.4

The results in Table 10 can be visualised better using the line graph in Figure 14 below.

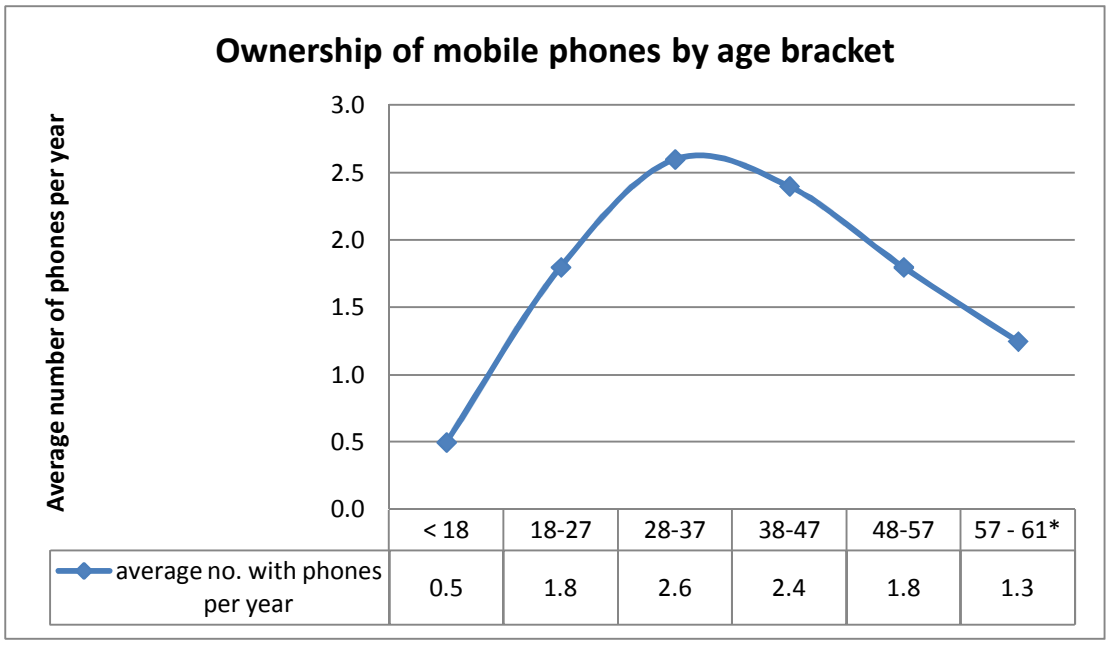

Figure 14: Line graph showing ownership of mobile phones by age bracket

The foregoing table and line graph show the pattern of mobile phone ownership and use among the various age groups. The highest age range was determined using WHO (2013) that pegs the highest life expectancy of a Kenyan at 61. It is evident that by average, mobile phones were most popular among the 28-37 years age group. This means that this group had the highest probability of owning a mobile phone. The graph also adopts a continuous distribution with a positive skew that shows a sharper rise in the level of phone ownership among the younger age groups and a gradual decline among older age groups.

Because usage of mobile phones could also be determined by the type of phone owned, the study investigated the variety of phones owned by the rural communities. The results of this investigation were as per Table 11 below.

Table 11: Types of mobile phones owned by rural communities

Phone type	Number	Percent
Basic Phone	122	30.50
Camera Phone	119	29.75
Music phone	90	22.5
Smart Phone	31	7.75
Video Phone	27	6.75
Pocket PC device	11	2.75
Total	**400**	**100**

According to the results in Table 11 above, the phone type was determined by the most predominant feature on it. Hence, 30.5% (122/400) of mobile phone users owned basic phones while 29.75% (119/400) owned phones with cameras as the most predominant feature. Other phone types were music phones, smart phones, video phones and pocket PC devices owned by 22.5% (90/400), 7.75% (31/400), 6.75% (27/400) and 2.75% (11/400) of phone users respectively. The results imply that majority of rural dwellers used basic phones which were the cheapest in the market while the smallest number used Pocket PC Devices such as iPads which were more expensive.

In addition, the study investigated the progressive trend of mobile phone ownership among rural communities. This was intended to understand the historical perspective of mobile phone ownership and possibly make future projections. The mobile phone users were asked to state the year when they owned their first mobile phone as an indicator of this trend. Because of the strong attachment people have towards their first experiences in life, it was expected that the mobile phone users would remember their first stint with mobile phones more accurately than any other. Figure 15 below shows the results of this investigation.

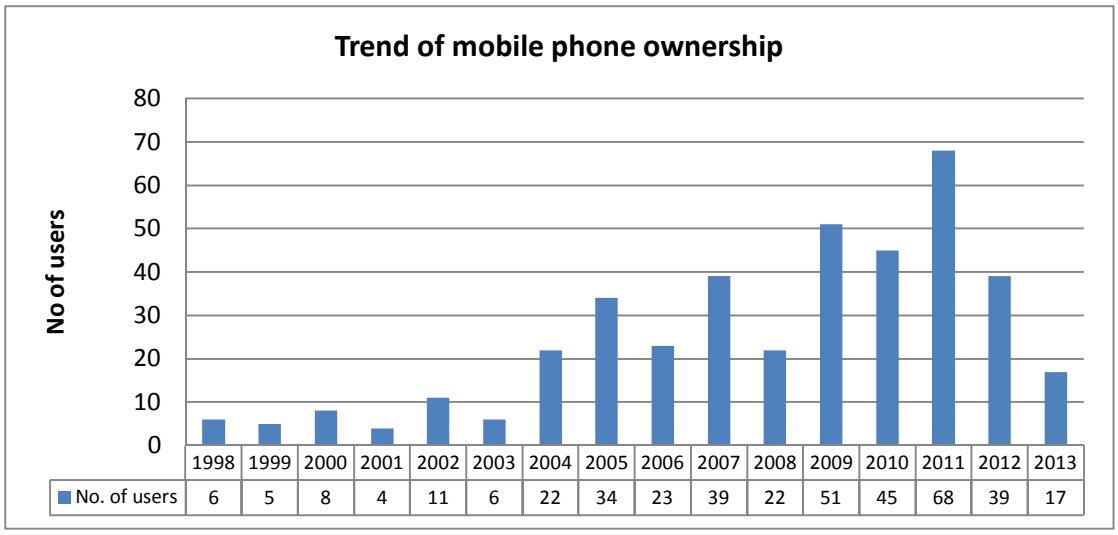

Figure 15: Trend of phone ownership among rural users

The above chart shows that mobile phones started penetrating the rural area under review in 1998 and though with a slow uptake in the beginning, there was an exponential rise in the years running up to 2011 when the peak of the uptake level was experienced. It was evident that even then, those who owned mobile phones could not use them from the comfort of their rural homes because of lack of network capacity. To do so, they had to move to urban centres where they could find the necessary network facilities.

Furthermore, because of the trending habit of using multiple SIM cards on phones, the study sought to understand better the pattern of mobile phone usage in the area of study in terms of SIM card ownership as a measure of communication behaviour. The results were as per Table 12 below.

Table 12: Pattern of Mobile Phone SIM card ownership

Number of phones	No. of SIM cards the phone(s) can hold	No. of SIM cards currently owned
400	**553**	**780**

From the foregoing table, the first 400 phones under investigation had a capacity to

hold 553 SIM cards. Hence, each mobile phone could carry 1.4 (553/400) SIM cards while each user owned 1.95 (780/400 SIM cards. This means that because there were more SIM cards owned than the total capacity of mobile phones to hold them, a number of users walked around with one or more SIM cards in their pockets to swap in their phones whenever they wanted to use them to communicate. It also implies that the demand for mobile phones in the rural setups was actually much higher than the supply.

4.3.8 Mobile phone acquisition patterns

Another important factor in the state of usage of mobile phones was the socioeconomic status of the community. To assess this uniformly, the study investigated the various methods employed by the communities in acquiring the first phones they owned. The results for this investigation were as shown in Table 13 below.

Table 13: Methods of acquiring mobile phones by rural communities

Method of acquisition	Number	Percent
Purchase	295	73.8
Donations	26	6.5
Gifts	26	6.5
Exchange	21	5.3
Offers	16	4.0
Lost and Found	11	2.8
Awards	5	1.3
Total	**400**	**100**

The results in Table 13 show that the largest proportion, that is 73.8% (295/400) of mobile phones had been purchased. This was followed by donations, gifts and exchange which accounted for 6.5% (26/400), 6.5% (26/400) and 5.3% (21/400) respectively.

Other methods through which rural mobile phones had been acquired included offers which accounted for 4% (16/400) and lost and found which accounted for 2.8% (11/400) of the phones. Acquiring phones through awards was the least prevalent method which accounted for 1.3% (5/400) of phones among rural communities.

In these findings, the fact that most users purchased their phones explains why most of them as observed in Table 11 owned basic phones which were the cheapest to acquire. This means that economic factors played a big role in determining the type of mobile phone systems and services used.

These results were further compounded by part of the interviews which helped to find out the average cost of mobile phones used by rural communities. It was found out that cumulatively, the total value of the first 400 mobile phones under investigation added up to Ksh 1,331,200. The average price of the phones owned was therefore Ksh 3,328.

Another measure of communication behaviour was the manner of affiliation of mobile phone users with specific service providers. This was intended to measure the rural market share and the level of investment of various service providers. Because different providers had put in place certain strategies and incentives to attract customers such as provision of flat calling rates for in-network and off-network calls, this measure was intended to elicit social, political and economic factors that affected mobile phone communication. The results of this investigation were as shown in Table 14 below.

Table 14: Rural Market share of mobile phone service providers

Service Provider	Frequency	Percent
Safaricom	266	66.5
Airtel	81	20.3
Yu	30	7.5
Orange	23	5.8
Total	**400**	**100**

The above table show that as at mid 2013, the mobile phone market share was dominated by Safaricom with 66.5% (266/400) followed by Airtel with 20.3% (81/400). The market shares of Yu and Orange were 7.5% (30/400) and 5.8% (23/400) respectively. These findings also reflect the proportionate levels to which the individual service providers had invested in the rural areas.

4.3.9 Ownership of locked and unlocked handsets

Another determinant of communication behaviour of the rural community involved examining the nature of their affiliation to specific service providers in terms of locked and unlocked mobile phones. Mobile phone users were therefore asked to state whether their phones were affiliated with their service providers through locked or unlocked service plans and the results were as per Table 15 below.

Table 15: Ownership of locked and unlocked handsets by mobile phone users

Service Plan	Frequency	Percent
Locked	105	26.3
Unlocked	295	73.8
Total	400	100

The foregoing table shows that slightly over a quarter, thus 26.3% (105/400) of mobile phone users in the rural owned phones that were subsidised by specific service providers and therefore locked to their own networks. Under normal circumstances,

using such phones on other networks was not possible. Those who owned unlocked phones were 73.8% (295/400) thus giving them flexibility in their communication patterns. However, ownership of the locked handsets is also a pointer to the economic factors at play. A numbers of users preferred the locked handsets which were cheaper to buy.

4.3.10 Pre and post-paid subscriptions

The study also measured the proportion of subscribers on post-paid and prepaid service plans as evidence of usage trends. For this reason, phone users were asked to state which service plan they had subscribed to and the results were as per Table 16 below.

Table 16: Pre and post-paid subscription of rural communities to mobile phone Service providers

Service Plan	Frequency	Percent
Post-paid	3	0.75
Prepaid	397	99.25
Total	**400**	**100**

The above table shows that the majority of 99% (397/400) of rural community mobile phone users were on prepaid service plan while only about 1% (3/400) was on post-paid service plan.

To assess the trends in service provision, mobile phone dealers were asked to state the proportion of rural clients they served and the results were as per Table 17 below.

Table 17: Rural clients served by mobile phone dealers

Class Intervals	Frequency (f)	Midpoint (x)	f x
≥30 <40	14	35	490
≥40 < 50	22	45	990
≥50 < 60	15	55	825
≥60 < 70	16	65	1040
≥70 < 80	9	75	675
≥80 < 90	14	85	1190
Total	90		5210
Mean	$\bar{x} = \frac{\sum fx}{\sum f} = \frac{5210}{90} = 57.9$		

The results above show that on average, 57.9% (5210%/90) of clients served by mobile phone dealers were from rural areas meaning the rural dwellers played a vital role in the mobile phone industry. However, this proportion differed sharply with the percentage of rural clients served by the service providers in the region which stood at about 30%. This means that whereas dealers mainly served rural communities from their locality, the service providers who were mostly based in urban areas mainly served urban dwellers because of proximity factor.

4.3.11 Mobile phone technology systems, services and features available to the rural communities

In line with the first objective of this study, the second research question helped to establish the mobile phone technology systems, services and features available to the communities and to what extent they met their needs.

To answer part of this question, mobile phone users were asked to state the general mobile phone features that were available to them in their locality. The question required the interviewers to scrutinise the phone(s) the rural mobile phone users had to

ascertain the availability of the services and features. Their responses were as presented in Table 18 below.

Table 18: Usage of features available on mobile phones

Features Available and used		
Features	Frequency	Percent
Connectivity		
Bluetooth	253	63.3
3G	84	21.0
USB	126	31.5
Wireless (Wi-Fi)	42	10.5
Infrared	0	0
Imaging		
Camera	295	73.8
Video Camera	200	50.0
Camera Flash	63	15.8
Messaging		
E-mail	179	44.8
MMS	179	44.8
Predictive Text	126	31.5
Entertainment		
FM Radio	274	68.5
Ringtones	274	68.5
Games	274	68.5
Media Player	189	47.3
Headphone Jack	189	47.3
Extras		
Vibrator	242	60.5
Memory Card	232	58.0
Organiser	221	55.3
Internal Memory	179	44.8
Touch screen	63	15.8
Video Calling	0	0

Generally the results in the foregoing table show that the camera was the most common mobile phone feature among rural communities with 73.8% (295/400) of the phone users reporting having used it. This was followed by FM radio at 68.5% (274/400); ringtones at 68.5% (274/400); games at 68.5% (274/400); Bluetooth at 63.3% (253/400); and vibrator at 60.5% (242/400).

In terms of the class of features investigated, the results show that the most prevalent connectivity, imaging, messaging, entertainment and extras features were Bluetooth,

camera, email, radio and vibrator respectively. However, in spite of being available on a number of mobile phones, video calling, infrared and imaging features did not record any usage at all, showing lack of capacity as well as the level of ignorance among mobile phone users regarding certain features on their phones.

4.3.12 Usage of internet and money transfer services

Besides the stated common features, the study helped to find out the extent to which internet and mobile money transfer services were used among the rural communities. These features were seen as the most substantive additives to the traditional use of phones and their pattern of usage shows the extent to which the communities were going to use mobile phones to meet their needs. The results of this investigation are shown in Table 19 below

Table 19: Usage of internet and money transfer services

Availability and use of phone features	Frequency	Percent
Use Mobile Phone Money Transfer	382	95.5
Phone(s) with Internet Capability	287	71.8
Use mobile phone Internet	282	70.5
No. of cellular modems owned	34	8.5

The above table shows that comparatively, mobile phone money transfer services were more prevalent among the rural communities than internet services. It is evident that more rural dwellers, thus 95.5% (382/400) used mobile money transfer services compared to 70.5% (282/400) who used internet services out of the 71.8% (287/400) of rural mobile phones had internet capability on their phones. The table also shows that in an effort to cover the gaps created by phones without internet, 8.5% of the mobile phone users owned mobile internet modems which they used with their laptops or as Wi-Fi routers which could be used by phones with similar capacity.

To show the level of coverage by mobile phone companies and service providers in the rural setups, the study investigated the various mobile phone technology systems and services available in rural localities. The results of this investigation were as in Table 20 belo.

Table 20: Phone technology systems and services available in rural communities

Systems	Frequency	Percent
Phone handsets	221	55.3
Communication masts	105	26.3
Satellite Systems	84	21.0
Signal Boosters	74	18.5
Wireless (Wi-Fi) Systems	21	5.3
Services/Features		
Phone Calls	400	100.0
SMS	387	96.8
Advertising	385	96.3
Radio	263	65.8
Phone charging	253	63.3
Music	242	60.5
Ring tones	232	58.0
Games	221	55.3
Mobile banking and money transfer	211	52.8
Photography	189	47.3
Television	84	21.0
Data storage	84	21.0
Phone sales	63	15.8
MMS	53	13.3
Service and maintenance	21	5.3

From the results in the foregoing table, phone handsets were the most useable mobile phone systems among the rural communities as 55.3% (221/400) of the mobile phone users said they were able to buy the handsets from their localities. The least useable systems were the Wireless (Wi-Fi) systems at 5.3% (21/400) meaning that only a few members of the rural communities were able to access them.

On the other hand, the most available mobile phone service was phone calls which registered 100% (400/400) usage. This was followed by SMS at 96.8% (387/400); advertising at 96.3% (385/400); radio at 65.8% (263/400) and phone charging. MMS

and phone maintenance were the least available services at 13.3% 53/400) and 5.3% (21/400) respectively.

The findings imply that most mobile phone users in the rural setups could easily acquire mobile handsets from their localities and that they mainly used them for communication through making phone calls and sending SMS.

On the other hand, the mobile phone dealers and service providers were also asked to state the main business activities or services they offered to their clients and the results in Figure 16 below were obtained.

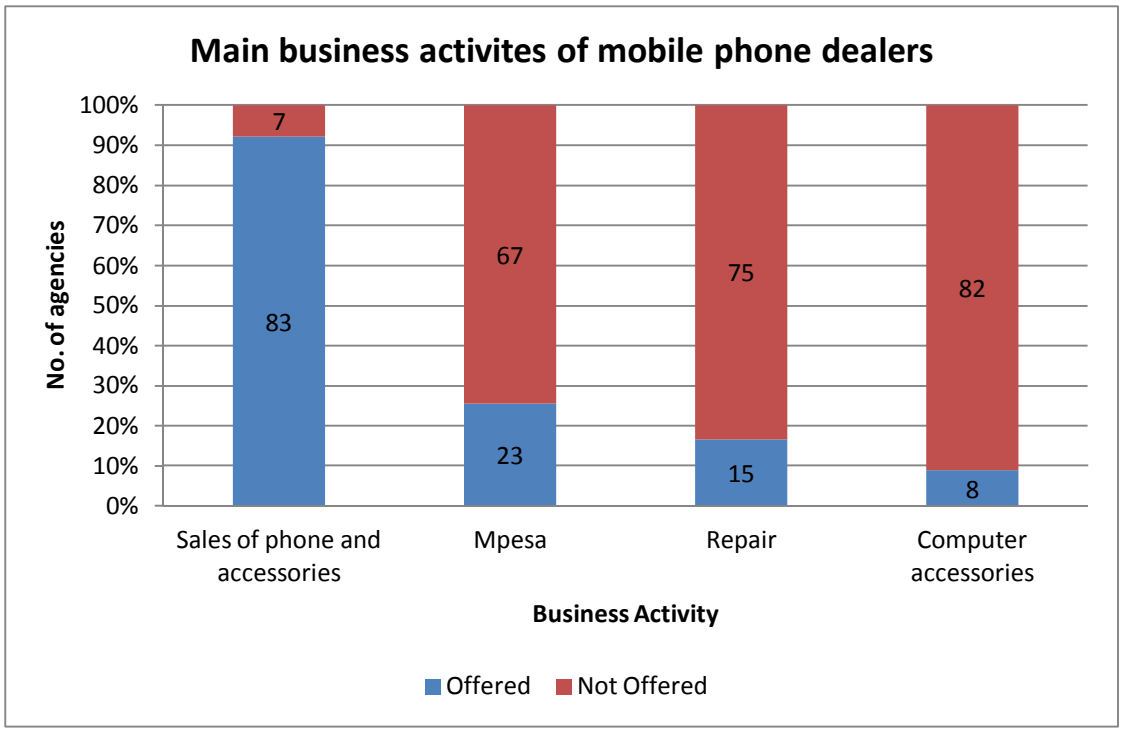

Figure 16: 100% Stacked Column Chart showing main business activities of mobile phone dealers

The results show that by far, the most common service offered by 92.2% (83/90) of the dealers was sales of phones and accessories followed by Mpesa which was offered by 25.6% (23/90). Repair services and computer accessories were offered by 16.7% (15/90) and 8.9% (8/90) respectively.

It is notable from the results that mobile phone dealers are mainly preoccupied with the sales of phones and their accessories as well as provision of Mpesa services. Being another reflection of economic factors playing a role in determining uptake of mobile phone services, the low number of computer sales is a reflection of the low demand for computers and their related services due to their relatively higher cost and portability issues.

4.3.13 Prevalence of mobile features among the rural communities

Assessment of frequency or active time of usage of various key mobile features was also used to measure the prevalence of the features. This assessment was useful in understanding the communication behaviour of rural communities in terms of their preferences in their bid to meet their information needs. Table 21 below shows the most frequently used features/services by the community rated on a scale of 1 to 5.

Table 21: Prevalence of mobile features/services among the rural communities

Feature/services	Mean Rating	Percent
Radio	4.4	88
SMS	4.29	85.8
Clock	4.27	85.4
Internet	4.06	81.2
Alarm and reminders	4.04	80.8
Calculator	3.94	78.8
Voice call	3.9	78
Camera	3.8	76
Audio	3.79	75.8
Games	3.52	70.4
Emails	3.48	69.6
Video	3.15	63
Voicemails	2.9	58
Word processing	2.9	58
MMS	2.62	52.4
Instant messaging	2.53	50.6

The results in the foregoing table show that comparatively, the most frequently used mobile phone feature/service in the rural set up was the radio. Rated at 88% (1758/400) this means that the rural community spent more time using the mobile phone radio

more than any other feature. This was closely followed by SMS at 85.8% (1714/400); clock at 85.4% (1709/400) and internet at 81.2% (1625/400). The most rarely used feature was instant messaging (IM) at 50.6% (1011/400).

The radio being the most used mobile phone feature was an indication that radio phones were quite popular among the rural communities. It is also noteworthy that the communities used more SMS communication with a mean rating of 85.5% than voice calls with a mean rating of 78%. According to the results, the least popular feature was instant messaging with a frequency rating of 50.6%. This was an indication that despite its important role in communication, many mobile phone users were not quite conversant with how the technology works.

4.3.14 Redundancy of Mobile Phone features/services

In order to understand what features/services the rural community regarded as unimportant to them, mobile phone users were asked to select the feature(s) they thought they did not need on their phones and the results were as shown in Table 22.

Table 22: Redundant Mobile Phone Features among rural communities

Feature/services	Frequency (f)	Percent
Instant Messaging	68	17.0
Voicemails	61	15.3
MMS	49	12.3
Games	45	11.3
Word Processing	25	6.3
Wireless (Wi-Fi)	23	5.8
Phone sales	17	4.3
Television	16	4.0
Advertisements	15	3.8
Camera	8	2.0
Calculator	8	2.0
Data Keeping	7	1.8
Mobile Money Banking	7	1.8
Ringtones	6	1.5
Radio	6	1.5

The foregoing table shows that the redundant mobile phone features in the table above were almost an exact inversion of the frequently used features in the previous table. Top on the list was instant messaging at 17% (68/400). This means that 17% of the mobile phone users did not want this feature on their phone as they regarded it unimportant. This was followed by voicemails at 15.3% (61/400); MMS at 12.3% (49/400); games at 11.3% (45/400) and word processors at 6.3% (25/400). The radio coming bottom in this listing at 1.5% (6/400) again means that it was the most important feature that mobile phone users associated with.

However, it is noteworthy that the highest ratio of redundant features was only 17% meaning that despite this negative rating, the same feature received an approval rating of 83% from the rest of the mobile phone users meaning that the features were generally useful to the users.

4.3.15 Satisfaction of rural information needs by mobile phone technology

In order to get direct views of mobile phone users on how they perceived mobile phone technology in terms of satisfying their information and communication needs, the users were asked to evaluate themselves and state their own satisfaction levels. The responses to this question were as per Table 23 below.

Table 23: Mobile phone users rating of their satisfaction with mobile phone technology

Rating (x)	**Frequency (f)**	fx
5	35	175
4	173	692
3	192	576
Total	400	1443
Mean	$\bar{x} = \frac{\sum fx}{\sum f} = \frac{1443}{400} = 3.6/5$	

In the foregoing table, the mobile phone users rated their own satisfaction level at 3.6/5 (72%) which was categorised as satisfied. This means that 72% of mobile phone users had their information and communication needs met by mobile phones.

Comparatively, when asked to rate the degree to which the information needs of mobile phone users as their clients were met, the mobile phone dealers responded as per the results in Table 24 below.

Table 24: Mobile phone dealers rating of clients' satisfaction with mobile phone technology

Rating (x)	**Frequency (f)**	fx
5	72	360
4	18	72
Total	**90**	**432**
Mean	$\bar{x} = \frac{\sum fx}{\sum f} = \frac{432}{90} = 4.8/5$	

According to these results, the mobile phone dealers rated the satisfaction of mobile phone users at 86% (4.8/5). This rating was within the category of very satisfied meaning that majority of mobile phone users were generally happy with the way mobile phones were helping them meet their information and communication needs. Again, the difference between this rating and that of the phone users was as a result of the fact that the mobile phone dealers' clientele included urban mobile users whose rating was higher thus pushing the overall score higher.

To maintain high levels of satisfaction with mobile phone technology, mobile phone users were asked to state what needed to be done. Their responses were grouped in broad categories as per table 25 below.

Table 25: Factors to increase satisfaction with mobile phone technology

Factors	Responses	Percent
Lower cost of airtime	267	66.8
Lower cost of mobile phones	241	60.3
Increase user education	207	51.8
Simplify phone menus	110	27.5
Add local content	91	22.8
Integrate local languages	66	16.5
Others (address security concerns)	5	1.3

From the results in the foregoing table, lower cost of airtime and mobile phones as well as increased user education were the factors that needed to be considered to enhance satisfaction of mobile phones among rural communities. These were mentioned by 66.8% (267/400), 60.3% (241/400) and 51.8% (207/400) of the mobile phone users respectively.

In the same context, 22.8% (91/400) of the mobile phone users suggested adding local content to the phones to make them more relevant. This would include having local ring

tones, traditional games and other features that the rural communities could easily identify with. This suggestion was closely related to the need to integrate local languages into the phones as suggested by16.5% (66/400) of the phone users. This would make the phones a lot easier to understand and use especially for people who were not highly educated.

The other factor that was suggested by 1.3% (5/400) of the mobile phone users was the need to use the phones in a manner that addresses security concerns that were hindering greater usage. For instance, a number of phone users said the way security agents were using the mobile phone technology to track and arrest criminals was haphazard and was subject to abuse where innocent civilians were targeted and their privacy infringed.

When asked a similar question to suggest what needed to be done to increase the level of satisfaction in the usage of mobile phones, the mobile phone dealers responses were also grouped in broad categories as per Table 26 below.

Table 26: Factors of mobile phone user satisfaction

Factors of satisfaction	Frequency (f)	Percent
Lower the cost of mobile phones	84	93.3
Increase user education	68	75.6
Simplify menus	53	58.9
Add local content	43	47.8
Use of local languages in phones	41	45.6
Give Free/subsidised phones to poor people	8	8.9

According to the above table, 93.3% (84/90) which represented the largest proportion of mobile phone dealers also suggested that the cost of mobile phones needed to be lowered to make them affordable especially to the mobile phone users who were less economically endowed compared to their urban counterparts. The cost included that of mobile phone handsets, accessories and airtime. On the other hand, 75.6% (84/90) of

the dealers felt that intensifying user education programmes would increase satisfaction in the use of mobile phones.

Besides the foregoing suggestions, 58.9% (53/90) of mobile phone dealers suggested the need to simplify mobile phone menus to make them flexible and easier to operate by people of all walks of life. Other suggestions that would spur greater usage of mobile phones included adding more local content, Use of local languages in phones and offering of free or subsidised phones to poor people by the Government. These were suggested by 47.8% (43/90), 45.6% (41/90) and 8.9% (8/90) of the mobile phone dealers respectively.

4.3.16 Mobile Phone Signal Strength

Mobile phone users were also asked to rate on a scale of 1 to 5 the signal strength of all the four mobile phone service providers from the perspective of their rural residences. The results of this assessment were as per Table 27

Table 27: Average Mobile Phone Signal Strength of Various Service Providers

Service Provider	Average Signal Strength	Percent
Safaricom	2.94	58.8
Airtel	2.91	58.2
Orange	2.17	43.4
Yu	1.60	32.0
Mean	**2.41**	**48.1**

The results in Table 27 above can be visualised better as per the graph in Figure 17.

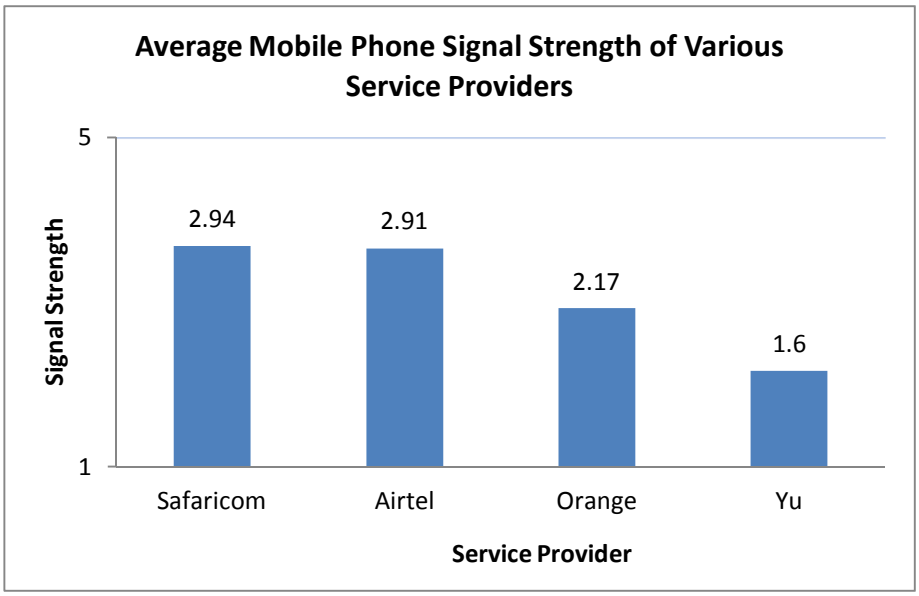

Figure 17: Average Mobile Phone Signal Strength of Various Service Providers

In the foregoing table and chart, the mobile phone users reported that Safaricom had the strongest signal strength at 58.8% (2.94/5) emanating from its wider network coverage. This was closely followed by Airtel at 58.2% (2.91/5). Both of these could be regarded as fair. However, Orange was third at 43.4% (2.17/5) while Yu was fourth at 32% (2.94/5). Both of these were regarded as poor. In fact, when the average network signal strength of all the four service providers was consolidated and regarded as the overall mobile network signal strength for Western Province, it stood at 48.1% (2.41/5) which was regarded below average.

4.3.17 Subscriber calling and expenditure patterns

In order to understand and comparatively analyse the communication trends and patterns among mobile phone users, the users were asked to state in approximate terms how many calls they received and made per day and how much time and money they spent on each call. The results were as per Table 28 below.

Table 28: Subscriber calling and expenditure patterns

Average number of calls per day		
Call type	in	out
Cumulative	2187	2330
Average	5.47	5.83
Average time for each call in seconds		
Call type	in	out
Cumulative	359	323
Average	53.85	48.45
Average value spent on calls in Ksh		
Call type	in	out
Cumulative	8222	7152
Average	20.56	17.88

From the foregoing results, it is evident that phone users made more calls than they received. On average, they received 5 phone calls for every 6 phone calls they made per day. However, the results also show that they spent less time on each call they made than on the one they received. On average, each of the call they made lasted 49 seconds while the one they received lasted 54 seconds. This is also evidence that economic factors played a role in mobile phone usage. It is clear here that users preferred receiving phone calls because it was cheaper to them than calling.

4.3.18 Emerging issues in mobile phone technology and their effect on usage

In line with the first objective of the study, the third research question helped to establish the emerging issues both technical and behavioural in mobile phone technology and their effect on usage.

To answer the question, the mobile phone users were asked to state in their own experience if they were aware of any new or emerging issues that had affected or were affecting the way they used mobile phone technology. The results of this investigation

showed that 59% (236/400) of the mobile phone users were aware of some new or emerging issues that had an impact on the way they used mobile phones.

Those who said they were aware of emerging issues or factors that affected mobile phone usage were further asked to state the specific issues/factors. The results were grouped in thematic categories as disaggregated in the following table.

Table 29: Issues/Factors that affected the development of mobile phone technology

RURAL MOBILE PHONE USERS				MOBILE PHONE DEALERS			
POSITIVE FACTORS				**POSITIVE FACTORS**			
Factor	Main Effect	Frequency	Percent	Factor	Main Effect	Frequency	Percent
Internet	Use for research	156	39	M-banking and money transfer,	Economic prosperity	42	46.7
M-**banking** and money transfer,	Increased phone usage	151	37.8	Social networks	Stay in touch	41	45.6
Multimedia functionalities,	Sharing of music	148	37	E-learning	More education opportunities	39	43.3
Reducing cost of airtime	More and longer calls	127	31.8	Mobile internet	More and cheaper access	31	34.4
Technological developments	Health issues	122	30.5	Price reduction	Mass connectivity	17	18.9
Better living standards	Immorality	111	27.8	Improving technology	Better phones	14	15.6
Proliferation of service providers	Competition and multiplicity of SIM cards	69	17.3	Text messaging	Cheaper communication	14	15.6
Use of memory card	Share backups	52	13	Number portability	Easy communication	13	14.4
National/international policies	Roaming technology	49	12.3	Phone maintenance	Increased durability	9	10.0
Changing expectations	Newer models/ smaller/more powerful phones	49	12.3	Phone variety	More user satisfaction	8	8.9
Increasing literacy levels	Increased usage and development level	34	8.5				
Rural coverage	Simplification of phones	26	6.5				
Population increase	Wider range of phones	20	5				
Increasing user education	More usage	16	4				
High cost of computers	Encouraged phone use	14	3.5				
NEGATIVE FACTORS				**NEGATIVE FACTORS.**			
Criminal use	Increased fraud	110	27.5	Criminal use	Increased Insecurity	62	86.9
Spying tracking	Use of GPS systems	62	15.5	Relationship issues	More divorces	43	47.8
Increased dependence	Inefficient com/extravagance addiction	60	15	High prices	Affordability	36	40.0
Theft of phones	Continuing development of antitheft technology	59	14.8	Pornography	Increased Immorality	27	30.0
Counterfesance	Reduced fakes/ increase lifespan	31	7.8	Phone repair & maintenance challenges	More e-waste	14	15.6
Unfaithfulness	Family disintegration	26	6.5	Counterfesance	Poor phone quality	11	12.2
Lack of electrical power	Longer battery life/solar chargers	17	4.3	Competition	More focus on marketing	8	8.9
Technology phobia	Low usage	14	3.5	Mobile internet	Rampant pornography	5	5.6

The results in the foregoing table show that from the mobile phone users' perspective, the internet stood out as the most significant factor that had greatly promoted the development and use of the mobile phone technology. This was according to 39% (156/400) of the rural mobile users. The main effect of this development was increased usage of the phone and particularly for education and research purposes. However, the internet had also caused the phones to increasingly be used for negative reasons including access to and sharing of pornographic materials.

The internet use was closely followed at 37.8% (151/400) by a more recent innovation which had made it possible to use the phone as a tool for mobile banking and money transfer. This had also led to increased usage of the phone and other services such as the internet and phone calls by making it easier to purchase airtime. However, this had to a lesser extent led to the emergence of criminals who tried to take advantage of loopholes that still existed in the innovation to defraud unsuspecting users.

Other factors that had boosted the use of the phone were the introduction of multimedia functionalities in the phones, reducing cost of airtime and handsets and technological developments. The development of multimedia functionalities in mobile phones in particular had marginally increased the uses to which the phones could possibly be put including radio and TV, video and audio recording. Reduced cost of air time meant that more and more people could now afford to buy and use phones for various purposes.

The continued development of the mobile phone technology on the other hand had also played a big role in enticing more people to use it. Unfortunately, increased use of mobile phones had also come at a cost including increasing immorality arising from sharing of pornographic materials.

Improved living standards as well as proliferation of service providers mentioned were also cited as factors that had increased usage of mobile phones. The later had led to positive competition among the service providers and also caused the development and supply of phones with multiple SIM cards.

The advent of phones with the option for addition of external memory had also increased the usage of phone for additional purposes beyond the traditional ones. It had increased backup storage and sharing of data and information among users.

Formulation and implementation of national and international policies governing cross border use of mobile phones had greatly boosted usage through the development of roaming technologies. This was a major catalyst of mobile phone usage in the sense that it opened up international borders for rural communities to communicate and exchange of ideas.

Other factors included changing user expectations, increasing literacy levels and expanding of rural coverage with mobile phone networks. The findings indicate that the ever-changing user expectations were thought to be responsible for the development of newer and miniaturised models with more powerful features to try and catch up with corresponding demand thus increasing usage. Furthermore, the introduction of free primary education in Kenya had lead to increasing literacy levels which encouraged usage of mobile phone whose features such as text messaging and internet were highly dependent on literacy. Similarly, the competition among service providers to increase their coverage to more rural areas had led to more usage of phones in those areas.

A number of mobile phone users also felt that population increase which had led to more diverse user needs thus challenging the mobile phone makers to develop a wider range of phones and increasing user education which led to more user knowhow had

greatly boosted usage of phones. However, the least positive factor mentioned by 3.5% (14/400) of the phone users, was the relatively higher cost of computers which had forced a number of users to resort to mobile phones as an alternative for internet access and data processing.

On the other hand, factors that had contributed negatively to the development of mobile phone usage were also highlighted. According to the results in the foregoing table, criminal use of mobile phones, tracking and spying as commonly done by security agents as well as increasing dependence on the phones were the leading factors that had negatively affected the development and use of mobile phone technology. These were mentioned by 27.5% (110/400), 15.5% (62/400) and 15% (60/400) of the mobile phone users respectively.

The criminal use was particularly associated with fraud, where criminals would use phones to get money from unsuspecting users. Even though this could be seen as having contributed to the development of the GPS technology on phones, tracking of people by security agencies had made some users who required total privacy at certain times to switch off their phones thus scaling down their usage.

Having quickly become the most fashionable technology of the day, competition among users to have the latest phones had led to rising cases of theft of phones. Although this had contributed to the development of antitheft technologies on phones, it had generally curtailed usage in that whereas the victim of theft would be denied the chance to use the phone, the culprit would on the other hand dread using it for fear of being tracked and apprehended.

Other deterrent factors included counterfesance, increased cases of unfaithfulness, lack of electrical power and technology phobia. Increasing number of counterfeit phones in

the market for instance had led to unreliability of services due to frequent breakdowns, reduced phone life and incompatibility with original systems thus deterring usage. In the same vein, cases of mobile phone related unfaithfulness had caused family disintegration thus leading to restricted usage in some cases. Although limited supply of electricity in the world had led to the development of more powerful and longer lasting battery kits and solar chargers, electrical blackouts were in the long term deterring phone usage especially in the remotest areas without proper infrastructure.

The phobia for technology especially in the wake of widespread myths and misconceptions about certain features of the mobile phones had made a number of users to scale down usage of mobile phones especially for fear of contracting illnesses. This had contributed to low usage.

Comparatively, phone dealers also mentioned a number of factors having positively affected the use and development of mobile phone technology. Among these factors, the introduction of mobile banking and money transfer were the most prominent having been mentioned by 46.7% (42/90) of the mobile phone dealers. This had contributed to economic prosperity with more and better circulation of money and availability of banking opportunities for those who could not otherwise afford it in conventional banking institutions. This was followed by social networking which had helped people stay in touch with one another.

As is evident in the table, other positive factors included e-learning which had contributed to more education opportunities, mobile internet which had led to cheaper access to information, continued and sustained price reduction which had been responsible for the booming mass connectivity as well as improving technology which had helped to produce better and more reliable phones. The increasing use of text

messaging which was a common feature on all phones was yet another positive factor that had made communication a lot cheaper compared to the traditional postal mail. A number of mobile phone dealers also noted that number portability had contributed to easier and hence more efficient communication while availability of phone maintenance facilities was said to have increased service life and durability of phones. The least positive factor mentioned by 8.9% (8/90) of phone dealers was the proliferation of the diverse variety of mobile phones. This was thought to have contributed to more user satisfaction since users were able to choose the phone that they were most comfortable to use and operate.

Regarding the factors that they thought had negatively contributed to the development of the mobile phone industry, the use of mobile phones in abetting crime which had caused increased insecurity in the country, was at the top. This was mentioned by 86.9% (62/90) of the mobile phone dealers followed by relationship issues which had led to higher divorce rates.

Despite citing reduction of prices as a positive factor, high prices which had caused affordability issues was mentioned by 40% (36/90) of the mobile phone dealers as a negative factor. On the other had pornography which had led to increased immorality and inadequate phone repair and maintenance facilities which had led to more e-waste were also mentioned as negative factors.

The other negative factors were counterfesance which had led to poor phone quality, high level of competition which had made service providers focus a lot more on marketing than value addition as well as mobile internet which was contributing to rampant access to pornographic materials.

Comparatively, responses from both the mobile phone users and dealers had a lot of similarities especially among the factors that negatively affected the mobile phone technology. However, inasmuch as the negative factors were dominated by crime related issues, positive factors centred on the use of the mobile phone technology for communication and economic purposes.

4.4 Modes of information sharing and empowerment

In line with the second objective of the study, the fourth research question sough to establish the fundamental ways through which mobile phone technology was contributing to empowerment of the rural communities.

4.4.1 Basic modes of using mobile phone technology and their usefulness

To investigate the fundamental ways of using mobile phone technology and their usefulness in empowering rural communities, part of the interview required mobile phone users to rate the usefulness of mobile phone technology to them and the rest of the community in general. in this regard, 84% (337/400) of the mobile phone users said that mobile phone technology was very useful to them while 63/400 (16%) said it was useful. On average, the total rating was 4.8/5 (96%) which implied that the rural communities generally regarded mobile phone technology as very useful to them.

To understand better how the technology was useful to the rural communities, mobile phone users were asked to state specific ways through which the technology was useful to them. Their responses were grouped as per Table 30.

Table 30: Specific ways of mobile phone usefulness to rural communities

Mode of Communication	Frequency	Percent
Communication	347	86.8
Entertainment	221	55.3
Internet	168	42.0
Money transfer	147	36.8
Socialization/networking	147	36.8
Education and research	137	34.3
Information access	126	31.5
Archival services	95	23.8
News	84	21.0
Use of phone accessories	74	18.5
Business management	53	13.3
Banking	21	5.3
Security	21	5.3

From the foregoing table, 86.8 % (347/400) of rural communities found communication to be the most useful aspect of mobile phones. This was followed by entertainment, internet and money transfer as mentioned by, 55.3% (221/400), 42% (168/400) and 36.8% (147/400) respectively. The results show that the rural mobile phone users cherished communication and entertainment which they achieved through phone calls, radio and TV communication as well as internet. In the same vein, the users used mobile phones extensively in money transfer as a way of sharing and circulating their financial resources for economic development.

The least useful aspect was security which was cited by 5.3% (21/400) of the mobile phone users. These findings were in line with the trends where the technology was more and more being used by the state security agencies such as the police and intelligence agencies in tracking criminals and stolen property.

4.4.2 Empowerment of Rural Communities by Mobile Phone Technology

The study went further to determine the various ways through which the mobile phone technology had empowered rural communities to live better lives. As defined by World Bank (2011: para. 1), empowerment is the process of increasing the capacity of individuals or groups to make choices and to transform those choices into desired actions and outcomes. Empowerment therefore is the increased capacity to do things better as a result of some process.

According to the findings, 100% (400/400) of the mobile phone users and mobile phone dealers (90/90) said that the technology had indeed empowered rural communities to live better lives. This is a clear indication that indeed the mobile phone technology had helped rural communities improve their lives and contribute more significantly to the general development of society.

In addition, the mobile phone users were asked to state the specific ways through which they had been empowered by the mobile phone technology and the results were categorised as per Table 31 below.

Table 31: Specific ways of empowerment by mobile phone technology to rural communities

Empowerment	Mobile phone users n=400		Mobile Phone Dealers n=90	
	Frequency	Percent	Frequency	Percent
Communication	158	39.5	90	100.0
Information	149	37.3	85	94.4
Entertainment	130	32.5	59	65.6
Education	102	25.5	56	62.2
Social	93	23.3	51	56.7
Economic	84	21.0	37	41.1
Political	60	15.0	18	20.0
Cultural	56	14.0	11	12.2
Spiritual	47	11.8		
Other (Research)	5	1.3		

The results in the above chart show that the highest level of empowerment cited by 39.5% (158/400) of rural communities emanating from mobile phone technology was through communication. By being able to communicate easily and share information and ideas, the community was more knowledgeable and in a vantage position to do things better and improve their lives. The users also cited other modes of empowerment including information at 37.3% (149/400), entertainment at 32.5% (130/400) and education at 25.5% (102/400). Phone users who were economically empowered were 21.0% (84/400) while those spiritually empowerment were 11.8% (47/400). A number of phone users said that they received religious sermons and even spiritual guidance from their religious leaders through the mobile phones thus becoming spiritually empowered. One particular user when asked to expound on how he was spiritually empowered, cited a relevant episode in his life by saying:

> "My religious leader called me on my mobile phone and after a long session of spiritual guidance and being taught more about the scriptures, he prevailed upon me to change from my criminal lifestyle to farming. I am now passionate about farming which is helping me take care of my family and will never go back to the evil ways." (Interviewee 202, male, 26/82013)

On the other hand, research was suggested by 5/400 (1.3%) of the mobile phone users. This means that the mobile phone users also appreciated the role of mobile phones in enhancing research and improving their lives.

On the other hand, when asked to give their views on how they thought the mobile phone users were empowered, 100% (90/90) of mobile phone dealers said that the users were empowered through communication. This observation was followed by 94.4% (85/90) of mobile phone dealers who felt that the users were empowered through information sharing while 65.6% (59/90) felt that they were empowered through entertainment.

Other modes of empowerment were educational, social, economic and political. These were mentioned by, 62.2% (56/90), 56.7% (51/90, 41.1% (37/90) and 20% (18/90) of the dealers respectively. Furthermore, 12.2% (11/90) of the dealers said that the users were empowered culturally.

The most important observation in the findings from the two categories of respondents was that although they differed in frequency, their responses were similar in the order of prevalence, starting from communication all the way to spiritual empowerment. This was not only a measure of reliability of the instruments used in data collection but also an indication that both the mobile phone users and dealers shared common experiences in relation to the use of the mobile technology.

In addition, the study went further to prompt mobile phone users to state specifically how each mode of usage had helped or empowered them to share information and do things better. Table 32 below summarises the responses for each mode of usage from the most prevalent to the least prevalent.

Table 32: Enhancement of information sharing and empowerment of rural communities by mobile phones

How information sharing was enhanced																		
Phone Calling			SMS			Mobile Banking			Mobile Radio			MMS			DSTV			
Mode of information sharing	*f*	%	Mode of information sharing	*f*	%	Mode of information sharing	*f*	%	Mode of information sharing	*f*	%	Mode of information sharing	*f*	%	Mode of information sharing	*f*	%	
Efficient communication	303	75.8	Faster communication	136	34	Buy airtime	325	81.3	Share news with friends	248	62	Not sure	352	88	Not sure	382	95.5	
Easy communication	72	18	Group communication	113	28.3	Send airtime to others	44	10.9	Fore knowledge	55	13.8	Share pictures	48	12	Share multiple channels	18	4.5	
Documentation	25	6.3	Easy communication	75	18.8	Get updates from bank	31	7.8	Exchange greetings	40	10							
			Uninterrupted communication	44	11				Easy communication	34	8.5							
			Integrated communication	22	5.5				Share entertainment	23	5.8							
			Selective communication	10	2.5													
Total	400	100		400	100		400	100		400	100		400	100		400	100	
How empowerment was enhanced																		
Phone Calling			SMS			Mobile Banking			Mobile Radio			MMS			DSTV			
Mode of empowerment	*f*	%	Mode of empowerment	*f*	%	Mode of empowerment	*f*	%	Mode of empowerment	*f*	%	Mode of empowerment	*f*	%	Mode of empowerment	*f*	%	
Save time	218	54.5	Mass communication	143	35.8	Communicate more	269	67.3	Being Knowledgeable	265	66.3	Not sure	356	89	Not sure	385	96.3	
Make informed decisions	85	21.3	Efficient Communication	84	21	Save time	67	16.8	Mass communication	68	17	Take and send clear photos	18	4.5	Save time and money	15	3.8	
Socialise easily	48	12	Make informed decisions	57	14.3	Respond to emergencies	64	16	Documentation	19	4.8	Reliability	16	4				
Share knowledge and experiences	24	6	Availability (on all phones all time)	48	12				Make informed decisions	48	12	Save time and money	10	2.5				
Broadcast to many	24	6	Reliability	28	7													
			Integrate with social media	21	5.3													
			Relevance of messages	19	4.8													
Total	**400**	**100**		**400**	**100**		**400**	**100**		**400**	**100**		**400**	**100**		**400**	**100**	

Key
f = Frequency
% = Percent

4.4.2.1 Phone Calls

According to the results in the foregoing table, the highest proportion, that is 75.8% (306/400) of the mobile phone users said that using a mobile phone to make calls was quite efficient implying that they used less resources to communicate compared to using the traditional landline. they also cited the fact that calling using a mobile phone was a much easier way to communicate especially with people who were far away and regardless of whether they were literate or not since verbal communication was universal. A number of users also appreciated that by use of mobile phone calls, it was possible to simultaneously record the conversation for future reference thus using the mobile phone as a documentation tool.

On how the phone calling had empowered them to do things better, the phone users said that it had enabled them save and use their time more productively. In times of emergencies, saving time could mean the difference between life and death and therefore, mobile phone technology could also be said to be empowering people to save lives.

Other ways through which the mobile phone calls had empowered rural communities included helping them to make informed decisions, socialise easily with each other and share knowledge and experiences. Similarly, a number of mobile phone users said they were empowered by being enabled to *sambaza* or broadcast information to large audiences simultaneously and thus achieving more with fewer resources.

In this regard, one major observation was that the popularity of phone call communication was among other factors based on the fact that it was a universal feature available on all mobile phones and therefore issues of compatibility among and between other mobile phones and other phone types such as landlines were not a

limitation.

4.4.2.2 Short Message Service (SMS)

The second most prevalent mode of commutation was the Short Message Service (SMS). Mobile phone users said that information sharing was enhanced by SMS through faster communication. By being able to send a single message to a multiplicity of recipients efficiently and simultaneously, it was possible to reach out to a large group of people and similarly get quick feedback hence speeding up information sharing.

Other ways in which SMS had enhanced information sharing was through the possibility of group or cloud messaging, ease of communication as well as minimal interruption during communication. The users felt that whereas it was easy to interfere with phone calls through noise and other physical barriers, SMS would deliver the complete message even when the recipient was busy or not on air at the time of transmitting it. Furthermore, SMS enhanced information sharing by its flexibility to integrate with the social media which had become part of the modern world. The possibility of transferring SMS which were already in textual form into a browser meant that one could easily convert such messages into emails, social media messages or even key words for searching the internet without having to retype them and hence saving a lot of time.

On the other hand, selectivity of communication was also cited by 2.5% (10/400) of the mobile phone users as a way of enhancement of information sharing. Whereas many people would be hindered to share confidential information in public through phone calls, SMS was regarded as the best alternative thus ensuring that there was continuous communication and information flow. With SMS, it was possible to select specific contacts of people to be communicated to and avoid redundancy that may arise when

information is sent to or heard by people who did not need it as it was the case with phone calls.

On how mobile phone technology had empowered them through SMS, mobile phone users said that this was achieved largely through the possibility of mass communication. Mass communication ensured consistency and standardisation thus being good for official messages and saving the time that would otherwise be spent on clarification. It is for this reason that 21% (84/400) of mobile phone users said they felt empowered by SMS service through efficient communication which would help them use and manage their time well. Unlike the phone call communication which would normally be affected by network signal quality, SMS could be transmitted accurately even with the lowest signal strength and quality.

As a result, the capacity to transmit information accurately empowered 14.3% (57/400) of the mobile phone users to make informed decisions. Other users said that the near perpetual availability of the SMS option even when the recipient was unavailable empowered them to communicate continuously.

Availability, reliability, flexibility to integrate with social media and the relevance of messages were mentioned as other ways of empowerment. Indeed, the possibility to selectively target specific groups with specific messages ensured maximum relevance thus saving the time of other people who may not be interested in the message.

4.4.2.3 Mobile Banking/Money Transfer

Even though mobile banking and money transfer services had recently been introduced within the general scope of mobile phone services, the rural communities cited them among the services that had greatly enhanced their capacity to share information as well as empowered them to live better lives. The study went further to investigate the

specific ways in which this was achieved.

The results in the foregoing table show that 81.3% (325/400) of the mobile phone users said that mobile banking and money transfer services were substantively being used as an easier and more efficient way of purchasing airtime which was required for communication and information sharing. The users said that the enhancement of information sharing was through the ability to send airtime directly or through the money transfer to their recipients who would otherwise be unable to communicate. Other phone users said they used them to get their bank account updates and even transact and make or receive the necessary updates.

On how these services empowered them, the mobile phone users said that the services which helped them to get airtime easily and at any time, empowered them to communicate more thus getting more information and knowledge. In the same vein, they said they empowered them to save and hence spend their time wisely and more productively as well as to respond effectively to emergencies and thus, saving lives.

4.4.2.4 Radio and Television

Traditionally, the communities living in Western Province were known to be radio and television enthusiasts. They particularly adored the radio. This is why mobile radio and television were among the most prevalent features on the phones they owned. In view of this, the study established to what extent these features had enhanced their capacity to share information and get empowered.

The findings in the table show that whereas 62% (248/400) of the mobile phone users used mobile radio and TV to share information through watching news with friends, others said they used them to get prior knowledge of things likely to happen in future so as to make better planning decisions and possibly take or give the necessary

precautions. On the other hand, some phone users said that these features helped and encouraged them to exchange greetings and interact with others during live media programmes. The ease of communication and sharing of entertainment were also said to be factors that greatly promoted sharing of information through mobile or cellular radio and TV.

Regarding how the mobile radio and TV empowered them, 66.3% (265/400) said that they helped them become knowledgeable and hence able to make better decisions while others said that the mass communication inherent in the two features had empowered them to communicate more effectively and save costs. Because of the capacity for mobile phones to make recordings in highly compressed digital formats some phone users said they were empowered to document programmes for future and reference hence empowering them to be better decision makers.

4.4.2.5 Media Messaging Services (MMS)

Although the study found the MMS to be among the services with the poorest uptake among rural communities, this was as a result of ignorance rather than a matter of choice. The study therefore went further to investigate how the few who ever attempted to use the services were being helped to share information and get empowered.

The results show that whereas 88% (352/400) of the mobile phone users were not sure about this service, 12% (48/400) said the service enabled them to send and receive pictures from friends, and hence, enhancing information sharing. The users said they used this service to take and send clear images instead of using the scanning and emailing option which was not only expensive but also time consuming and rare in the rural settings. This service empowered them to be more reliable when communicating with friends and efficient in the use of their time and money.

4.4.2.6 Digital Satellite Television (DSTV)

Among the services that were examined in terms of how they enhanced information sharing and empowerment of rural communities, the DSTV seemed to be at the bottom of the prevalence score. Nevertheless, in order to improve its uptake, it was necessary to find out whether it added any value to people's lives.

According to the findings in the above table, 95.5% (382/400) of the mobile phone users were not sure about this service and hence did not use it. Only 4.5% (18/400) of the phone users who we aware of and used the service said it helped them access and share multiple channels of media programmes. This, in essence, helped them share current information that was prerequisite to making informed decisions.

On the other hand, 96.3% (385/400) of the rural communities were not sure about how the service empowered them to live a better life. Only 3.8% (15/400) said that the service empowered them to access high quality information easily and efficiently thus enabling them save and make better use of their time.

4.5 Key factors affecting the growth of mobile phone technology

In line with the third objective, this study investigated both the positive and negative factors that had affected the growth and use of mobile phone technology. Because "a problem well understood is a problem half solved" (Mercer, 2013: Para 1), the study went a little deeper in this regard to discern the various key factors affecting usage and development of mobile phone technology with a view to finding appropriate solutions to them. The study examined the general and major challenges affecting mobile phone technology and risks and maintenance issues associated with its use. Personal barriers impeding proper use of the technology were also explored.

To make their responses exhaustive, the respondents were first asked to state

advantages and disadvantages of mobile phone technology. In this regard, they stated factors that made them like or dislike mobile phone technology before zeroing in on challenges that they thought affected its development.

4.5.1 Advantages and Disadvantages of mobile phone technology

The 5th research question helped to investigate the key factors that had endeared the mobile phone technology to the communities thus promoting its usage. To answer the question, mobile phone users were asked to state the advantages which attracted and encouraged them to own and use mobile phones. On the other hand, they were also asked to state the disadvantages which discouraged them from using them. Very diverse responses were obtained and classified under broad categories as listed in Table 13 below.

Table 33: Advantages and disadvantages of mobile phone technology to rural communities

Advantages	Frequency	Percent	Disadvantages	Frequency	Percent
Efficiency	263	65.8	High Cost	331	82.8
Ease of use	246	61.5	Electricity dependence	179	44.8
Multimedia capacity	157	39.3	Incredibility	99	24.8
Enjoyability	137	34.3	Health issues	91	22.8
Convenience	109	27.3	Relationship issues	75	18.8
Mobile money transfer	98	24.5	Criminal use	68	17.00
Documentation capacity	93	23.3	Immorality	68	17.00
Educational value	75	18.8	Network dependence	47	11.8
Affordability	72	18.0	Lack of confidentiality	43	10.8
Multipurpose	51	12.8	Delicateness	42	10.5
Seamless information access	50	12.5	Technical, Knowledge needs basic	37	9.3
Reliability	42	10.5	Insecurity	31	7.8
Information sharing	42	10.5	Laziness	26	6.5
Duality (interactiveness)	22	5.5	Public nuisance	25	6.3
			Maintenance problems	19	4.8
			Phone Dependence	11	2.8
Total	1457			1192	

The results in the foregoing table which gives a side-by-side breakdown of the two

variables under investigation show that comparatively, there were more advantages (1486) than disadvantages (1192) cited.

Similarly, the results show that the most outstanding advantage of the mobile phone was its efficiency as mentioned by 65.8% (263/400) of the rural users. This was the case because most rural areas were not endowed with the best infrastructure and anything that would help them save time in their ventures was to be appreciated more.

The second most outstanding advantage was ease of use which was mentioned by 61.5% (246/400) of the mobile phone users. From this, it is clear that many rural communities found it easier to use mobile phone and all its related technologies and services than the traditional landline which relied on abstract and lengthy procedures depending on the nature of the phone call to be made. International calls for instance required the assistance of an operator and one had to bear with significant delays and the lag in communication that was not only expensive but also time consuming.

The multimedia and multitasking capacity of mobile phones was also mentioned by 39.3% (157/400) of the mobile phone users as a major advantage while 34.3% (137/400) said that it was more enjoyable to use mobile phones. The technology made it possible to use the mobile phone for any of its substantive purposes while at the same time enjoying a game or listening to music.

With mobile phone technology, users could make calls and even transact in the comfort of their homes. Convenience was therefore mentioned by 27.3% (109/400) of the users as yet another advantage.

More advantages included mobile money transfer, documentation capacity and the educational value. The users said that the technology had made it easier to carry out money transfer services with fewer risks and at the same time to record the transactions

and communication processes for future reference. Its documentation and multimedia functionalities such as visual and sound players were handy in educating the masses especially young children.

Eighteen percent (72/400) of the mobile phone users said that because of the convenience inherent in mobile phones, they were more affordable thus encouraging them to make more calls. Compared with the traditional landline phones, mobile phones could be used for many other functions hence their multipurpose nature was mentioned by the phone users as yet another advantage. Other advantages included accessibility to a wide range of information, reliability of the phones, the ability to share mobile phone information and duality or interactiveness of communication. The reliability mentioned here referred more to the hardware systems more that the information that they carried or relayed.

By far, the most outstanding disadvantage of mobile phones was the high operational cost as mentioned by 82.8% **(**331/400) of the mobile phone users. It is important to note that though 18% (72/400) of the mobile phone users had mentioned that affordability was an advantage, what they mentioned here was the long term cost of communication. Because it was a lot easier, enjoyable, fashionable and convenient to use a mobile phone, people were being encouraged to use it more and more often thus making the long term cost of usage high.

The second most outstanding disadvantage was the ever dependence of mobile phones on electrical power. Most rural parts of the Western Province did not have electricity hence mobile phones users would find it difficult to use them when they ran out of electrical power. Issues of credibility were also mentioned as a major disadvantage. In the recent past, mobile phones have been closely associated with cheating and dishonesty hence information relayed by use of these gadgets was largely regarded as

incredible. Furthermore, mobile phones have also been associated with health issues such as stress, cancer, insomnia and addiction thus featuring among major disadvantages. These also included relationship issues, criminal use, immorality and network dependence. In this regard, there was a great concern that mobile phones were being used for immoral reasons and causing breakups of relationships thus leading to separations and divorces.

On the other hand, a good number of mobile phone calls were made in public thus making them lack confidentiality as mentioned by 10.8% (43/400) of the mobile phone users. This was closely related to the habit of people shouting when calling thus making it a public nuisance.

Other minor disadvantages of the technology were the delicateness of the phones which made it easy to break down or get lost, technicalities involved in learning and their susceptibility to cause insecurity. Users also cited the fact that mobile phones caused laziness, were subject to maintenance problems and were also prone to cause dependence syndrome.

It was a lot easier to lose a mobile phone than a landline and therefore many people ended up either buying a new phone or having to do without one for awhile. Furthermore, mobile phones had numerous accessories and related services which were technical to learn thus requiring time and some level of education.

A number of users also cited the use of mobile phones by criminals to achieve their selfish ends especially with regard to mobile banking and money transfer services where fraudsters illegally solicited money from unsuspecting victims. Because of the ease soliciting financial help from relatives and other people using the mobile phones, some mobile phone users felt that this had encouraged laziness. Furthermore, a number

of phone users felt that with long term usage, some mobile phone users developed dependence syndrome which made them unable to think or become creative without the gadgets.

4.5.2 Factors affecting access, development and use of mobile phone technology

In line with the third objective, the third research question sought to investigate emerging factors affecting access, development and use of mobile phone technology among rural communities. Because part of the aim of this study was to explore ways of maximising the mobile phone technology development and application for a more empowered society, this question was regarded fundamental and broken down into a number of interview questions for purposes of exhaustively. Generally, the questions investigated major challenges affecting the use and development of mobile phone technology, risks associated with the use of mobile phones, repair and maintenance issues and major barriers to mobile phone communication.

4.5.2.1 Major challenges affecting the use and development of mobile phone technology

To address this aspect, the mobile phone users were required to state specifically the four major problems and challenges they encountered when using their phones. Their responses were as categorised in Table 34.

Table 34: Major challenges experienced by mobile phone users and dealers

Mobile phone users			**Mobile Phone Dealers**		
Challenge	Frequency	Percent	Challenge	Frequency	Percent
Network failure	175	43.8	High cost	54	60.0
High cost	166	41.5	Language barrier	47	52.2
Electrical power charging	162	40.5	Illiteracy	21	23.3
Maintenance issues	159	39.8	Ignorance	18	20.0
Frequent break down	133	33.3	Phone incompatibility	22	24.4
Memory problems	122	30.5	Counterfesance	13	14.4
Battery failure	104	26	Phone complexity	10	11.1
Insufficient user education	102	25.5	Customer hostility	9	10.0
Health related issues	81	20.3	Inability to serve the physically challenged	4	3.6
Insecurity	74	18.5			
Policy issues	69	17.3			
Technological problems	67	16.8			
Privacy	59	14.8			
Relationship issues	53	13.3			
Pilferage	40	10			
Phone disposal	18	4.5			
Virus	16	4			

According to the results in the foregoing table, network related issues constituted the most serious challenge encountered by 43.8% (73/400) of the mobile phone users. This was closely followed by high cost of phones and airtime which made them unaffordable to the rural folk, insufficient electrical power supply as well as maintenance issues. These were mentioned by 41.5% (166/400), 40.5% (162/400) and 39.8% (159/400) of the phone users respectively. Maintenance and repair of phones in the rural areas was

said to be a major problem given that most repair shops were found in or closer to urban centres.

Another major challenge was the frequent breakdown of phones caused mainly by liquid damage which resulted in rusting and keypad failure as mentioned by 33.3% (133/400) of the mobile phone users. Closely related to this were phone memory problems and battery failure which were mentioned by 30.5% (122/400) and 26% (104/400) of the phone users respectively.

Most people in the rural settings still used pit latrines and water from rivers, dams and streams and cases of phones falling in water and other corrosive liquids which could cause memory and battery failure were quite common. This problem was also partly because of lack of appropriate user education which was mentioned by 25.5% (102/400) of the mobile phone users. Despite the existence of many basic procedures that one could follow to maintain and repair mobile phones, the rural communities were not aware of them because such information had not been given out or availed in a form that they could easily understand.

Health related issues such as stress emanating from making and receiving too many calls in a given period or accidents emanating from text driving was mentioned by 20.3% (81/400) as a problem affecting mobile phone users. This was followed by problems of insecurity, lack of proper policy guidelines to clearly define when and when not to use a mobile phone as well as technological challenges. The users decried the haphazard ways in which mobile phones were being used by security agents and unscrupulous dealers to track and locate people as a security threat. Besides, policies governing the use of mobile phones were not clearly spelt out and each agent including banks, schools, road and air traffic controllers, hospitals and many others subjectively imposed unreasonable restrictions which were often punitive to the users. The users

also pointed out the advancement of technology to be a major challenge especially when not accompanied with proper user education.

Given that most mobile phone calls were made in public, 14.8% (59/400) of the phone users decried lack of privacy enhancing innovations on the phones to ensure that conversations even when done in the glare of the public would remain silent and private.

Other challenges encountered in the use of mobile phones include relationship issues which emanated from lack of trust among friends and partners, pilferage which entailed theft of phones, lack of proper phone disposal mechanisms and policies as well as phone viruses which caused phones to become slow and discordant.

On the other hand, the most prevalent challenge as experienced by 60% (54/90) of the mobile phone dealers was the high cost of operating a phone. This included the cost of the phone handsets and accessories, repairs and maintenance as well as airtime. This affected their returns and ultimately their business operations.

The other problem experienced by 52.2% (47/90) of the mobile phone dealers was language barrier. It was noted that whereas Western Province was predominantly occupied by the Luhya ethnic group, there were many other ethnic communities as well thus causing linguistic disparities when it came to communicating with clients. However, much of this problem was felt as a result of many phones being configured in the English and other foreign languages and whose operational manuals and guides were not translated into local languages spoken by the users.

Because of the lower literacy levels in rural areas (Kilele, 2007:21), illiteracy was another challenge that affected 23.3% (21/90) of the mobile phone dealers. This was coupled by ignorance which was mentioned by 20% (18/90) of the dealers. This made it

difficult for the dealers to share vital knowledge and information regarding the use of mobile phone technology.

Other challenges included phone incompatibility, counterfeit phone products, phone complexity and customer hostility. These were mentioned by 24.4% (22/90), 14.4% (13/90), 11.1% (10/90) and 10% (9/90) of the dealers respectively.

However, one of the most unique challenges as mentioned by 3.6% (4/90) of the mobile phone dealers was their limited capacity to serve clients who were physically challenged. It was observed that even though this challenge was only expressed by this small number of dealers, most of the dealers lacked appropriate facilities to take care of clients with physical challenges.

Generally, the most predominant challenges were a mixture of technical, economic as well as infrastructural which could only be handled by relevant agencies including the mobile phone companies and the Government. The least predominant challenges were mostly social which were not quite urgent because they could be handles largely by the users themselves.

4.5.2.2 Risks associated with the use of mobile phone technology

The rural phone users were also asked to mention any risk they were aware of that were related to the use of mobile phones. These are factors that generally made the mobile phone users fearful of using their phones. Fear in this case was regarded as an antidevelopment factor since people who are fearful cannot confidently and effectively take part in development initiatives. Their responses were quite diverse but broadly, they were categorised as listed in Table 35 below.

Table 35: Risks associated with the use of mobile phone technology

Risk	Frequency	Percent
Safety and Security	136	34.04
Health	106	26.60
Environmental	64	15.96
Behavioural	55	13.83
EM interference	26	6.38
Others	9	2.13
Fires	4	1.06
Total	400	100

The foregoing table indicates that the gravest risk associated with the use of mobile phones was safety and security as mentioned by 34.04% (136/400) of the mobile phone users. The users felt that increasingly, the phones were being used for criminal activities which put the lives and property of users at risk.

Health related risks were the second most significant as pointed out by 26.60% (106/400) of the mobile phone users. The risks mainly included cancer infections, and hearing defects associated with listening to loud music through the phones.

Environmental risks mainly caused by poor disposal of mobile e-waste and sound pollution emanating from usage of laud phones was mentioned by 15.96% (64/400) of the mobile phone users as a major risk.

Others included behavioural risks arising from peer pressure and influence to use certain functionalities or services that would especially degrade the behaviour of younger members of society was cited by 13.83% (55/400) while electromagnetic interference was mentioned by 6.38% (26/400) of the mobile phone users Other risks mentioned by 2.13% (9/400) of the phone users were mainly deaths and accidents arising from electrocution and explosions of mobile phone accessories. Fires

constituted 1.06% (4/400) of the risks that phone users associated with mobile phones especially in the petrol stations.

Looking at the foregoing results generally, the cited risks were more artificial than natural meaning that they were mainly caused by human agents. The implication here is that the mobile phone stake holders including both users and service providers had a big potential to stem the risks and improve the use of mobile phone technologies in the rural setups.

Mobile phone users were also asked to show how they responded to the risks they associated with usage of mobile phones. Their responses were as categorised Table 36 below.

Table 36: Responses to mobile phone risks

Problem	No	Percent
Reduced usage of phone	160	40.00
Sought further information	160	40.00
Sought expert attention	67	16.8
Took no action	13	3.3
Stopped using phone	0	0.0

According to the results in the foregoing table, none of the mobile phone users indicated that they ever stopped using their phones as a result of the stated risks. However, 40% (160/400) said that they reduced usage while a similar proportion sought further information about the specific risks so as to understand them better and take the necessary precautions. Such reduction in usage can have a great subsequent effect on communication patterns as the volume of communication is reduced.

4.5.2.3 Repair and maintenance of mobile phones

To complement the challenges they had experienced, phone users were asked to say whether or not they had ever taken their phones for repairs to measure the magnanimity of maintenance related issues. Seventy-seven percent (308/400) of phone users said they had experienced problems with their phones that warranted repairs. For comparative analysis, the phone dealers were also asked if they were aware of any phone repair problems encountered by their clients and 79% (71/90) said they were. These results showed a clear correlation between phone users who had experienced challenges and those who had taken phones for repairs as the proportions were nearly equal.

When the two categories of respondents were asked to name the specific major problems that made phone users seek repair services, their responses were categorised as per Table 37 below.

Table 37: Repairable mobile phone problems experienced by phone users and dealers

Mobile Phone Users			**Mobile Phone Dealers**		
Problem	**Frequency**	**Percent**	**Phone Problems**	**Frequency**	**Percent**
Audio problems	278	69.5	Audio (ear piece/mouth piece problems)	66	73.3
Other Problems	213	53.3	Screen problems	54	60
Screen failure	152	38	Brocken Handset	42	46.7
Charger failure	122	30.5	Liquid damage	36	40
Memory problems	105	26.3	Network loss	18	20
Battery failure	99	24.8	Battery and charging	12	13.3
Network loss	87	21.8	Software	6	6.7
Keypad failure	84	21	Features not working	6	6.7
Money transfer issues	72	18			
Casing replacement	56	14			
Power consumption	42	10.5			
Settings	34	8.5			
Virus	23	5.8			

According to the results in the foregoing table, the commonest problem experienced by 69.5% (278/400) of the phone users that compelled them to seek help from repair shops was breakdown of audio systems. This mainly involved both the earpiece and mouthpiece with the former being more prevalent. This was followed by other problems such as corrosion, mentioned by 53% (213/400), of phone users. The screen failure mentioned by 38% (152/400) included the inability to display properly in a bright environment. The problem was more prevalent with smart phones that had touch screens.

Battery failure was also reported as one of the common problems that were referred for repair followed by network loss, keypad failure, money transfer issues, casing replacement problems and excessive power consumption. Whereas only a few users also experienced problems that required change of settings on their phones, the problem that was least reported was virus related issues experienced by 5.8% (23/400) of phone users.

On the other hand, when asked to state the nature of mobile phone problems that made their clients to bring their phones for repairs, 73.3% (66/90) of the mobile phone dealers cited audio related problems to be the most prevalent. These included ear piece and mouth piece breakdowns. This was followed by screen related problems which were cited by 60% (54/90) of the dealers. Broken handsets constituted 46.7% (42/90) of the problems while 40% (36/90) of the cases related to liquid damage.

Other problems in their order of prevalence were liquid damage, network loss and battery charging issues and operating software problems. The least prevalent problem was unresponsive features constituting 6.7% (6/90).

A comparison of the two sets of data shows that the experiences of both the mobile users and dealers were well synchronised. Noting that their responses were generally similar especially in terms of the order of prevalence is an indication that they understood the problems affecting usage of mobile phones in the rural setups quite well and hence their responses were reliable.

To find out how mobile phone users coped with phone related problems, the study investigated the proportion of mobile phone repair shops used by the rural community members compared with urban dwellers and the findings were as per Figure 18 below.

Proportion of mobile phone repair shops used by the rural community members

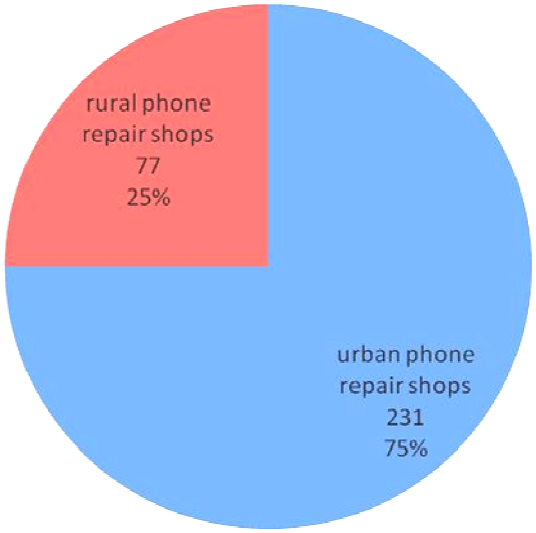

Figure 18: Pie Chart showing proportion of mobile phone repair shops used by rural phone users

The results in the foregoing chart show that 75% (231/308) of the repair shops used by mobile phone users were from urban areas while only 25% were from rural areas. This implies that most of the repair shops were either in or near urban areas and away from the rural phone users.

Furthermore, the users who had ever taken their mobile phones for repairs were prompted to evaluate in percentage terms, the success rate of such repairs and their responses were as recorded in Table 38 and Table 39.

Table 38: Success rating of rural mobile phone repairs by users

Success Rating (x)	Frequency (f)	fx
5	5	25
4	22	88
3	101	303
2	160	320
1	20	20
Total	308	756
Mean Rating	$\bar{x} = \frac{\sum fx}{\sum f} = \frac{756}{308} = 2.5/5$	

Table 39: Success rating of rural mobile phone repairs by dealers

Success Rating (x)	Frequency (f)	fx
5	4	20
4	10	40
3	1	3
Total	15	63
Mean Rating	$\bar{x} = \frac{\sum fx}{\sum f} = \frac{1937}{400} = 4.8/5$	

According to the results in the above tables, the average success rating of mobile phone repairs as expressed by mobile phone users was 49% (2.45/5) as opposed to 84% (4.2/5) expressed by dealers. This difference is as a result of the fact that the mobile phone dealers also served urban users thus pushing the overall rating above that of the mobile phone users. This implies that the success rate among the urban mobile phone users was higher than that of rural users proving the premise of this study that rural mobile phone users were somehow neglected in terms of provision of mobile phone products and services and hence disadvantaged in the use of mobile phone technology.

4.5.2.4 Barriers to Mobile Phone Communication

To corroborate the general challenges they experienced which were quite broad, the mobile phone users were asked to narrow down further and state the major phone specific communication related barriers that prevented them from maximizing the use

of mobile phones. Since mobile phones were predominantly used for communication, discerning the communication barriers associated with them would go a long way in enhancing this aspect and fostering their development. The responses were categorised in two broad groups thus, technical and personal. The reason for this investigation was to isolate the different roles the phone companies as well as the users can play in spurring development and increasing mobile phone usage.

i. Technical barriers to mobile phone communication

When mobile phone users were asked to list the technical or phone specific barriers that they felt prevented them from communicating effectively using their mobile phones, their responses were as per Table 40 below.

Table 40: Technical barriers to the use of mobile phone technology

Phone related barriers	Frequency	Percent
Fast pace of technology change	214	53.5
Complicated phone menus and procedures	173	43.3
Fragility of phones	167	41.8
Risks associated with mobile phone use	125	31.3
Lack of adequate user support	103	25.8
Use of foreign languages	75	18.8
Others (limited phone features, short battery life and lack of internet capacity)	32	8

According to the foregoing table, the most prevalent phone specific communication barrier that affected use among mobile users was the rapid pace of technology change that affected both the hardware and software as mentioned by 53.5% (214/400) of the phone users. This was followed by complicated phone menus and procedures which 43.3% (173/400) of the phone users felt affected their effort to maximise their use of

phones. On the other hand, 41.8% (167/400) of the users felt that fragility of phones was to blame. Most phones were easily susceptible to damage owing to the fragile nature of materials used in making them.

More phone specific barriers that prevented maximum use were risks associated with the phones, lack of adequate user support and use of foreign languages on the phones. These were mentioned by 31.3% (125/400), 25.8% (103/400) and 18.8% (75/400) of the mobile phone users respectively. Others mentioned by 8% (32/400) of the phone users included limited phone features, short battery life and lack of internet capacity.

The results show that the pace of technology change was a major factor in the uptake of mobile services. It is clear that majority of rural dwellers found the technology change too fast thus making it a barrier to usage. However all these barriers were mostly outside the control of mobile phone users and phone companies needed to play a bigger role in breaking them.

ii. Personal barriers to mobile phone communication

In this regard mobile phone users were asked to state their own personal limitations that prevented them from maximising the use of mobile phones. Their responses were categorised as per Table 41.

Table 41: Users specific barriers to the use of mobile phone technology

Personal barrier	Frequency	Percent
Poverty	349	87.3
Residence locality	215	53.8
Technology phobia	185	46.3
Inefficiency	129	32.3
Ignorance	88	22
Language barrier	85	21.3
Illiteracy	82	20.5
Work schedule	46	11.5
Disturbance	21	5.3
Relationship issues	21	5.3
Eyesight problem	20	5
Limited contacts	17	4.3

According to the foregoing table, poverty was the most prevalent personal limitation that affected the rural community's ability to maximise the use of mobile phones. This was mentioned by 87.3% (349/400) of the mobile phone users. Poverty manifested itself in various ways including inability to afford the cost of handsets and airtime as well as the cost of electrification of rural homes which was a major factor in the use and maintenance of mobile phones. This was closely followed by problems relating to residence locality as mentioned by 53.8% (215/400) of the phone users. Residence locality determined the strength and quality of mobile phone network as well as support services which were best in or near urban areas.

Technology phobia, inefficiency due to wastefulness, ignorance and language barrier were also cited as major factors that curtailed their ability to maximise mobile phone usage. Inefficiency mainly manifested itself in wasteful and often extravagant use of phones as well as the inability to match the multitasking capacities of mobile phones.

Illiteracy was mentioned by 20.5% (82/400) of the mobile phone users as yet another personal barrier to communication while 11.5% (46/400) of the users said that their work schedule prevented them from maximising the use of mobile phones. This was a common case for certain professionals such as medical doctors whose job assignments prohibited them from making or receiving phone calls during certain time such as when carrying out an operation in a medical theatre.

Other personal barriers to communication included disturbance, relationship issues, eyesight problems and limited contacts. A number of phone users particularly those with large networks of contacts viewed some calls or SMS as disturbance especially if they were stray, received quite frequently or outside the normal operating hours and would even try to avoid them altogether. On the other hand, a number of users especially those with basic phones decried their own inability to expand their limited network of contacts as a major barrier to communication.

4.6 Unexplored potential of mobile phone technology

In line with the fourth objective, the fifth research question helped to discern unexplored areas and uses of mobile phone technology that could further enhance the development and application of mobile phone technology among rural communities. Such measures would ensure that the rural communities are not disadvantaged when it comes to communicating and sharing ideas with the rest of the world and thus getting more empowered.

In this regard, mobile phone users were asked to state how else the technology currently in use could be used to stimulate greater levels of information sharing and empowerment. Their responses were classified and grouped as per Table 42 below.

Table 42: Ways of using mobile phone technology o stimulate greater levels of information sharing and empowerment

Additional use of mobile phone technology	No.	Percent
Use for human security and safety	160	40
Computing functions	106	26.5
Efficient use	62	18.8
SMS chatting	37	15.5
Research application	30	9.3
Integrated money transfer	75	7.5
Repackaging	20	5
Generation of local content	18	4.5

According to the foregoing results, 40% (160/400) of mobile phone users wished to see the mobile phone technology play a bigger role in the safety and security of human life more than it was currently done. For instance some phone users wished to see mobile phones especially those with cameras used as CCTV surveillance systems which could transmit pictures that could be saved both in the phone and the service provider's servers and retrieved when necessary. One respondent said that:

> "I wish mobile phones could capture pictures which can be used in times of emergencies or danger whereby in case of theft, robbery or even death, they could be used to track the last steps of the victim in the hands of the criminals." (Interviewee 336, female, 11/9/2013)

Some phone users quoted the terrorist attack at Westgate Mall in Nairobi where they felt that if the mobile phones were used this way, they could have streamed live pictures about the terrorists and made it possible to arrest them quickly.

The mobile phone technology could also be used more in computing applications. This was suggested by 26.5% (106/400) of the phone users who felt that the phones could be

used more to perform tasks traditionally reserved for computers. In this regard, users could spend more time on the internet or even word processing using their mobile phones.

Comparing with computers, mobile phones seemed to lack some degree of efficiency especially in terms of data processing. Their key pads and screens were much smaller thus requiring one to take longer to type messages or process information. For this and many other reasons, 18.8% (75/400) of the phone users felt that existing mobile phone applications could be enhanced to increase efficiency in communication and hence boost the usage of phones. Such applications include cheaper data and voice transmission technologies and applications that used less electricity.

Furthermore, 15.5% (62/400) of the mobile phone users felt that strengthening the capacity of mobile phones as tools for SMS chatting would increase their usage. Currently, this technology was confined to online applications which were rare in rural areas.

Because of the voice and text functionalities of mobile phones, 9.3% (37/400) of the mobile phone users felt that the technology could play a much bigger role in research whereby people in the remote area should be reached more easily for interviews thus saving costs. Responses in text format should also easily and conveniently be downloaded on computers for direct processing thus saving time and other resources.

Integrating money transfer services into mobile phones was yet another way of enhancing their usage. This was suggested by 7.5% (30/400) of the mobile phone users who felt that instead of locking the service to SIM cards which were specific to various service providers and thus limiting, pushing the service to the phone level would be quite enhancing.

Other applications that could stimulate greater use of mobile phones included use in repackaging of information and generation of local content. These suggestions were made by 5% (20/400) and 4.5% (18/400) of the mobile phone users respectively.

The users felt that many mobile phones could be enabled to play a bigger role in repackaging of information such as turning voice calls more efficiently into text messages that could be reproduced and edited for storage, transmission or future reference. This suggestion was closely related to the need for mobile phones to be used to generate local content such as ring tones, folk tunes and traditional games.

In addition, 4.3% (17/400) of the mobile phone users said that greater exploitation of the mobile phone artificial intelligence would increase usage. Some phone users wished to see mobile phone systems used to accumulate knowledge with time and even offer to handle some routine requirements of the users automatically out of experience without being prompted to.

4.7 Innovative use, features and services of the mobile phone technology

In line with the fifth objective which sought to make the development of mobile phone technology more responsive, mobile phone users through the seventh research question were also allowed to project how they would wish the future phones and related systems and services to look like. They were asked to mention additional services, features and capabilities both real and imaginary that they would have liked the mobile phone service providers and phone makers to incorporate in their new products. Their responses were categorised as per Table 43.

Table 43: New and more innovative features and services of the mobile phone technology

Phone features / capabilities	Frequency	Percent
Detection capabilities	246	61.5
Increased Universal features	141	35.3
Improved technology and services	132	33.0
Automated functions	94	23.5
Planning and management features	43	10.8
Artificial intelligence	41	10.3
Full scale computerization	26	6.5
Medical capabilities	25	6.3
Remote controlled phones	25	6.3
More simplified phones	22	5.5
Genetic technology	19	4.8
Embedded assistive technologies	17	4.3
Psychosocial Support	6	1.5

According to the foregoing results, 61.5% (246/400) of the mobile phone users wished to see a mobile phone that carried out more of detection functions. This was in tandem with the observation in Section 4.5.2 where the phone users had wanted the phones to be used largely to enhance human safety and security.

A number of mobile phone users said they would have liked to see a phone that could do weird things like detect danger such as fire, explosives, adverse environmental changes and even detect dangerous people like thieves and robbers. In response, the phone would sound an alarm or in extreme cases trigger a siren. Because mobile phones had come to be closely associated with cheating, other phone users said they would have wished phones to be able to detect lies and alert the victims.

Furthermore, some mobile phone users wished to see phones that could detect unregistered SIM cards and automatically reject or deactivate them. Besides, detection of movements could see the phones used more in security tracking.

Traditionally, the most universal features on mobile phones were voice call and text messaging. However, 35.3% (141/400) of the mobile phone users wished to see these features increased. For instance, some users wanted to see all phones have internet capability, inbuilt power backup especially for emergency calls as well as have radio and television. Because of a large number of rural users who had lost their phones after dropping them in water or other corrosive liquid substances, some wished to see all phone made damp-proof and impermeable to any kind of corrosive liquid.

To catch up with the changing user needs, 33% (132/400) of the phone users wanted to see the mobile phone technology and services generally improved to cater for their needs. For instance, they wished to see enhancement of mobile phone multitasking capabilities such as cloud communication and the ability to make and receive multiple calls. Some also wished to see the improvement of the touch screen technology to make the screens more visible in bright environments and thus reduce accidents that are associated with users struggling to operate them especially while walking or driving.

In terms of services, some users said they would like phone operators to allow the traditional reverse calls as well as reverse messages which would be paid for by the recipient rather than the caller. They also cited emergency cases when the recipients may be in dire need to communicate yet they did not have airtime or the free messaging services popularly known as ‘please call me’, offered by service providers. Some users also wanted phones and service providers to provide for video calls.

Given that most of the prevailing mobile phone systems and services were manual and thus requiring human intervention, 23.5% (94/400) of the phone users wanted to see phones with more automated functions. These included auto locking when stolen and automatic battery charger which like automatic watches, could recharge the phone by virtue of mechanical movements and vibrations rather than by electrical charging.

Some users also wanted the phones that could work as research assistants where they could collect data automatically from the text or voice calls received, analyze it and generate a report.

To help them use their time and other resources effectively, 10.8% (43/400) of the phone users said that this could happen if mobile phones had more planning and management features. The features included those that could help budget and manage financial resources. Some phone users also wanted to see phones that could help them manage and supervise their work and projects especially farming which was the main occupation in the rural areas.

With the prevalence of artificial intelligence mainly associated with computers, 10.3% (41/400) of the mobile phone users wanted to see more of this technology in the mobile phone application. They wished to see a phone that gathered intelligence with more usage so that it could on its own make certain decisions and implement appropriate measures with little or no human intervention. For instance, they wanted a phone that could gather information after a period of routine applications and conversations and use it to advice or caution the owner. Such information could also be used to make the phone manage and even repair itself.

In terms of mobiles phone being regarded as the poor man's computer in the rural areas, 6.5% (26/400) of the phone users wished to see a full scale computerization of the phone so that it could do everything that a computer could do. Comparatively, phones were seen as the lesser computers in terms of memory and processor capacities as well as their smaller keypads. They wanted to see an improvement in technology so that for instance at the click of a button, the keypads could expand in real or virtual terms and enable them to type faster and more conveniently.

As shown in Section 4.5.2, a large number of rural phone users wanted to see mobile phones play a bigger role in human safety and security. It is perhaps because of this that 6.3% (25/400) of the users wanted to see mobile phones that had medical capabilities such as detecting and testing for diseases and medical conditions such as sugar levels and blood pressure and prescribe appropriate medication.

One of the limitations of phones in general was that they could only be controlled at the two ends by the caller and recipient. However, 6.3% (25/400) of rural users felt that if there were technologies that could enable the caller to remotely control the phone on the other end, the phone technology would be put to grater use. In trying to expound on this need, one phone user said that:

> "The provision for remote controlled phones would be handy in picking sounds and other signals from the recipient's environment for instance in cases where the receiver or subject on the other side of the line such as a crying toddler or critically ill or a carjacked person was not in a position to speak, handle or respond to the phone call." (Interviewee 95, male, 16/7/2013)

With the generally mounting sophistication of mobile phones, 5.5% (22/400) of users felt that there was need for much simpler phones fully dedicated to specific callers that could be used by young children at school or in remote areas to keep them in touch with their parents or guardians. The same would also be useful by old people who could not manage highly sophisticated handsets.

Arising out of the concern that many people stored a lot of valuable information on their phones and when they died or were immobilized, their phones especially those with security passwords were left to 'die' with treasures of information which could otherwise have been used for the benefit of relatives and the society at large. Because of this, 4.8% (19/400) of the phone users wished to see a 'genetic' phone that could be programmed or instructed by its owner to automatically unlock itself upon death or any

immobilising situation and pass over its information content to all those left behind if not to specific people.

In the same context, 4.3% (17/400) of the phone users felt that current phones were not quite considerate to the needs of the handicapped people. By embedding assistive technologies, even handicapped people could use them thus increasing their relevance.

With economic and other hardships associated with living in the rural areas, 1.5% (6/400) of the mobile phone users wanted to see phones that could offer psychosocial support in case of one being stressed or traumatized. Generally, a good number of people would suffer from isolation when befallen with problems without someone to talk to. This is quite common in the rural settings where those who cannot go to the market centres to do business or to the farms to cultivate are usually left home alone. But even in isolation, these people would be having their phones which could be used to keep them company and even offer support. The phone users said that if phones could preach, teach and even offer counselling services, many lives could be saved and numerous problems solved.

On the other hand, when asked the same question to advise mobile phone companies on new features they would wish mobile phones to have in future, the mobile phone dealers responded as per Table 44.

Table 44: Suggested additional features for mobile phones

Advice	Frequency (f)	Percent
Phone Simplicity	56	62.2
Assistive technologies	32	35.6
More power	29	32.2
Antitheft features (alarm)	26	28.9
Monitoring feature	20	22.2
Quality assurance	12	13.3
Word processing and printing	9	10.0

In the foregoing table, 62.2% (56/90) of the mobile phone dealers said they would wish to see phones that had much simpler features that could make them operable by people of all walks of life. Specifically, they wished to see phones that had simpler menus and language as well as being equipped with translators to local languages. In addition, some of the dealers wanted to see phones that could read the mind of the user in advance and make a call by simply touching a single button instead of going through lengthy processes which were time consuming.

On the other hand, 35% (32/90) of the dealers also wanted phones equipped with adequate assistive technologies to make them useable by people with all kinds of physical challenges. The phones could for instance have a system that could generate and transmit brail for the blind. This wish was closely related to the need to have phones with more power as suggested by 29% of the dealers. The dealers wanted a phone that could effectively and completely mimic the computing power of a desktop or laptop computers as suggested by 32.2% (29/90) of the dealers. This would enable them to handle more features simultaneously. Specifically, they wished to see phones with more battery power and longer power retention capacity. In addition, all phones should be equipped with solar charger systems, Wi-Fi connectivity and bigger speakers for improved audibility and playback of audio and video files.

Other preferred features included more antitheft features, monitoring features, quality evaluation features and word processing and printing features. Specifically, the commonest antitheft feature suggested was a simple alarm system that could be triggered automatically upon the phone becoming stolen or getting in the wrong hands. Because of the rising cases related to safety and security arising from use of mobile phones, it was suggested that each phone must be equipped with a tool to monitor the movement of people especially young children as well as track the movement of dangerous people such as thieves and issue automatic alerts.

In the wake of many counterfeit products in the market, it was also suggested that mobile phones should have a system that could quickly help to rate the quality of the phone at the point of buying in terms of active and inactive features so that users could make informed choices on the spot and avoid disappointment. In addition, because of the increasing use of mobile phones in surfing the internet, many users got disappointed on realizing that they could not easily edit and print the documents they downloaded onto their phones. This is one of the reasons why a number of mobile phone dealers suggested that phones should be equipped with more convenient word processing capacity and the ability to print easily.

4.8 General User Recommendations on development of mobile phone technology

Finally, mobile phone users were given a chance to give at least one major general recommendation that could further enhance the development and application of mobile phone technology in information sharing and empowerment. Their responses were classified and grouped as per Table 45.

Table 45: Recommendations of mobile phone users to service providers and phone makers

Recommendation	Frequency	Percent
Subsidised costs	(258)	64.5
Availability of Electricity	(128)	32
Wider phone network coverage	(115)	28.8
improve phone technology	(105)	26.3
More local content	(103)	25.8
Enhanced web technology	(85)	21.3
Discouraged criminal/abusive use	(78)	19.5
Enhanced user education	(68)	17
Programme for phone e-waste disposal	(38)	9.5

According to the results in the foregoing table, 64.5% (258/400) of the mobile phone users recommended the subsidisation of mobile phone related costs especially the cost of airtime and phone handsets. Compared to their urban counterparts who enjoy more investment opportunities as argued by Viswanadham (2007:10), rural communities were largely peasants and generally poorer (Suri, *et al,* 2009: para 1).and reduction of mobile phone costs would help them use the technology more effectively.

Another recommendation made by 32% (128/400) of the mobile phone users was that for the mobile phone technology to thrive in the rural areas, electricity must be made widely available. This recommendation was in line with the fact that mobile phones were electricity dependent yet electrification programmes had not covered many parts of the country especially the rural areas.

Whereas 28.8% (115/400) of the mobile phone users advocated for wider phone network coverage to encompass all remote areas, 26.3% (105/400) and 25.8% (103/400) recommended the improvement of phone technology and integration of more local content. While explaining the need for wider network coverage, one mobile phone user said that:

> "At times, I am forced to defy rain and all night time dangers to climb high up in the trees to make or receive a phone call. The mobile phone companies should consider our plight and ensure that we get proper network at all times." Interviewee 114, female, 21/8/2013)

More specifically, those who recommended for improved phone technology to a large extent expressed their wish to see mobile phones have greater computing capabilities as an alternative to computers which were scarcer, and even more technical and expensive to use in the rural areas. Having the phone become the poor man's or the rural person's computer would mean addressing its legibility challenges because of smaller screens, keypads and less powerful processors. Local content on the other hand required having translation applications on the phones which could switch interface menus from the default language to any another especially those spoken by the rural communities.

The other recommendations included the need to enhance web technology, discouragement of criminal/abusive use, enhancement of user education as well as establishing programmes for phone e-waste disposal.

Regarding the enhancement of web technology, and bearing in mind the increasing use of internet in the rural areas, many mobile phone users said that the technology needed to be improved as their main, and sometimes the only source of internet access. Issues raised were to do with display limitations, slower speeds and memory capacity for storage of downloaded materials.

In light of widespread cases of criminal and abusive use, the mobile phone users said that this needed to be curtailed if meaningful development in the mobile phone industry was to be realised. It was common to see criminals using the technology to defraud unsuspecting users. Many users also passively used a lot of time on the phones thus being less productive. The recommendation to increase user education was geared

towards addressing these challenges but more specifically to help users maximise and use their phones in a more fulfilling way.

4.9 Chapter Summary

This chapter has made a detailed presentation of the data collected during this study. The data is presented in a logical sequence in relation to the objectives and research questions. According to the data, the study found that in terms of status of mobile phone service provision in the country, there was a positive cumulative trend in the establishment of mobile phone service providers and customer subscriptions. Analytically, there were also more factors promoting the growth of mobile phone industry in the country than those discouraging it. All these implied a promising future for the industry. However, awareness level of 57.9% (2.9/5) in Table 4 was considered low. This was compounded by high costs of mobile phone ownership as well as gender imbalances in usage patterns in favour of the male population.

The study found that mobile phone technology was very useful as rated at 96% (4.8/5) by mobile phone users. The technology empowered them mainly through communication and money transfer thus enabling them live a better life. However, several factors were found to affect both positively and negatively the development and use of mobile phone technology in the rural areas. The five most outstanding positive factors were efficiency, ease of use, multimedia capacity, enjoyability, convenience, and the mobile money transfer. Those that discouraged the use of mobile phone technology were high long-term cost of use, lack of electricity in the rural villages, the dependence syndrome that came with long term use and incredibility of mobile phone related messages. Other factors were health concerns, relationship issues and criminal use. Generally, the main challenges included network failure, electrical power,

charging problems, maintenance issues, frequent break downs, memory problems, battery failure, technological problems, phone disposal issues and phone viruses.

Regarding the untapped potential of mobile phone technology that could spur higher levels of information sharing and empowerment, the study found that respondents' suggestions mainly centred on introducing new or expanding the existing technologies to make them better. Therefore, in order to enhance more usage of the phone, there was need to increase certain functionalities. These included use of mobile phones for human security and safety, enhancing computing functions such as having expansive keypads, integrating efficiency monitoring systems as well as enhancing SMS chatting just like in the internet and integrating local content.

On how to use the mobile phone technology more innovatively, respondents also made a number of suggestions. These included, using them as detective devices, increasing universal features, having more automated functions such as charging and antitheft systems as well as making phones offer psychosocial support.

The chapter has also captured recommendations from respondents that could spur more development in the mobile phone industry. These include subsidisation of mobile phone related costs especially the cost of handsets and airtime, ensuring more electrification of rural areas, strengthening and widening of mobile phone network coverage as well as improving phone technology especially with regard to resistance from easy damage. There was also need to ensure more integration of local content, widen network coverage, enhance user education, increase internet capability and prevent criminal and abusive use of mobile phones.

The next chapter is a critical interpretation of the findings in this chapter. It aims at integrating various themes of the results and drawing out emerging patterns in line with

the study objectives. The discussions are focused at both the practical and theoretical application of the findings.

CHAPTER 5: DISCUSSIONS

5.1 Introduction

This chapter aims at synthesising and drawing emerging patterns from the findings of this study in response to the objectives. It provides a critical analysis and discusses both the practical and theoretical implications of the findings. Sections are, arranged in a logical sequence in relation to the objectives and research questions. The chapter also links the findings to the literature review and addresses assumptions previously made particularly in the conceptual framework. It has also collated various results under the broader themes so as to bridge any existing gaps and make the findings and conclusions clearer and more meaningful.

Covered in this chapter are discussions relating to the trends in development and use of mobile phone technology to meet information needs of rural communities, modes of empowerment of mobile phone technology and key factors affecting access, development and use of mobile phone technology. Also discussed are the potential of mobile phone technology that can spur higher levels of information sharing and empowerment and measures to foster more innovative application and development of mobile phone technology. This section is largely based on the suggestions and recommendations made by respondents on new and more innovative features and application of the mobile phone technology.

5.2 Trends and developments of mobile phone technology and their role in meeting information needs of rural communities

This study considered a number of factors that collectively defined the trends of mobile phone technology usage among rural communities. The factors included service provision, gender dynamics and awareness levels relating to the use of the technology.

5.2.1 Mobile phone services and their role in spurring access and use

To understand the level of mobile phone service provision in Kenya, Section 4.3.1 of this study examined trends in the establishment of mobile phone service providers. This investigation found that since 1997 when the first mobile phone service provider company was established, three others followed leading to a steady growth of the industry. The positive cumulative trend in their establishment together with the fact that all the four companies were still operational and growing in terms of customer subscription and service roll-outs led to the conclusion that the mobile phone industry in the country had a bright and promising future.

This trend was also an indication that the technology was continuing to receive acceptance among rural communities, a fact that was in tandem with Section 2.4 of the literature review which shows that there was accelerated growth in the mobile phone industry both in local and global perspectives. The two perspectives were covered in more details under sections 2.4.1 and 2.4.2 respectively.

5.2.2 Mobile phone awareness patterns and strategies

In examining the prevailing circumstances in mobile phone technology, the study looked at gender as one of the main parameters that define trend and status of usage. As such, gender composition of rural mobile phone subscribers was analysed. According to Table 4, the gender composition of mobile phone usage in Western Province which

was found to be 52% male and 48% female, meant that the practical usage of mobile phone technology was slightly dominated by men. However, when viewed in the light of Table 2 which contains summarised demographic statistics of the Province as per the *Kenya 2009 Population and Housing Census Report* which shows that the rural population of the Western Province was dominated by females at 52%, this disparity was considered significant.

The evidence implies that the mobile phone technology was significantly dominated by the male population and that cultural and socio-economic dynamics played a big role in determining its usage. Men were therefore more advantaged than women and hence poised to play a dominant role in sharing information and decision making which only makes them further their dominance and widen the gap. Furthermore, the fact that only 59% of the rural population in Figure 12 owned mobile phones means that there was a significant proportion of the female population that did not have access to the mobile phone technology thus making them heavily disadvantaged.

The situation was worse considering that the awareness levels in Table 5 were at 57.9% (2.9/5) which was regarded as fair but not good enough for rural communities. This is because unlike their urban counterparts, rural communities had much fewer alternative sources of information. In general terms, more than half of the population's awareness level was far below this average. This is because 41% of the population did not own mobile phones as per Figure 12.

Although the self-assessment of the levels of awareness of mobile phone users was above average, the difference between this (2.9/5 = 57.9%) and that of the mobile phone dealers (4.3/5 = 86%) in Section 4.3.5 was notable. Whereas the assessment given by the former was exclusively for the mobile phone users, that of the mobile phone dealers included the nearly 42% of urban mobile phone users they also served as

per figure 17. This means that the level of competence and awareness among the urban mobile phone users was far much higher than that of the rural users thus pushing the average rating given by the mobile phone dealers to a much higher level. Any effort to create parity and further empowerment in the area must therefore take all these factors into consideration and particularly the strategies that the users themselves used to better the situation. It would therefore be important to also understand what the urban mobile users did differently to make their level of awareness much higher than that of rural users.

For instance, the most prevalent means of raising their knowledge and awareness relating to mobile phones was through trial and error, followed by peer education, use of documentation and also through user support from the suppliers (Section 4.3.6). All these and particularly the first strategy show a high level of determination that the rural communities had towards acquiring new knowledge and skills about the mobile phone technology. This means that appropriate efforts geared towards building their capacities through knowledge and skills were sure to achieve good results. Furthermore, since users preferred to explore available options on their own before trying out any other solution, it implies that they preferred phones that were equipped with intelligent and self exploratory menus and documentation that could offer as much help as possible at the spur of the moment.

Regarding the measures and strategies that mobile phone users used to bridge their knowledge gaps in relation to mobile phone technology, the study as evidenced in Table 9 found that the largest proportion, thus 36.5% of users used customer support services. This shows the important role the customer care services played in providing user knowledge that the mobile phone users could not find on their own.

However, despite the fact that education was the main strategy used, its effectiveness

needed to be enhanced as expressed by the phone users. Nevertheless, combining all cases of user oriented means of seeking knowledge about mobile phone technology including trial and error, use of phone manuals and consultation of peers added up to 58.3%. This implies that to a large extent, mobile phone users preferred a source of user knowledge and education that was more readily available, convenient and reliable.

Furthermore, the fact that 2% of the users took no action to overcome their own ignorance about mobile phones shows the low level and impact of sensitisation initiatives undertaken by service providers. If they were well implemented, they could enable rural mobile phone users understand and use more effectively the various user education services and opportunities available to them thus scaling down this group of users.

The low level of sensitisation was best manifested in the mobile phone ownership pattern in Section 4.3.7 which revealed that 8% of the phones in the area of study were owned by minors. This was not only against the law but also dangerous to the community. Such phones could easily be used by criminals and other deviant characters to perpetuate crime.

The ownership pattern also revealed a sharp rise from the 18-27 year to 28-37 year age groups, then gradually declining to the last 57 – 61 year age group. This was a proportionate measure of how the technology was used among the respective age groups. It was also a proportionate measure of the different levels of interest and euphoria relating to mobile phones among the age groups.

With the age group owning most phones expected to use them most, the pattern also revealed phone ownership was determined by socio-economic and cultural factors. The 18 to 50 year age group which owned most phones, engaged more in social activities

which required them to communicate more frequently. In addition, this group was also involved more in educational, professional and occupational undertakings which gave them greater capacity including economic empowerment to carry out and sustain more intense and purposeful communication. As implied in the 5th objective and 6th research question, any efforts tailored towards promoting and maximising the use of mobile phones must take into account the dynamics of the various age groups.

As shown in Table 11, another trend which was inherent in the type of mobile phones owned by the rural communities showed that the largest proportion, thus60.25% (241/400) of the rural phone users owned either a basic phone or a camera phone. These could mainly handle functions such as phone calls and SMS. This can be interpreted in two ways. One, that the rural communities were not very well versed with sophisticated phones. However, the most evident interpretation is that besides these phones being the cheapest in the market, the services available to them in the rural localities were equally basic and did not warrant ownership of phones with expensive features that were of little use. This view is supported by the fact that combining music phones, smart phones, video phones and pocket PC devices accounted for only 39.8% (159/400) against the rest that were basic phones. This observation concurs with that of (Viswanadham, 2007:10) and Scott (2004:ii) in Section 1.1 who have demonstrated that rural communities are disadvantaged in terms of access to mobile phone technology.

The cost factor as a determinant of the pattern of phone ownership was also revealed by the various methods employed by rural communities to acquire phones. By acquiring majority of their phones (75.8%) through direct purchase as shown in Table 13 implied that ownership of mobile phones was directly related to their price. Considering that the average cost of phones owned by the rural user was found to be Ksh 3,328, which was

considered above the reach of many rural dwellers, anything that affected affordability of the phones would invariably affect the level of ownership and use.

However, nonndirect purchase methods having accounted for a significant 24.2%, means that any strategies put in place to further enhance phone ownership would need to consider them. These indirect methods included donations, gifts, exchange, offers, lost and found as well as awards which were generally humanitarian in nature.

By interrogating how the users acquired their first phones, the study in Figure 15 revealed that mobile phones had been in use in the rural setup for over 14 years starting from 1998. However, though the trend was progressive with the highest yearly ownership happening in 2011, the pattern was largely wavering with the exception of years 2003 to 2005. This implies the existence of unfavourable conditions that discouraged a smooth rise. Causative factors were rapid obsolescence of mobile phone technology and cost. It was evident that whereas new mobile phone models were highly fancied within a year of their debut, users generally employed a wait and see strategy, in order to get the latest phones in the market. Furthermore, prices of phones generally plummeted within a year of introduction and the same scenario applied to those who wanted to wait and buy them at their cheapest price. This observation was in agreement with the findings in Table 1 under the literature review which indicates the exponential growth in the mobile phone industry in Kenya.

As shown in Table 12, there was also a noticeable trend of people owning phones with the capacity to hold multiple SIM cards. With nearly two thirds of the phones in the rural area having multiple SIM cards this was a sign of preference. Such phones were more cost effective and convenient in terms of their portability and flexibility to make calls using different service providers.

Another communication habit of the rural communities was evident in their subscription to various service providers as shown in Table 14. With Safaricom which was largely owned by Kenyans taking nearly two thirds of the rural market share and leaving only a third to be shared by Airtel, Orange and Yu which were considered foreign, proved that Kenyans were nationalists who proudly associated themselves with local products particularly in this sector.

For a long time, many people have wondered why Safaricom easily outmanoeuvred their local and international competitors especially with their innovative Money Transfer services popularly known as MPesa despite their higher prising regimes. Through this research, however, it is evident that it is all to do with nationalism. The lesson learnt here is that one of the best marketing and promotional strategies was to spice up mobile phone products and services with home grown flavour.

With about 74% of the mobile phone users in Table 15 owning unlocked phones despite their higher cost show the proportion of users who preferred the freedom of choice, to use their phones without being compelled to stick to products and services of a particular service provider. However, the remaining 26% show the proportion of users who preferred the subsidised phones offered by various service providers. Because of poverty and other socioeconomic factors, this category seemed to be more influenced by affordability at the expense of freedom of choice.

Another measure of the status and trend of mobile phone usage in the rural areas was the level of subscription to prepaid and post-paid platforms. Because the prepaid platforms were normally associated with business people mainly in the retail industry, the 1% subscription to this platform among the rural communities as shown in Section 4.3.10 indicated the proportion of the community involved in business-like activities. Furthermore, the 99% on prepaid indicated the proportion of people who wanted to

apply safeguards in their communication so as to avoid extravagance and paying of higher premiums. Because one could only communicate for as long as the available airtime could allow, it would not be possible for people to communicate more than they could afford. Given the higher poverty levels in the rural compared to urban areas, this was the reason why this was the preferred choice. However, it was also evident that the proportion of users on the post-paid service plan was initially much lower before the various mobile phone service providers started campaigns to make it attractive and entice users to adopt it.

On the other hand, the 57.9% of rural clients served by mobile phone dealers as opposed to the 30% served by the service providers' regional offices as per Table 17 implies that proximity played a big role in access to mobile phone services. Most rural dwellers preferred to seek the services of phone dealers who were better spread across the Province and hence closer to them than the service providers who were all located in major urban centres. Besides, the mobile phone dealers were better placed to understand the problems of the mobile phone users because they mostly shared a common language and cultural background since most of their staff were from the surrounding areas.

From the foregoing trends, it is evident that knowledge plays a major role in determining usage. Both the knowledge of how to use the phones as well as the knowledge about available phone products, support and other resources are key to the empowerment process of rural communities and the promotion and uptake of relevant services. This is in agreement with the proposed conceptual model of communication (Figure 5 under Section 2.3) where communication leads to acquisition of additional information and knowledge and hence leads to empowerment. On the other hand, empowerment leads to even more knowledge and hence more development. It is

imperative, therefore, that for the rural communities to play a leading role in fostering the development of mobile phone technology as per the fifth objective, they must themselves be empowered to communicate.

5.2.3 Access to mobile phone technology systems and services

Deriving from the five most useful mobile phone features in Table 18 namely camera, radio, ringtones, games and Bluetooth which were common to the rural communities, it was evident that they all inclined towards entertainment, communication and sharing of resources. This implies that these factors were highly valued by the rural communities and had a major bearing on the satisfaction of their communication needs. This resonates well with the thinking behind the media-system dependency theory in Section 2.2.

With regard to the uptake of internet and mobile money transfer services in Table 19, the latter appeared to be one of the most popular services related to the mobile phone technology with over 95% of mobile phone users reporting having used it. However, use of the internet was equally substantive considering that 98.6% (70.5%/71.5%) of those who owned phones with internet capability were actually using it. This could be interpreted in several ways. First, that the capacity of rural mobile the phone users to use the internet was fairly good. In addition, the users had a high affinity for internet services and those who bought phones with browsing capacity had deliberately acquired them specifically for that purpose. It was also evident that such users made every effort possible to learn and use the internet in a more fulfilling way.

This was attested to by the significant proportion of 8.5% of mobile phone users who owned internet modems to partly fill the internet access gap created by phones without internet capability. Furthermore, the proximity between the 70.5% of rural mobile the

phone users who used internet services and the 71.5% of phones with internet capability implies that those who bought phones with internet capability had the intention to use them to access related services and also made efforts to achieve that.

An assessment of availability of mobile phone technology systems and services in the rural areas in Table 20 was used to gauge the level of investment and coverage of mobile phone service providers and dealers in the areas under investigation. The assessment revealed that the most common systems were phone handsets, communication masts, satellite systems and Wireless systems.

With 55.3% of rural adult population using mobile phones, the results implied that this was equally the proportion of mobile phone users able to communicate directly from their localities. This modest proportion was taken as evidence that rural dwellers were not properly facilitated in terms of network connectivity and other support services to communicate with the outside world. The even smaller percentage of those who cited availability and usability of communication masts, satellite systems, signal boosters, Wi-Fi Systems is the small proportion of rural dwellers who mostly resided closer to urban areas or major corporate institutions where such systems were found. This implies that those residing further were facing greater depravity and hence were less empowered to participate fully in the further development of the mobile phone industry through active usage.

Similarly, the results also mean that 55.3% of the mobile phone users could find and purchase their phones in the local shops. However the average levels of availability of all the mentioned systems added to 22.79% which was taken as the measure of investment by mobile phone dealers and service providers in the rural areas. This was far below average – a fact that agreed with the observations in the literature review and

conceptual framework that indeed, mobile phone service providers had failed to focus their investments on the rural areas.

On the other hand, an assessment of the mobile phone features and services available to the mobile phone users in Table 20 revealed that phone calls were the most common service and feature as all rural mobile phone users were able to use it. However, despite being very popular, SMS was used by 96.8% of the mobile phone users. This was close to the 96.3% of the mobile phone users who reported receiving and reading SMS advertisements through their phones. Because these services required some level of literacy, the proportion of phone users who could not use or read them were largely those who lacked literacy skills.

The results also showed that 65.8% of mobile phone users owned phones with radio features. As captured in Section 1.2, this was an affirmation of the long time tradition that associated the western province community with the radios. The rest of the features and services in descending order were further evidence that mobile phone users, dealers, service providers and manufacturers were tending towards passive and entertaining features and services that encouraged users to spend more time on their phones. These included phone charging, music, ring tones, games, mobile banking and money transfer. Others were photography, television, data storage, phone sales, MMS and service and maintenance.

In terms of actual prevalence emanating from duration of usage of the available features in Table 21, radio attained the highest rating at 4.4 (88%) on a scale of 1 to 5. This implied that mobile phone users spent more time using the radio on their phones than doing anything else. This was followed by SMS at 4.29 which made it the most popular communication feature ahead of internet at 4.06. These were followed by voice calls,

emails, voice mails, media messaging services and instant messaging. These features made the mobile phone take the outlook of both a communication and social networking tool thus playing a much bigger role among rural communities.

The other prevalent features were clock, alarm and reminders, calculator, camera, audio, games, video and word processing revealed that many users were actually using their phones for many other purposes beyond the traditional ones while also taking full advantage of their growing multimedia capabilities. However, the low rating for word-processing indicated that phones were still a long way to go if they were to be alternatives to computers in this area. The main problem noted in this case was the small size of mobile phone keypads which made typing and editing of text and graphics quite inefficient.

Conversely, the most redundant features to mobile phone users in descending order, were: instant messaging, voicemails, media messaging, games, word processing, wireless (Wi-Fi), satellite and phone sales as per Table 22. The others were television, advertisements, camera, calculator, data keeping, mobile money banking, ringtones and radio.

Generally, the order of these features was almost an exact inversion of the popular features and services. However, it was notable that voice calls and SMS were not mentioned among the redundant features of mobile phones which imply that the users considered them quite essential. On the other hand, despite being among the most used mobile phone features, radio, ringtones and mobile money banking were regarded by a number of mobile phone users as redundant because of their disruptive and burdensome nature.

Comparably, there was a much higher percentage of mobile phone users citing useful features than redundant ones. This was an indication that despite its shortfalls, many mobile phone users still regarded the mobile phone technology highly. The listing of the redundant features and services also symbolised a scale of ignorance among mobile phone users as it represented a minority that was not well educated and by extension not well versed with the operations of phones. As implied in the Figure 5 under the conceptual framework, communication must be preceded by some message gap (need) whose satisfaction leads to further empowerment.

Regarding the satisfaction of user information needs by mobile phone technology in Section 4.3.15, a 3.6/5 rating implied that 72% of mobile phone users had their needs met while 24% did not. Despite the rating being regarded as good, further evaluation of these results in the light of the numerous challenges faced by rural communities in their effort to maximize the value of mobile phones in Section 2.6.2 leads to a different conclusion. The results give an indication that the rating could have been much higher if the barriers that impeded communication in the areas were adequately addressed.

This rating was also closely related to the rating of the average network signal strength of various service providers in Section 4.3.16. The study showed that Safaricom had the widest and strongest average network coverage at 58.8% followed by Airtel (58%), Orange (43.4%) and Yu (32%). With a combined overall average of 48.1%, the network strength and coverage by the four service providers was considered below average and thus being one of the reasons why 2426% of the mobile phone users needs were not being met according to Table 24.

This fact was also reflected in the subscriber calling and expenditure patterns adopted by mobile phone users. In terms of the number of calls made by the users per day, the fact that they on average made 5.83 calls which were more than the 5.47 that they

received meant that mobile phone users were enthusiastic about communication (Section 4.3.17). However, the phone calls they made lasted an average of 48.45 seconds each, which was less than the duration of the received calls which lasted 53.85 seconds. This meant that because of rampant poverty, rural mobile phone users could not afford making longer calls and tried to be as economical as possible when using their phones. It was also an indication that most of the received calls were from their relatives and friends in urban areas. This evidence was also seen in the average daily amount of money they spent on making calls which was Ksh. 17.88/= as opposed to Ksh 20.56/= that was spent on the calls they received. The amounts included their expenditure on both calls and data. This implied that the communication behaviour of mobile phone users was largely influenced by economic factors.

In a nutshell, it is evident that the findings in the forgoing part of the study largely agreed with the global trends in mobile telephony. For instance, the results in Table 15 which show the spontaneity with which rural communities were embracing mobile telephony imply that the technology was to a large extent continuing to meet their needs. The Discussions under the conceptual framework and particularly Figure 5 under Section 2.3 also agree with this trend. Mobile phone technology is providing a more and more spontaneous communication possibility as evidenced in the conceptual framework in section 2.3, thus becoming the preference of many people especially in the rural areas.

As already argued by Scott (2004:ii) “the next generation of [mobile phone] users can only be rural and low-income communities” and hence, leaving them out of the development matrix by service providers is counterproductive. Unfortunately, this reality has been overlooked by the mobile phone service providers and dealers who

have continued to focus a lot more on urban areas as evidenced in figure 18 as well as in their network coverage and investment patterns.

However, the common assumption that associates rural communities with high levels of illiteracy and ignorance with the trending technologies and lifestyles which many service providers use to justify their low investment levels was not clearly proven. For instance, the results in Table 19 of rural communities who had internet phones and the percentage of the same who actually used the internet was a surprising observation.

5.2.4 Emerging trends and their effect on usage of mobile phone technology

Judging from the available literature, many emerging trends had been known to affect the usage of mobile phone technology (Comninos, 2011:2). When mobile phone users were asked as per Section 4.3.18 to state whether or not they were aware of any issue trends that affected the way the mobile phone technology was being used, only 59% said they were aware. This finding was therefore used as an assessment or their knowledge of current affairs regarding the use of mobile phones. Dividing the issues trends into two categories, it was possible to distinguish between those that had affected the technology in the positive as well as in the negative way.

Looking at all the trends that had contributed positively to the development and uptake of mobile phone technology in Table 33, the study revealed that efficiency and cost effectiveness stood out to be key areas of interest for users and providers of the technology. In general, the four most outstanding factors that promoted the mobile phone technology were the continued enhancement of mobile internet application followed by m-banking and money transfer, multimedia functionalities as well as reducing cost of airtime. Initially, access to the internet, banking and money transfer services was difficult and costly process. One had to go to a cybercafés and

conventional banking facilities which were mostly far away in the urban centres. On the other hand, access to radio, television, mail services and other multimedia utilities now available on the phone was the preserve of the rich. The fact that one could now access all these services at the click of a button and in the comfort of one's home, was enough reason to boost usage of the mobile phones.

The other feature that was quite prominent among the factors that promoted the mobile phone technology was the changing dynamics in the mobile phone industry itself. Further technological developments in the industry such as the use of bigger memory cards for instance had improved the variety and quality of services while also reducing the risks associated with mobile phone usage. This implied that in future, the mobile phone technology would be used to handle more and heavier applications. Better living standards on the other hand meant that people would have more and more money to spend on mobile phones thus enabling them to communicate more.

Furthermore, the proliferation of service providers had led to more competition thus furthering the lowering of calling rates. Changing user expectations coupled with increasing population and user literacy levels had prompted the mobile phone manufacturers and service providers to come up with more competitive phone models and innovative services as well as increase coverage of their services to meet the user needs.

Internationalisation of the mobile phone technology was yet another very important feature. The formulation of policies and introduction of roaming technologies that allowed users to make phone calls, send messages and even transfer money across borders had also tremendously promoted the application of the mobile phone technology. This was further boosted by the relatively higher cost of computers some of

whose functions such as internet and e-mail could now be effectively and more conveniently handled by mobile phones.

Looking at all these positive factors collectively, their enhancement could greatly boost the development of the mobile phone industry in the country in line with the objective 5 of the study.

On the other hand, the study found that the most outstanding trends that negatively affected the development of mobile phone technology as per Table 33 were the crime, negative behaviour change and poor infrastructure.

Largely, the use of mobile phone technology was being discouraged by increasing cases of fraud associated with mobile phones especially with regard to mobile banking and money transfer. Other criminal issues included espionage, theft and counterfesance. For instance users who purchased stolen or counterfeit phones would eventually be unable to use them when the phones are inactivated remotely by their owners or service providers, confiscated by security agents or switched off the network altogether.

On the other hand, and in line with the media-system dependency theory, discussed in Section 2.2 negative behaviour change was manifested in the overwhelming dependence of people on mobile phones which affected their thinking and reasoning capacities. Additionally cases of mobile phone related unfaithfulness had led to some families imposing restrictions on the use of this technology especially at home. The associated fear factor had also played a role in discouraging the effective use of mobile phones especially among those who were not well versed with the technology.

5.3 Mobile phone technology and empowerment of rural communities

The results in Section 4.4.1 helped to gauge the degree of empowerment of mobile phones to rural communities by assessing the value of mobile phone technology to the communities. In this regard, the mobile phone users rated the usefulness of the technology at 4.8/5 which translated to 96% (very useful). With their responses having ranged between useful and very useful, this rating was evidence that the entire community regarded the mobile phone technology highly and that it played a vital role in their lives.

The technology was said to be useful as a communication tool that could help the rural communities share ideas with the outside world and therefore improve their lives. Specifically, the technology was used for entertainment, internet access, providing archival storage and transfer of money. Others uses were social networking, education, research, information access, archival services, accessing first hand news, use of phone accessories such as calculator, business management as well as use for security purposes.

Because the rural communities were dominated by small scale farmers and traders means that the communication aspect of the technology was helpful in marketing, selling and buying farm and business products as a source of their livelihood. By promoting business, the communities were helped to earn a living, educate their children, and generally live a better life. In fact, when asked to say if the technology had turned around their lives 100% of the mobile phone users said so. The technology had empowered and hence enabled them to share information, do things better and generally live a better life. This happened through various modes of empowerment mentioned by the users which included information and communication, entertainment, education, social, economic, political, cultural, spiritual and research aspects.

According to Table 32, mobile phone users gave their views on specific features of the mobile phone technology and how they enhanced information sharing and empowerment which had a lot of implications on the quality of life in the rural settings. These included phone calls, short message service, mobile banking/money transfer, radio and television, media messaging services and digital satellite television.

Being one of the most universal features found on every mobile phone, the phone users equally regarded phone calls to be one of the most empowering aspects of the technology through communicating and sharing information (Section 4.4.2.1). This was because all recipients except those with hearing problems and regardless of the type of phone they were using could exchange messages. It was also regarded as very efficient, cost effective, and compatible with many other communication systems besides its ability to record or document information for future reference. As long as the recipient was online, the two communicators could share and exchange information instantaneously thus making it handy in times of emergencies where help could be given on the spot. The ability to document information was an indispensable value of the phone given that most people in the rural areas did not have adequate facilities to keep or archive their records. The empowerment was therefore in terms of the time saved which they could use on other gainful activities, the ability to share information at any given time, and also the ability to save costs. The saved costs could be spent on income generation and other useful business ventures.

According to Section 4.4.2.2 the use of SMS empowered rural communities to communicate and share information at any time. They were said to be generally faster, cheaper, reliable and more confidential. This made them handy for conveying official and emergency information. Because there was little or no influence from their recipients, the communicators had a sense of ownership, consistency, assurance and

control of the process and one could communicate easily to large groups and even senior people without interruption or feeling intimidated. This technology also empowered rural communities to document and permanently keep vital messages, information and records in the digital formats that did not require a lot of space, for future reference.

Even with limited size of keypads, the flexibility to integrate textual, audio and video messages on the mobile phones with the social media enabled rural communities to share and browse massive chunks of information without necessarily having to retype or recreate it hence, saving time.

Section 4.4.2.3 clearly indicates that mobile banking and money transfer services empowered the rural communities to circulate and share financial resources. These resources could be used to buy food, clothing, medicines and pay school fees for their children thus helping to improve their lives. The money could also be used to buy mobile phone handsets, airtime and other accessories necessary for communication.

Furthermore, to rural communities that resided far away from urban areas where there were few or no shops and bureaus that could sell mobile phone handsets and airtime, they used mobile banking and money transfer services as the best alternative to purchasing airtime. This enabled them to communicate and access information more conveniently thus helping to save and use their time more productively. In addition, money sent though the mobile phone money transfer services was quite often used in times of emergencies to save lives and help the communities improve their living conditions.

Section 4.4.2.4 shows that 62% of mobile phone users were using mobile radio and television meaning that jointly, the two features were the most popular among rural

communities. These were mainly used to share information through watching news and exchanging messages with friends and relatives. Consequently, they empowered the communities to stay in touch and remain knowledgeable and up-to-date with what was happening around them and the rest of the world.

The power of mass communication and documentation inherent in these media also meant that the communities could cheaply and conveniently exchange ideas among themselves and with the rest of the world as well as keep messages for future reference. The knowledge they acquired through these media meant empowerment to make informed decisions and better their lives.

Despite having a poor uptake because of lack of awareness and poorer network quality in the rural areas as is evident in Section 4.4.2.5, the use of MMS held great potential to empower and improve the lives of rural communities. Although 88% (352/400) of the phone users seemed to have no idea about it, there was evidence from the 12% who reported having actively used the service that it could improve with time and with more sensitisation and better network capacity in the rural areas.

Without scanners and other imaging equipment in the villages, this service was being used by a minority of mobile phone users to take high definition images and share them with others either directly or through online platforms. With this service, it was possible for farm workers or business people to take pictures of their products and send them to their customers as part of marketing thus improving their turnover. Besides being very reliable and quite informative, the service helped the rural dwellers save time which they spent on other life enhancing activities.

With only 4.5% of mobile phone users having used them, DSTV services had the poorest uptake. From the results in (Section 4.4.2.6), this was due to lack of the

requisite technologies including appropriate mobile phone handsets and network capacities in the rural areas. This small proportion of usage was evidence that there was also inadequate sensitisation of the rural communities about this service. However, increasing interest by users in the service and continuing investment by various service providers in the area meant that it will in the long term turn out to be one of the most substantive mobile phone services in the future.

Generally, all the foregoing discussions attest to the fact that indeed, the mobile phone technology does empower rural communities to live better lives. Its enhancement through the various modes and manifestations is key for the development of the communities as well as the mobile phone industry itself. This conclusion is also captured in the conceptual model (Figure 5) which shows that the act of communication empowers all the participants in the process thus enabling them to do things better and live a better life.

5.4 Factors affecting access, development and use of mobile phone technology

The factors affecting development and use of mobile phone technology in rural areas were examined from three perspectives namely: positive and negative features of mobile phones, challenges that made it difficult to use the phones as well as perceived risks that users were exposed to in using the technology.

As per the results in Table 33 the mobile phone users listed the five most outstanding endearments of the mobile phone technology to be efficiency, ease of use, multimedia capacity, enjoyability, convenience, and ability to share financial resources through mobile money transfer services. This meant that the rural communities valued the technology that saved their time, was simple enough to use and multipurpose in nature.

They also cherished technology that was entertaining, not laborious and also one that could help them share and circulate their financial resources easily.

On the other hand, factors that discouraged the use of mobile phone technology were high long term cost of use, lack of electricity in the rural villages, the dependence syndrome that came with long term use as well as lack of credibility of mobile phone mediated messages. Other factors were health concerns, relationship issues and criminal use.

However, it was quite notable that the positive and negative features of mobile phone technology having garnered 1486 and 1192 cumulative responses respectively, meaning that the rural communities viewed the mobile phone technology more positively than negatively. This showed that the technology had a lot of potential in turning around the rural life if well harnessed.

For mobile phone manufactures and service providers, it would be prudent while packaging services and products to take all these factors that made mobile phone technology either attractive or unattractive into consideration.

Generally, with 77% of the mobile phone users reporting having experienced one or more challenges that affected the development and uptake of mobile phone technology in their areas, more focus was placed on the 23% of the users who said they did not experience such. The implication of this proportion was quite different when evaluated in light of Figure 15 which shows that 31% (124/400) of phone users had only acquired their first phones within the last three years (2011-2013). This was an indication that this category formed a large part of those who had not experienced phone related problems primarily because they had not owned them long enough to experience any problem. Besides, their phones were still new and in relatively good working conditions

thus posing fewer problems. This means that in the long-term, every mobile phone user was bound to experience one problem or the other with the technology.

Generally, the main challenges relating to mobile phone technology were technical. According to the data presented in Section 4.5.2.1, these included network failure, electrical power, charging problems, maintenance issues, frequent break downs, memory problems, battery failure, phone disposal issues and phone viruses. Others included cost of phones and airtime, insufficient user education, health related issues, insecurity, inadequate policy guidelines, privacy concerns, relationship problems and pilferage. Collectively, these are the issues that made it either impossible or difficult to use and develop the mobile phone technology. This means that addressing the said issues would accelerate the development, and use of mobile phone technology in the rural areas. Just like in the conceptual model (Figure 5), reducing noise or interference in the communication process would greatly enhance its success.

In Section 4.5.2.2, the mobile phone users also mentioned a number of risks that they felt made them fear or become more cautious while using mobile phones. As already noted, fear factor can play a major negative role in any development process. As mentioned by 34.04% of the mobile phone users, the most prominent risk was safety and security. Others were health, environmental, behavioural, electromagnetic interference, death and accidents and fire in their order of prevalence. These risks were an indication of the fact that even though the number of mobile phone users was increasing, there were fears about the effect of the mobile phones on their lives which needed to be addressed.

However, it was notable that in spite of the felt risks, none of the mobile phone users responded by stopping to use the technology. This was an indication of the length to

which rural communities were willing to go in using the mobile phone technology regardless of how it negatively affected them. Instead, 40% of mobile phone users only resorted to minimising its usage and seek further information from experts. Reduction of usage was evidence that indeed, fear plaid a role in curtailing the use and development of mobile phone technology. The other major response was to seek expert attention such as medical checkups. Nevertheless, the least proportion of 3.3% of mobile phone users took no action. Again this group of users was in the category of those who were either new to the technology or not well sensitised about the stated risks. Generally, it also pointed to the poor mobile phone user education campaigns in the rural settings.

With regard to reparability of mobile phones in Section 4.5.2.3, 77 % of mobile phone users had reported experiencing issues that warranted repairs. From the results, there was a clear correlation between users who had experienced challenges with their phones and those who had sought repair services.

The list of the problems showed that all were technical issues with the most prominent ones being audio problems cited by 69.5% of mobile phone users. Others included general handset failure, screen failure, charger failure, memory problems, battery failure and network loss. The users also mentioned keypad failure, money transfer issues, casing replacement, power consumption, settings, and mobile phone viruses as problems that required repair services.

The results meant that the most prominent technical weaknesses of mobile phones that required urgent attention were their audio systems including earpiece and mouthpiece, screen failure and charging problems. Screen failure particularly had two dimensions. Long term usage which rendered the buttons unresponsive and over and above visibility

issues. The visibility issues were mainly associated with touch screens when used in very bright environments such as under direct sunlight.

With 75% of mobile phone repair shops used mobile phone users located in urban areas and only 25% in rural areas, the users were disadvantaged when it came to seeking repair and maintenance services for their phones. As per the results in Table 36, this was regarded as one of the reasons why the success rate of mobile phone repairs in the area of study was 49.11% - a proportion that was considered below average. Furthermore, considering the large size of user population in Western Province, the proportion of 16.7% (15/90) of the dealers who offered repair and maintenance services in Figure 16 was considered highly inadequate.

To show the limitations of mobile phones, the users stated a number of phone specific technical barriers that if addressed would help the communities maximise the benefits they got from the technology as per Section 4.5.2.4. These included fast pace of technology change, complicated phone menus and procedures, fragility of phones, risks associated with mobile phone use, lack of adequate user support and use of foreign languages. Others were limited phone features especially in basic phones which were the commonest in the area, short battery life and lack of internet capacity. All these barriers were within the ambit of mobile phone makers and service providers to address so as to enhance further development of the mobile phone technology as per objective 5 of the study.

According to Table 41, user specific limitations that prevented mobile phone users from maximising communication included poverty, residence locality, technology phobia, inefficiency due to wastefulness, ignorance, language barrier and illiteracy. Others were tight work schedule, disruption, relationship issues, eyesight problem and limited phone contacts. The last limitation was especially prominent with basic phones

whose memory capacities were quite limited. However, all these barriers are easily surmountable from the user perspective with support from the Government and the mobile phone service providers.

5.5 The potential of mobile phone technology to spur more development

In order to boost the development and use of mobile phone technology, the study looked at unexplored areas of the technology both from short term and long term perspectives.

Before implementing any kind of enhancement, it was important to find out if the mobile technology was in any way satisfying the needs of users and hence valuable to them. With an average rating of 72% (3.6/5) in Table 23, the satisfaction of rural phone users with the mobile phone technology was found to be good. However, this being an average meant that there were as many individuals whose ratings were above as they were below. It was therefore concluded that a number of mobile phone users had their satisfaction level below this average and hence, needed urgent help to make them move at par with the rest of the communities.

When asked to make suggestions that could enhance this rating, the most popular suggestion made by over 66% of mobile phone users was lowering of the cost of airtime and that of the mobile phone handsets as per Table 25. Others were to increase user education, simplification of phone menus, increasing local content and integration of local languages into mobile phones. The only suggestion made by 1.3% of the mobile phone users outside the provided answers for this question was addressing security concerns. This made it a major concern that required urgent attention.

On the other hand, when asked the same question independently, the responses from the mobile phone dealers were to a large extent similar to those of the users implying that

the two groups of respondents shared common experiences in the use of mobile phone technology. For instance whereas the most popular suggestion by the users was to lower the cost of airtime, that of the dealers as suggested by more than 93% was to lower the cost of mobile phone handsets as per Table 26. The only difference that was noted was that whereas the users looked at the technology from the cost of usage (airtime), the dealers looked at it from the cost of doing business (handsets). This implied that any strategy to boost the use of mobile phones should have a two-pronged approach to satisfy the needs of both the users and the business community in the mobile phone industry.

Furthermore, in order to kindle more innovative use of mobile phone technology, it was necessary to enhance and use it more differently. The most popular suggestion given by 40% of mobile phone users in Table 42 was to increase the use of mobile phones for human security and safety followed by enhancing computing functions such as having expansive keypads, integrating efficiency monitoring systems to cut on wasteful usage as well as promoting the use of SMS chatting to mimic the online chatting on the internet.

Other suggestions included enhancing the research capability of mobile phones, integrating money transfer on the handsets instead of SIM cards, having phones that could remotely be controlled by the caller as well as introducing phones with highly simplified menus. Some mobile phone users wanted to see phones that could automatically and more accurately repackage information from one format such as audio into another one like text. Others wanted phones with increased local content including traditional songs and games such as *ajua*.

Generally, the suggestions by mobile phone users mainly centred on introducing new or expanding the existing technologies to make them better. Some enhancements would

require higher levels of artificial intelligence that would make phones mimic the human mind and behaviour. Another mechanism suggested by 4.3% of mobile phone users was to provide all the necessary assistive technologies for people with disabilities. This suggestion was a reflection of the fact that generally, mobile phone development had little regard for people with disabilities thus making it impossible to penetrate this important user group.

5.6 Stimulating innovative application and development of mobile phone technology

Just like any other information technology, mobile phone technology should be responsive to the needs of users. Mobile phone users made suggestions as to the new or enhanced services and features that could make the use of the technology more innovative and responsive to their needs.

In their own world of imagination, 61.5% of mobile phone users in Table 43 wanted mobile phones to act as super detectors with the ability to sense and take notice of adverse conditions as well as dangerous objects and people around them. Other improvements included increasing universal features besides calls and SMS, improving the general technology and services to cater for new demands and also have more automated functions such as additional intelligent, automatic locking when stolen as well as automatic charging capability that work independently from the normal electrical supply.

Users also wanted phones that had plenty of features that could help them with planning and management of their activities while others wanted phones with more ‘brain power’ to help in decision making. The suggestions imply that the use of mobile phones

could also be more innovative with full scale computerization where they would be able to do everything that computers were doing.

Some users also expressed the need for mobile phones to have medical capabilities to diagnose diseases and administer or prescribe treatment. Besides, other respondents wanted phones with genetic capability to evolve and fit in various environments as well as pass over vital information to the relevant people when the owner died or was incapacitated.

Although it was the least suggested by 1.5% of the mobile phone users, psychosocial support also featured as one of the novel ways of using the mobile phone technology. Users wanted phones that could talk, teach, preach and even counsel them when they were traumatised.

From all these suggestions, it is evident that users wanted to see the development of the mobile phone technology take a new dimension whereby it would be laced with more artificial intelligence so that the handsets could perform more remarkable tasks. They wanted phones that could practically imitate and do everything that a computer does and to some extent some of the things that only human beings could do. These suggestions were in line with the third objective where user feedback can play very important role in determining future development and innovative use of mobile phone technology.

Closely related to these suggestions, the phone users made a number of recommendations in Section 4.8 that could see even better mobile phone systems and services in the market. In this regard, the most prevalent recommendation made by 64.5% of mobile phone users, was subsidisation of mobile phone related costs especially the cost of handsets and airtime. This could be interpreted to mean that

majority of mobile phone users found prising of mobile phone systems and services quite unfriendly in the long term. Other recommendations included ensuring more electrification of rural areas, strengthening and widening of mobile phone network coverage as well as improving phone technology especially with regard to resistance from easy damage. As a policy matter, some users wanted stakeholders including mobile phone manufacturers, service providers and even the Kenya Government to ensure more integration of local content to make the mobile phone technology more relevant to the rural communities.

With the increasing use of mobile phone to access the internet, there were also suggestions to the effect that the web related technology features on the phone including browsers and processors be enhanced to enable phones open and exchange web content more efficiently and effectively.

From the recommendations, it was also evident that there were increasing security and ethical concerns. This was evident from the 19.5% of mobile phone users who recommended that relevant authorities especially the Government and security agents take steps to discourage criminal and abusive use of mobile phone related technologies.

The recommendation to enhance user education as suggested by 17% of mobile phone users was yet another evidence that rural communities were not well sensitised about mobile phone systems and services available to them. This was clearly demonstrated by 9.5% of phone users who recommended that there should be elaborate programmes for phone e-waste disposal in the rural settings. This was an indication that despite e-waste disposal management being a menace, the communities needed more knowledge and support on how to manage the problem.

In terms of how the current mobile phone technology could be used differently to spur greater levels of information sharing and empowerment, mobile phone dealers wanted phones to play a bigger role as business assistants to increase their sales. Of particular interest was the use of systems with the ability to collect and process business data and records

The mobile phone dealers in particular recommended that the Government and service providers should play a bigger role in ensuring wider coverage of the mobile phone technology by expanding rural electrification programmes, expanding connectivity, and subsidising mobile communication through moderation of related taxes and other levies. The mobile phone industry players should also involve rural communities more in defining features such as language that were friendly to them and establish sponsored mobile phone clinics in the rural villages where charging and repair services could be offered. In addition, mobile phone manufacturers should integrate systems that could give the phones some self-repairing capacity.

Looking at all the recommendations comparatively, whereas the advice by mobile phone dealers to improve the technology was largely to enhance its saleability, that of the mobile phone users was more about technical as well as enhancement of features. This was intended to help them use it with more ease and increase user benefits. For instance the mobile phone dealers in Table 26 recommended more simplicity, more power, antitheft features, monitoring and evaluation as well as word processing and printing capabilities all of which required additional technical inputs. The mobile phone users on the other hand, recommended phones to have more detection capabilities, more automated functions, planning and management features and artificial intelligence. The advice from the two categories of respondents portray a trend where

the mobile phone was viewed as a technological device, a commercial good as well as a social tool to help people and communities live together and prosper.

Putting the foregoing suggestions and recommendations into the perspective of the conceptual framework (Figure 5) in the literature review, objectives 1 and 2 as well as research questions 1 to 4 of the study, user expectations are a key determinant of the direction the development of mobile phone technology can take. As portrayed in the conceptual model, any successful communication process must be preceded by the need to exchange a message. Similarly, successful development of mobile phone technology requires that the users of the technology should express their needs effectively so that the phone developers and service providers can use such needs to put in place their blueprints for future planning and development. In this regard, it is hoped that the findings in this study will be useful to all mobile phone technology stakeholders including phone users, governments, developers and service providers to stimulate further development, innovation and uptake.

5.7 Chapter Summary

This chapter has given a review of findings in line with the set goal and objectives of the study. In particular, the chapter has assessed the current status and trends in the development, development and use of mobile phone technology providing ample evidence to show that despite the prevailing problems, the application of the mobile phone technology in the rural setup has a bright future. This is further attested to by a review of a number of mobile phone technology systems, services and features which showed that they were generally quite popular and will continue to be used. The features include phone calls, SMS, mobile banking/money transfer, radio and television, MMS, and DSTV. These and many other uses of the technology have

empowered the communities to live a better life through communication and information sharing.

Furthermore, the chapter has highlighted that most of the emerging trends in the mobile phone technology promoted more than they discouraged its development. The recommendations from the phone users as well as dealers and service providers as highlighted here show the need for more integration and involvement of the three groups together with mobile phone manufacturers in any efforts to promote the development and use of mobile phone technologies. Such efforts must also take into account the prevailing circumstances including a thorough assessment of the user's needs. Synthesising both the views and recommendations of mobile phone users on one hand and those of the dealers and service providers on the other, the findings are a first step towards developing an elaborate blueprint by mobile phone stakeholders for future planning and development.

The next chapter concludes the thesis by providing an overview of the findings and recommendations. The conclusions and recommendations are drawn from the findings of the study with a view to foster the application and development of the mobile phone technology.

CHAPTER 6: SUMMARY, CONCLUSION AND RECOMMENDATIONS

6.1 Introduction

The essence of this research work is well embodied in its title *The Role of Mobile Phone Technology in the Empowerment of Rural Communities in Western Kenya.* The title is representative of the broad range of concepts and issues covered in this research. These concepts and issues are important in the way they interrelate and focus on promoting the empowerment of rural communities through mobile phone mediated information and related services. In this regard, this chapter concludes the thesis by providing an overview of the findings and recommendations of the study. The recommendations are geared towards optimising the development and uptake of mobile phone technology to make the society and particularly communities in rural areas raise their awareness and become more empowered to live better lives. Suggestions for future research in related areas have also been made with a view to expanding the existing body of knowledge and inspire future generations of scholars.

6.2 Summary of the study

Mobile phone technology has emerged as one of the greatest innovations of the modern society but its potential to accelerate development and improve the lives of rural communities has not been maximised. This study aimed to investigate the contribution that the mobile phone technology had made towards enabling rural communities improve their lives and explore ways of maximising its development and application for a more empowered society.

This aim was achieved through a number of objectives which included examining the extent to which current trends and developments in the use of mobile phone technology

had met the needs of rural communities. In addition, the study investigated the modes of information empowerment emanating from the technology. The study also identified key factors and challenges that affected access and use of the technology in the rural areas and evaluated its untapped potential to stimulate greater information sharing and empowerment.

A multistage sample of 400 rural households across the Western Province was selected based on the population data from the Kenya 2009 National Census Report as the main respondents. A census of the managers of the provincial customer care shops of the 4 service providers (Safaricom, Airtel, Orange and Yu) and a systematic random sample of 90 mobile phone dealers within the Province were selected as informants.

The study focused on sub-locations of districts with the highest rural population of 90% and above. The districts were Hamisi, Kakamega, Samia, Kakamega East, Kakamega North, Butere, Mt. Elgon and Lugari with a total household rural population of 1,367,514. Because of difficulties encountered in obtaining the list of households in the area that was compiled from the said census, households were selected using the Global Positioning System (GPS) via Google Maps (https://maps.google.com/maps?hl=en). Randomly generated, the GPS coordinates were inserted in the Google Maps website and the exact position on the ground located via Google satellite images. The nearest household was picked for participation in the study.

The study found out several trends in the development and uptake of mobile phone technology. Whereas available literature generally showered a progression towards more powerful and trendy mobile phone systems, mobile companies, service providers and users' preferences tended towards features that appealed for prolonged usage, self-esteem and convenience. These traits were quite pronounced in the habit of rural mobile phone users carrying several phones with different SIM cards or owning phone

brands that could use multiple SIM cards simultaneously. The same was true with the habit of users continuing to prefer mobile money transfer services especially from service providers they could easily identify with.

There was also a noticeable trend in the gender composition of mobile phone users whereby 52% of the mobile phone users were male despite their population ratio being 48%. This meant that the male population enjoyed an 8% advantage over the female population. The situation was made even worse by cultural considerations that were found to exist. Generally, because of gender discrimination that was still rampant in many parts of the world, male and female norms were constructed to privilege men and disadvantage women (International Federation for Human Rights: 2002). This was confirmed by the findings of the study which showed that like in most African traditional rural setups, males enjoyed more economic privileges than females. Consequently, campaigns that promoted mobile phone usage targeted and to some extent favoured the male than the female population mostly for economic and business reasons thus making the female population not to maximise the usage of the technology.

The socioeconomic factor in the mobile phone usage was also evident in the fact that only 59% of rural community members owned phones and 75.8% of which were through direct purchases. In addition, 68% of the phones owned were basic phones regarded as the cheapest in the market and on average, the phones owned by mobile phone users cost slightly over Ksh 3,000, which was considered above the reach of many rural dwellers. This was supported by the fact that in terms of phone ownership, 28-37 year was the modal age group which coincidentally was the most active working class and hence more economically endowed.

Besides, the large proportion of the mobile phone users on prepaid tariffs was a sign

that majority of them tried to apply safeguards in their communication so as to avoid extravagance and paying of higher premiums than necessary. This was further supported by the evidence which showed that mobile phone users received more calls than they made and also, that they spent less than what their callers spent. This meant that they were more cautious with the way they spent on the usage of the phone technology. It implies that many people in the rural did not own or use mobile phones because they could not afford the related costs. The situation required some urgent interventions from the stakeholder particularly the Government.

Another trend was that although there was an exponential progression in terms of ownership of mobile phones spanning from 1998 to 2013, the level of awareness among mobile phone owners at 57.9% was considered very low. This was because majority of phone owners used trial and error in self education while many others did not take any step to build their knowledge about mobile phones. Furthermore, over 40% of the rural population did not own any phone and therefore their awareness level was very low. Evidence of low level of sensitisation was also manifested in the mobile phone ownership pattern which revealed that 8% of the phones in the area of study were owned by minors which was against the law.

The study found that the five most useful mobile phone features were camera, radio, ringtones, games and Bluetooth which tended towards entertainment, communication and sharing of resources and regarded as the major indicators of satisfaction. Conversely, features that did not satisfy users included imaging, infrared, video calling, wireless (Wi-Fi) and touch screen. This was a result of technological challenges and lack of awareness and capacity.

It was also found that apart from voice call and SMS which were regarded as essential, the internet and mobile money transfer were the most popular services related to the

mobile phone technology with an increasing number of mobile phone users owning internet dedicated modems. The most popular mobile phone related systems were mobile phone handsets. However, only about half of the phone users could buy and access mobile phone handsets from their rural settings and also communicate directly from their localities. The remaining half of the population that could not communicate directly implied that there was inadequate facilitation in terms of network connectivity and other support services. On average, availability of all mobile phone related systems added to about one fifth, which was taken as the low level of investment by mobile phone dealers and service providers in the rural areas.

On the other hand, the most redundant mobile phone features to the users included instant messaging, voicemails, MMS, games, word processing and wireless (Wi-Fi). Comparably, there was a much lower percentage of mobile phone users citing redundant features than otherwise meaning that despite its shortfalls, many mobile phone users still regarded the mobile phone technology highly. This was further confirmed by 72% of mobile phone users who admitted that their needs were satisfied by the mobile phone technology. Besides, there was evidence that satisfaction levels were closely related to the network coverage whereby the service provider with the widest network was viewed more favourably by the phone users. The order of preference from the highest to the lowest was Safaricom, Airtel, Orange and Yu.

The study also found a number of merging trends and issues that affected the development of mobile phone technology both positively and negatively. The positive factors included efficiency and cost effectiveness particularly evident in the internet technology, m-banking and money transfer, multimedia functionalities of mobile phones and reducing cost of airtime. Others included continuing technological developments which improved the variety and quality of services while also reducing

associated risks. Improving living standards also meant that more people were increasingly having money to spend on mobile phones thus enabling them make more and longer calls. In addition, proliferation of service providers led to more competition and lower calling rates to the benefit of mobile phone users. More factors included, changing user expectations, increasing rural population and literacy levels as well as the internationalisation of the mobile phone technology which enabled cross border communication.

On the other hand, issues that negatively affected the development of mobile phone technology were crime, negative behaviour change and poor or lack of infrastructure.

The study found a number of modes of information sharing and empowerment emanating from mobile phone mediated services that were prevalent among the communities and their effect on the quality of life of rural communities. These included entertainment, internet, social networking, education, research and information access. These helped the community share ideas with the outside world and make their lives better. However, the most predominant modes of empowerment in their order of preference were phone calls, Short Message Service (SMS), mobile banking/money transfer, radio and television, Media Messaging Services (MMS), and Digital Satellite Television (DSTV).

In an attempt to identify key factors and challenges affecting access, development and use of mobile phone technology in the rural areas, the study found that factors that endeared the mobile phone technology to the communities included efficiency, ease of use, multimedia capacity, enjoyability, convenience, and the mobile money transfer. It was therefore concluded that the rural communities preferred technology that was simple, time saving, and also multipurpose in nature. They also cherished technology that was entertaining and easy to use and also one that could help them mobilise and

share their resources. On the other hand, factors that discouraged the use of mobile phone technology were high long term cost, lack of electricity, the dependence syndrome, incredibility of mobile phone related messages, health concerns, relationship issues and criminal use.

The study found a number of challenges that also negatively affected the development and uptake of mobile phone technology among rural communities which were mainly technical. These included network failure, electrical power and charging problems, maintenance issues, frequent break down, memory problems, battery failure, technological problems, phone disposal issues and phone viruses, cost of phones and airtime, insufficient user education, health related issues, insecurity, inadequate policy guidelines, privacy concerns, relationship problems and pilferage.

The risks that made mobile phone users fear using mobile phone technology and hence slow uptake were safety and security, health, environmental, behavioural, interference, death and accidents and fire. However, none of the risks stopped the phone users from actual usage of the mobile phone technology which meant that the rural communities regarded mobile phone technology in high esteem. Instead, most of the users responded to the risks by mainly seeking further information from experts. The other response was to seek expert services such as medical check-ups.

In terms of day to day technical problems that made it necessary to take mobile phones for repairs, the study found these to be audio problems, handset problems, screen failure, charger failure, memory problems, battery failure and network loss.

The study also found mobile phone specific barriers that prevented mobile phone users from maximising their use. These included the fast pace of technology change, complicated phone menus and procedures, the fragility of phones, risks associated with

mobile use, inadequate user support and use of foreign languages. Others were limited phone features especially on basic phones which were the commonest in the area, short battery life and lack of internet capacity. On the other hand, user specific barriers included poverty, residence locality, technology phobia, inefficiency due to wastefulness, ignorance, language barrier and illiteracy. Others were tight work schedule, disruption, relationship issues, eyesight problem and limited contacts that phones, especially the basic phones could accommodate.

Regarding the untapped potential of mobile phone technology that could spur higher levels of information sharing and empowerment, the study found that only 71.6% of mobile phone users were satisfied with the mobile phone technology showing that there was quite some room for improvement. Areas of improvement included more use of the phone in human security and safety, enhancing computing functions, integrating efficiency monitoring systems and SMS chatting and increased research functionalities. Others included integrating money transfer on the handsets, having remote controlled and much simpler handsets as well as increased local content including traditional songs and games such as ajua. Generally, the suggestions by the mobile phone users mainly centred on introducing new or expanding the existing technologies to make them better. Some enhancements would require higher levels of artificial intelligence and assistive technologies for people with disabilities.

New and more innovative features and services of the mobile phone technology as suggested by mobile phone users included having mobile phones to act as super detectors of many things including adverse conditions as well as dangerous objects and people around. Other innovations included increasing universal features besides calls and SMS, improving the general technology and services to cater for new demands and also have more automated functions such as auto locking or self-destruction capability

when stolen and automatic battery charging. Users also wanted more features to support planning and management of their activities. They wanted to see phones with more 'brain power' to help in decision making, full scale computerization of handsets to handle more complex tasks and, more medical capabilities to diagnose and administer treatment of diseases as well as have genetic capability to evolve and divulge vital information when the owner died or was incapacitated. Some users also wanted mobile phones that could offer psychosocial support features that would make phones talk, teach, preach and even counsel their owners in times of need.

In conclusion, therefore, the study found that there were both positive and negative trends in the development and use of mobile phone technology. The main positive trends which were responsible for a 72% satisfaction rate among mobile phone users and needed to be enhanced were efficiency and cost effectiveness mainly associated with internet technology, m-banking and money transfer, increasing multimedia functionalities of mobile phones as well as reducing cost of airtime. The negative trends that needed to be curtailed were crime, negative behaviour change and deteriorating infrastructure.

The main modes of information sharing such as communication, entertainment, internet, money transfer social networking, education, research empowered rural communities to do things better. Specifically, the empowerment was realised through, information access and record keeping services, easy access to news, use of phone accessories such as calculator, use of simple applications for business management such as mobile banking and money transfer as well as security. These helped the community share ideas and resources with the outside world and make their lives better thus requiring to be enhanced for greater empowerment capacity and availability of services showed that the rural areas had had somehow been neglected by mobile phone

investors hence disadvantaging their effort to self empowerment through the technology. In addition gender dynamics showed that the male population was favoured by the mobile technology more than the female population thus requiring measures to balance out.

6.3 Conclusion

From the foregoing analysis, it is evident that generally, the rural communities were not given adequate attention in terms of provision of mobile phone products and services. As a result the study concludes that:

i. **The needs of rural mobile phone users are not well understood by mobile phone service providers and hence not effectively met:**

This conclusion is based on a number of observations made in the findings. For instance the gender imbalance observed in Figure 11 proves that the male users dominated use of the mobile phone technology at 52%, despite their overall population being less than that of the female users. First and foremost, this was a reflection of how the needs of one gender were not being equitably met. It also reflects that the needs of the entire population had not been adequately met given that the general usage in terms of rural community members owning mobile phones was still at 59% as shown in Figure 12. In addition, Table 19 shows that only 70.5% of mobile phone users in the rural areas actually used internet services meaning that nearly 30% of them could not satisfy their needs for this service which has become part and parcel of modern life.

The conclusion is also inherent in Table 24 where rural mobile phone users rated their satisfaction at 86%. Although the rating appears to be high, the fact that 16% of the users felt that their needs were not being met shows that the mobile phone technology had some way to go to cater for people of all walks of life in the rural villages. On the

other hand, Table 27 as well as Figure 17 shows that on average, the rural mobile phone users could only access 48.1% of the signal strength which was regarded as below average. Technically, this means that more than half of the rural mobile subscribers could not access the respective networks to communicate effectively.

Unmet needs of rural phone users were also apparent in Table 38 which measured the success rating of mobile phone repairs. This showed that on average, the success rating of mobile phone repairs as expressed by mobile phone users was 49%. This also means that more than 50% of rural mobile phone users could not get their phones repaired thus rendering the phones junk and effectively unusable.

ii. Access and use of mobile phone technology is critically hampered by affordability issues:

As demonstrated in Table 33 the most outstanding disadvantage of mobile phones was the long term cost of use. This means that many rural mobile phone users had their communication needs curtailed by the high cost of use including the cost of airtime and maintenance and thus hampering their ability to communicate and access information and related services. Because affordability is relative to one's financial capacity, this observation was closely linked to findings in Table 41 which showed that poverty was the most prevalent personal limitation that affected the rural community's ability to maximise the use of the phones.

The issue of cost was also echoed in Table 34 as one of the most serious challenges encountered by mobile phone users. Table 45 on the other hand lists recommendations of mobile phone users to service providers and phone makers which included subsidisation of mobile phone related costs especially the cost of airtime and phone handsets. Generally, the recommendations were made as part of suggestions geared to

promote usage of mobile phones in the rural setups. Given that majority of phones used in these settings were directly purchased from dealers as shown in Table 13, the cost factor was bound to continue being an issue until the necessary steps are taken to forestall it.

iii. Inadequate knowledge and capacity among mobile phone users has slowed down uptake thus effecting the growth and development of the industry:

The Scatter diagram in Figure 13 showing self evaluation of mobile user knowledge of mobile phone technology supports this conclusion. The Figure shows a mean rating of the knowledge of the phone users to be 57.9% which was regarded as fair (neither low nor high). This clearly demonstrates that rural mobile phone users did not have all the knowledge and capacity needed to optimally use the mobile technology available to them and thus affecting its usage.

This observation is supported by findings in Table 8 showing the user education strategies used among the rural communities to up their knowledge of using the phones. The fact that 37.8% of the users relied on trial and error to gain the necessary knowledge and skills to operate mobile phones shows the level of ignorance, desperation and lack of relevant support from dealers and service providers to this community. Ignorance is also inherent in Section 4.3.5 of the findings where despite the glaring inadequacy in user knowledge, the rural mobile phone users rated themselves very highly in terms of awareness levels. These observations are compounded by those in Table 7 which showed the various strategies used by mobile phone dealers to promote the use of mobile phone technology'. In the findings, user education stood out to be the most predominant strategy meaning that lack of knowledge among rural mobile phone users was a major issue. From all these, more knowledge and capacity would undoubtedly increase uptake, usage and development of mobile phone

technology in the rural setups.

iv. Criminal and abusive use of mobile phones is a major concern with tremendous impact on communication behaviour:

This conclusion is based on findings in Table 29, 33 and 45 as well as Sections 5.1 and 5.2.1. Table 29 clearly shows that the emergence of criminals who took advantage of loopholes that still existed in the mobile phone innovation to defraud unsuspecting users had become a major issue. This observation is supported by the findings in Table 33 showing that criminal use was one of the most outstanding disadvantages associated with mobile phone technology. In Table 45, one of the recommendations of mobile phone users to service providers and phone makers was the discouragement of criminal/abusive use of the mobile phone technology as one of the strategies of promoting usage.

Section 5.2.1 on the other hand shows that among the emerging trends that had a very negative effect on the mobile phone technology was the increasing cases of criminal activities associated with mobile phones. These included fraud especially that associated with mobile banking and money transfer, espionage, theft and counterfesance. This observation was also supported by the findings in Section 5.1 which showed that one of the major factors affecting access development and use of mobile phone technology was criminal use.

v. Continued use of mobile phone technology creates environmental challenges emanating from disposal of phone related waste:

Compared to urban setups, mobile phones were a relatively new phenomenon in the rural areas. As such, the technology came with its share of risks given that the rural communities have limited options and knowledge of how to dispose of the mobile

phone gadgets when they reached their end of life. Section 4.5.2.1 for instance shows that environmental damage was one of the most outstanding risks associated with the use of mobile phone technology in the rural areas mainly caused by poor disposal of mobile e-waste and sound pollution emanating from usage of phones in laud mode. This observation was compounded by the findings in Table 29 showing factors that affected the development of mobile phone technology. Among these factors were inadequate phone repair and maintenance facilities which had led to more e-waste.

Given that recycling had widely become one of the leading strategies of cost and environmental management, lack of proper disposal of phones meant that rural mobile phone users were not only exposed to toxic waste that directly affected their health but also the inability to benefit from e-waste related subsidies which could lower the cost of mobile phones and increase uptake levels. Furthermore, one of the recommendations made by rural mobile phone users in Table 35 was the establishment of elaborate programmes for e-waste disposal meaning that it was a major concern that needed intervention.

vi. Mobile phone network coverage in rural areas is fairly weak thus affecting the number and quality of mobile phone related services:

This conclusion is derived from the assessment of the average mobile phone signal strength of various service providers in Table 27 which shows that in the overall, the total network strength of all service providers stood at 48.1% which was regarded as below average. This assessment is supported by Table 29 showing the factors that affected the development of mobile phone technology to include expansion of rural coverage with mobile phone networks. Weak network resources in the rural areas affected the entire spectrum of mobile phone services making it a major hindrance to uptake.

vii. Most mobile phone users are unable to maximise use of the technology because of foreign content and language barrier:

According to Sunday (2016: para. 1) the issue of local content is not only a national issue in Kenya but one that is required by law to be implemented across all media platforms. In this study, both mobile phone users and dealers in Table 34 expressed the challenges they experienced with the technology- one of them being language barrier. Whereas dealers – some of whom were business operators not familiar with the local languages, experienced difficulties interacting with some of the local clients not familiar with Kiswahili or English, most users were mostly frustrated by the phone content which was in foreign languages. However, much of this problem was felt as a result of many phones being configured in English and other foreign languages and whose operational manuals and guides were not translated into local languages spoken by users. This observation is compounded by findings in Table 40 showing use of foreign languages as one of the major technical barriers associated with mobile phone technology.

viii. Mobile phone technology in rural areas still has unexplored capacity that needs to be exploited for the benefit of all:

In the findings, the rural mobile phone users made several expressions that implied gaps that needed to be filled by the technology. One of such expressions was in terms of more innovative use, features and services of the mobile phone technology in Section 4.7 and Table 43. These were things that the mobile phone users thought were not yet factored in the current technology, yet useful. For instance, among the things they thought the technology could do was to be used more as a detector that could automatically sense various circumstances such as danger and notify the owner.

More specifically, Section 4.6 discusses unexplored areas and uses of mobile phone technology that could further enhance the development and application of mobile phone technology among rural communities. It shows a number of areas that the technology could explore to become even more purposeful. These areas include enhancing the use of the technology for security and safety purposes given that it is one of the commonest gadgets owned by human beings.

ix. Mobile phone web functionalities are still rudimentary thus curtailing the quality and volume of content that can be developed and used:

As per the findings in Table 29, Internet had turned out as the most significant factor that had greatly promoted the development and use of the mobile phone technology in rural areas. Indeed, the trendiness and fashionable use of the mobile phone technology seemed cantered on web functionalities and hence the capacity for the technology to be manipulated to disseminate information over the web platform is quite significant. However, Table 45 and Section 4.8 which discussed general user recommendations on development of mobile phone technology show that enhanced web technology was a key recommendation. Since the recommendations were aimed at suggesting ways and means of enhancing the development and application of mobile phone technology in information sharing and empowerment, this was an indication that the technology in its current state and form did not have satisfactory web functionality.

x. Rural communities suffer from poor transport and communication infrastructure which is the backbone of mobile phone development:

As pointed out in Section 1.10, one of the major limitations of the study was the poor transport and communication infrastructure in the rural areas. This did not only make it difficult to reach the targeted respondents but also prevented dealers and service

providers from installing new technologies or even servicing and maintaining existing ones thus affecting uptake and development. This observation is supported by Section 2.10 that discussed emerging issues in mobile phone technology and their effect on usage as well as Table 29 which lists factors that affected its development including lack of adequate supply of electricity, frequent electrical blackouts and poor communication network facilities occasioned by serviceability of the equipment due to the bad state of roads. Poor infrastructure is also cited in Section 5.2.4 and listed in Table 33 as one of the emerging issues that negatively affected usage of mobile phone technology.

xi. Rural communities lack proper incentives to promote the use of mobile phone technology in their areas thus making them lag behind in uptake levels:

The many disparities such as those in Figure 18 which emerged throughout the study proves that urban mobile phone users enjoyed a significant advantage over their rural counterparts. This means that for the parity and communicative commonality discussed in the Conceptual Framework in Section 2.3 to be achieved, the rural mobile phone users needed proper incentives to promote uptake levels of the technology. This conclusion is supported by the findings listed in Table 26 showing subsidization of mobile phone handsets and services for the poor and marginalized communities as one of the factors to boost user satisfaction. This also featured strongly among the recommendations of mobile phone users to service providers and phone makers in Table 45.

6.4 Recommendations

In view of the foregoing findings, discussions and conclusions, the study makes the following recommendations to the respective stakeholders namely: rural mobile phone

users, service providers, manufactures and the Government. The recommendations will go a long way in addressing a number of issues found in the findings and help to boost the growth of the mobile phone industry and empowerment of rural communities. For purposes of implementation, the recommendations have been grouped in two broad categories - short-term and long-term.

6.4.1 Short Term Recommendations

Short-term recommendations in this case are those expected to take up to one year to implement. They fall in four broad categories including needs assessment, cost reduction, user education and marketing.

6.4.1.1 Mobile phone users

The mobile phone users should:

i. Form User Support Groups

In order to stem many of the problems they experienced in the course of using the mobile phone technology, users should form user support groups which will give them more lobbying and bargaining powers to demand for new services or even improvement of existing ones. With such support groups, users can also share knowledge and experience whenever challenged with the ever metamorphosing mobile phone technology. Furthermore, users will enjoy enhanced capacity and confidence to continue exploring new and more innovative uses of mobile phone technology.

ii. Form Community Watchdogs

Because criminals are usually members of the same communities whose rights they violate, mobile phone users should form watchdog groups to help them monitor the use of mobile phones in their communities. This is more so because many users were very much concerned about the increasing cases of criminal and abusive use of mobile

phones as one of the factors that prevented growth and development of the industry. By promptly reporting all manner and cases of abusive use of mobile phones to the police and other security agencies, this could go a long way in creating more trust in the technology and in the long run promote further development.

6.4.1.2 Mobile phone service providers

The mobile phone service providers should:

i. **Conduct rural user needs assessment**

In view of the evidence that mobile phone service providers had invested more in urban than rural areas, changing this scenario requires that the service providers must first conduct elaborate needs assessment to understand the user requirements so as to roll out information services that are effective in addressing community needs. Because a community and household approach used in this study would be the most appropriate and cost effective for this exercise, the service providers should achieve this through collaboration with the Kenya National Bureau of Statistics (KNBS) through the Ministry of Planning and Devolution. The assessment can be done through a nationwide survey using the regional structures of KNBS to ensure inclusivity and exhaustivity so that all the underlying dynamics of rural mobile phone usage are taken into account. This would not only accelerate the level of development in the mobile phone industry but also ensure that all aspects of such development are both relevant and responsive.

ii. Lower the cost of mobile phone services:

Because the most popular recommendation made by mobile phone users was that the cost of airtime should be lowered, the study recommends that this should be done as a matter of urgency. This recommendation is both practical and feasible to implement

noting as Okoth, Edwin (2015: para 1) puts it, the most profitable business in Kenya in the financial year 2014/2015, was a mobile phone company. As a corporate social responsibility, the mobile phone companies can still make profits by ploughing part of their good business results in subsidising their service charges. Furthermore, lowering of service charges would attract more customers thus lead to even more profits and hence further development of the mobile phone industry.

iii. **Conduct more sensitisation and marketing campaigns**

Given that most mobile phone users were not well versed with some of the more technical mobile phone services, features and accompanying documentation, it is recommended that service providers should put in place more concerted efforts to not only market their services to reach more potential clients especially women and the physically challenged who comparatively spend most of their time indoors, but also to sensitise mobile phone users on available services and phone features that were not well understood and consequently not well used. For instance despite being a much cheaper alternative to regular international TV programming, the use of DSTV was poorly registered and such sensitisation would ensure that uptake levels of such services are increased. The service providers can achieve this feat effectively by tapping the cheap labour available in the rural areas to conduct the campaigns. Furth more, available documentation should also be reviewed and where necessary simplified and translated into vernacular to help the mobile phone users use them as their first-line reference whenever they felt challenged by the technology. This would in the long term help users become experts and more innovative in phone usage.

6.4.1.3 Mobile phone manufacturers

The mobile phone manufacturers should:

i. **Conduct User Needs Assessment**

In view of the evidence from the literature review, the invention of the mobile phone technology was done in the western countries and its development has largely remained skewed towards the same. Consequently, the technology has hardly reflected the needs and aspirations of the people in the developing world and Africa in particular. For instance, the study found tat almost all language options, games and other features on mobile phones were those of the developed world. Consequently, much of the assessments and user reviews that had been used to inform future developments were largely done online thus capturing responses and feedback mostly from the western mobile phone users. Mobile phone companies should therefore review their strategies and conduct more representative assessments of user needs from a global perspective so that the new developments in the industry reflect the needs of all users and particularly those in the marginalised parts. In so doing, they will ensure that their products attract more markets and also that marginalised communities will be empowered to communicate more and walk side by side with the rest of the world.

ii. **Lower the cost of mobile phone handsets**

Most mobile phone users lamented the high cost of mobile phones. It is therefore recommended that this cost should be lowered to help them communicate more and enhance their empowerment. The most practical and cost-effective way of doing this is to put in place e-waste disposal and recycling programmes to ensure that the phones that break down are reused to make new ones without using any new materials and endangering our environment. From the literature review and the findings of the study, it was noted that the development of the mobile phone technology was happening at

supersonic speeds and therefore, a user was not able to own a phone for a long time before being necessitated to acquire the next one. This was caused by either obsolescence due to rapid technology change or the delicateness of the handsets which made them easy to break down. The mobile phone manufacturers should take advantage of this phenomenon and put in place strategies to buy back phones that have broken down for either recycling or proper waste management. The funds generated should be used to subsidise new phones and hence lead to further development of the mobile phone industry.

6.4.1.4 The Government

The Government should:

i. **Lower mobile phone related taxes**

Because part of the high cost of mobile phone airtime and handsets that mobile phone users and dealers complained about in the findings of this study arose from taxes, the Kenya Government can tremendously boost the development of the mobile phone industry in the country by moderating these taxes. This can be achieved, for instance by creating an enabling environment where all the rural and marginalised communities are empowered to use mobile phones. This includes rural electrification and creation of employment opportunities. Increased usage would spread the tax burden and ensure that even with lower per-unit-tax, enough revenue is collected so as not hamper Government operations. This recommendation is tenable taking into account the reviewed literature which shows that Kenya is the leading country in East and Central Africa in terms of the development of the mobile phone technology and hence mobilising bigger user numbers cannot be a major challenge.

ii. **End criminal and abusive use of mobile phones**

Despite the stern warnings issued by the Government regarding the abusive use of unregistered mobile phone SIM cards to perpetuate crime, the same is still happening as this study found out. The Government must stamp its authority and put in place stricter laws and policies to enforce control of how mobile phone accounts are opened and used as well as seal all the loopholes exploited by criminals. For instance, since the biggest cyber crimes relating to mobile phones have largely been associated with hardcore criminals serving life sentences in the Kenyan prisons, one of the preventive mechanisms is for the Government to install mobile phone signal jammers in and around prison precincts to ensure that unauthorised phone communication is not possible. The government should also put in place systems and mechanisms to ensure that local mobile phone accounts are properly managed immediately the owners pass on to avoid criminals using them for criminal undertakings.

iii. **Enforce mobile phone disposal and e-waste management**

Lack of mobile phone disposal systems in the rural areas was cited as one of the major environmental risks associated with mobile phone technology. However, given that mobile telephony in the country is relatively a newer phenomenon compared to the western world, this problem is not just unique to the rural areas alone. The Government should in collaboration with the mobile phone companies establish elaborate programmes and systems to control and manage mobile phone e-waste disposal in the rural settings to make the technology safe and sustainable. For proper management and administration, disposal centres and facilities should be installed in various parts of the rural setup to enhance accessibility and compliance.

6.4.2 Long Term Recommendations

Long-term recommendations are those that would require more than a year to implement. They fall in six broad areas including network coverage, local content, technical capacity, infrastructure, incentives as well as user education.

6.4.2.1 Mobile phone users

i. Promote Education and Literacy Levels

Because many users complained about the predominant use of foreign languages as a major barrier to their ability to use mobile phones, the rural communities should play a bigger role in promoting education literacy initiatives in their own backyards. This can be done directly by sending more children to school and increasing enrolment at primary and secondary school levels. It can also be done indirectly by helping the Government develop more education opportunities and initiatives like schools and adult literacy programmes. A literate community will not only experience fewer problems in understanding the content and usage of their phones, but will also play a more substantive role in generating local content that will promote the usage of the technology.

ii. Improve Economic Empowerment

Rural communities can ensure that relatively higher poverty levels in the rural setups do not become a major impediment or even a crippling factor in the use of the mobile phone technology. This is more so because a number of rural mobile phone users complained that they were unable to afford communicating as much as they needed to ecause of the high cost of mobile phone handsets, airtime as well as handset repairs and maintenance. The communities must therefore continue investing in sustainable income generating programmes such as commercial farming to improve their

livelihoods which will give them more economic powers to promote and sustain usage of the mobile phone technology.

6.4.2.2 Mobile phone service providers

The mobile phone service providers should:

i. **Widen and strengthen mobile phone network coverage**

From the findings of the study, it was evident that both the coverage and the overall signal strength of various mobile phone services providers was below average. However, the cost of this undertaking can be quite overwhelming considering the country is large and parts that do not have adequate supportive infrastructure such as roads and electricity are vast. The most practical and cost effective approach would be for all the service providers to implement this as a joint venture and share the cost of installation and maintenance at least for certain parts of the country if not all. This would ensure maximum use of these facilities and avoid wastage that result from redundancy when used by a single service provider. On the other hand, phone users would increase uptake levels thereby boosting the development of the industry and enhance the empowerment of rural communities.

ii. **Integrate more local content into mobile phones**

Since the service providers have a big say in determining the type of after sale services that mobile phone users can enjoy, they should use this window of opportunity to develop and integrate more local content. This should include academic text materials and traditional songs and games so as to enhance the relevance of mobile phone technology. To achieve this, the service providers must work with relevant stakeholders including educational institutions, community leaders, the civil society as well as

respective government and international agencies in order to maximise the use mobile phones in the rural setups and enhance its overall development.

6.4.2.3 Mobile phone manufacturers

The mobile phone manufacturers should:

i. **Expand mobile phone capabilities**

With the advancement of miniaturisation and the technical capability to make memory cards that can hold very large data, mobile phone manufacturers must expand the capacities of mobile phones to accommodate the diverse needs of all people and communities of the world. For instance, mobile phones should be made in such a way that they can be customised and reprogrammed easily at the whims of their users. Given the numerous possibilities provided by the existing web technologies, there is no reason why for instance all major languages of the world including those spoken in the developing world such as Kiswahili should not be integrated into modern phones. Those not in the default setup of the phone should at least be downloadable to be installed in any phone whenever required. To achieve this, the mobile phone manufacturers should set up web platforms where community members can create their own modules of translated menus in their own languages either free of charge or at minimal fees. Having mobile phone menus in vernacular languages will greatly increase uptake especially among rural community members with low literacy and lack of foreign language skills and hence boost the development and innovative use of the mobile phone technology.

ii. **Enhance mobile web functionality**

In the findings of this study, the relative poverty and lack of supportive infrastructure in the rural areas had made the rural dwellers regard the mobile phone as the poor man's computer. However, one of the areas where mobile phones have not effectively emulated the computers is in the way they execute the web content. Mobile phones are equipped with smaller and slower processors as well as smaller keyboards and display

screens which often can only handle lighter or modified web content. The mobile phone manufacturers should change this and enable their products to open and exchange web content more efficiently. With bigger processors, the manufacturers can for instance explore the possibility of equipping the phones with unlimited virtual display screens and keyboards whose sizes can be adjusted accordingly.

iii. Promote and strengthen mobile user education programmes

In the findings of this study, it was noted that uptake and effective use of mobile phones was greatly affected by awareness levels which were only average. It is therefore recommended that mobile phone manufacturers should put in place mechanisms for continuous education of the phone users so as to maximise their usage. For cost-effectiveness, this can be achieved by integrating the mobile phone user education content into the sensitisation campaign programmes mounted by the service providers. Existing documentation on mobile phone technology should also be reviewed and where necessary be translated and simplified so as to be understood even by those with low or no literacy or foreign language skills.

6.4.2.4 The Government

The mobile phone service providers should:

i. Develop communication infrastructure

During data collection, it was noted that rural areas have very poor infrastructure especially roads and electricity which made use of mobile phone technology quite difficult. To enable the rural communities also participate effectively in the development of mobile phone industry and become more empowered to access knowledge and other resources, the Government must indiscriminately up its investments in developing communication infrastructure and related services so as to

ensure parity in the development of the industry. The Government should build more roads in the rural areas and install electricity so that the service providers can easily access all the strategic areas to install telecommunication facilities.

ii. Offer incentives for rural mobile phone use

To encourage investment and uptake of mobile phone technology in the rural areas, the Government should consider giving incentives such as tax exemptions, free or highly subsidised services as well as cheap credit facilities to those who wish to procure equipment and materials for investment in the rural areas.

6.5 Suggestions for future research

While this study focused on investigating the contribution that the mobile phone technology had made to the lives of rural communities with a view to optimising it for greater community empowerment, there were a few limitations that made it difficult to explore beyond the current scope. However, more value could be added to the findings of this study and make the recommendations even more practical and meaningful by conducting more research with a wider focus to capture the following related areas.

6.5.1 Impact of mobile phones on education

In the findings of this study it was noted that the use of mobile phones had been associated with cheating which had led to tremendous marital problems. During the data collection discussions, one of the most related topics was the association of mobile phones with in disciple among school going children and particularly cheating in examinations. Though interesting, these discussions could not be pursued any further than the scope of the study. However, there has been in the recent past heightened debate in Kenya relating to the use of mobile phones in schools. Whereas there are many who support the use of the phones among school-going children to access

educational content through the internet, many still argue that the use of these gadgets in schools leads to indiscipline and examination malpractices thus compromising the standards of education. The main proponent of this argument has been the Kenya Government which went ahead to effect a general ban on the use of mobile phones and music in schools (CapitalNews: 2008 para). It is therefore necessary for a more empirical study to be conducted to discern the actual effect of mobile phones' use on education in the country and make recommendations that would form part of future decision making.

6.5.2 Long term effects of mobile phones on Health

In the literature review and also in the findings of the study, mobile phone technology has been associated with major risks to the human life. For instance, more recently, there have been many numerous arguments and counter arguments about the medical effects of mobile phones on the human beings. However, it is becoming increasingly difficult to get unbiased scientific information about this fact. This is more so because the mobile phone industry has become a major business venture and dealers are more preoccupied with selling and promoting their products by sometimes giving uncorroborated information especially geared towards negating the negative aspects of the technology. Of particular concern is the long term impact of the mobile phone use on the human memory and general health. For instance, in view of the conclusion by Bhargavi *et. al* (2013:196) that long term usage and overreliance on mobile phones to figure out basic facts of life especially by use of the internet can cause leakages in the human brain and cause serious memory problems, it is necessary to conduct a more elaborate study to establish the greater reality. This will help forestall peddling of wrong information that could curtail the development of the mobile phone technology.

6.5.3 Mobile phones and human interaction

One of the major empirical studies covered under Section 2.10 of the literature review focused on the addictive nature of mobile phone use especially among the younger generations and its adverse effect on job performance. As a result, some scholars have portended that the use of mobile phones is slowly killing the direct human-to-human interaction and this will in the long term make human beings lose their social nature. Soni (2006: para 15) for instance argues that mobile phones destroy the pleasures of direct human-to-human interaction through telecommunication and addiction. On the other hand there have been discussions revolving around the real value of mobile phone use in the workplace environments as the technology is thought to seriously affect office work performance. Furthermore, the association of mobile phones with rampant cheating among friends and partners is becoming more prevalent and causing breakups in relationships. All these postulations need thorough investigation.

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APPENDICES

Appendix 1: Sample of Households per Sub-location in Western Province

Sub-location	Location	District	Total Population	Total HHs (H)	Sample HHs $h = \frac{H\ x400}{295,825}$	Whole HHs
1.Buchenya	**Lunza**	**Butere**	**6,825**	**1,519**	2.1	**2**
2.Bumamu	**Lunza**	**Butere**	**5,728**	**1,236**	1.7	**2**
3.Lunza	**Lunza**	**Butere**	**9,873**	**2,102**	2.8	**3**
4.Shitari	**Lunza**	**Butere**	**8,824**	**1,879**	2.5	**3**
5.Bushieni	**Manyala**	**Butere**	**3,256**	**752**	1.0	**1**
6.Eshihenjera	**Manyala**	**Butere**	**4,673**	**1,129**	1.5	**2**
7.Ibokolo	**Marama C.**	**Butere**	**7,144**	**1,565**	2.1	**2**
8.Imanga	**Marama C.**	**Butere**	**11,131**	**2,310**	3.1	**3**
9.Mutoma	**Marama C.**	**Butere**	**6,107**	**1,305**	1.8	**2**
10.Bushitinji	**Marama N.**	**Butere**	**6,422**	**1,435**	1.9	**2**
11.Inaya	**Marama N.**	**Butere**	**3,346**	**732**	1.0	**1**
12.Lukoye	**Marama N.**	**Butere**	**4,791**	**1,073**	1.5	**1**
13.Shiraha	**Marama N.**	**Butere**	**6,237**	**1,412**	1.9	**2**
14.Buboko	**Marenyo**	**Butere**	**2,550**	**564**	0.8	**1**
15.Muyundi	**Marenyo**	**Butere**	**6,365**	**1,400**	1.9	**2**
16.Shikunga	**Marenyo**	**Butere**	**2,993**	**670**	0.9	**1**
17.Masaba	**S. Marama**	**Butere**	**3,912**	**884**	1.2	**1**
18.Shiatsala	**S. Marama**	**Butere**	**3,155**	**731**	1.0	**1**
19.Shibembe	**S. Marama**	**Butere**	**4,956**	**1,110**	1.5	**2**
20.Bubala	**Shianda**	**Butere**	**3,158**	**711**	1.0	**1**
21.Mabole	**Shianda**	**Butere**	**4,695**	**1,049**	1.4	**1**
22.Shianda	**Shianda**	**Butere**	**3,304**	**746**	1.0	**1**
23.Shinamwinyuli	**Township**	**Butere**	**7,555**	**1,630**	2.2	**2**
24.Shirembe	**Township**	**Butere**	**4,536**	**1,052**	1.4	**1**
25.Shirotsa	**Township**	**Butere**	**8,244**	**1,871**	2.5	**3**
26.Emutsasa	**Kisa C.**	**Butere**	**4,773**	**1,100**	1.5	**1**
27.Mundeku	**Kisa C.**	**Butere**	**4,451**	**1,041**	1.4	**1**
28.Wambulishe	**Kisa C.**	**Butere**	**10,519**	**2,432**	3.3	**3**
29.Emasatsi	**Kisa E.**	**Butere**	**5,648**	**1,239**	1.7	**2**
30.Emuruba	**Kisa E.**	**Butere**	**3,017**	**684**	0.9	**1**
31.Munjiti	**Kisa E.**	**Butere**	**3,150**	**706**	1.0	**1**
32.Emalindi	**Kisa S.**	**Butere**	**4,306**	**967**	1.3	**1**
33.Eshibinga	**Kisa S.**	**Butere**	**4,149**	**958**	1.3	**1**
34.Mundaha	**Kisa S.**	**Butere**	**2,652**	**597**	0.8	**1**
35.Doho	**Kisa W.**	**Butere**	**3,138**	**725**	1.0	**1**
36.Dudi	**Kisa W.**	**Butere**	**2,872**	**646**	0.9	**1**
37.Muhaka	**Kisa W.**	**Butere**	**5,252**	**1,223**	1.7	**2**
38.Khusiku	**Mulwanda**	**Butere**	**5,382**	**1,301**	1.8	**2**
39.Mulwanda	**Mulwanda**	**Butere**	**5,242**	**1,220**	1.6	**2**
40.Mushiangubu	**Mulwanda**	**Butere**	**6,334**	**1,522**	2.1	**2**
41.Shirali	**Mulwanda**	**Butere**	**5,499**	**1,285**	1.7	**2**
42.Mundobelwa	**N. Kisa**	**Butere**	**11,160**	**2,485**	3.4	**3**
43.Mwikalikha	**N. Kisa**	**Butere**	**5,123**	**1,095**	1.5	**1**
44.Ebuhala	**Shirombe**	**Butere**	**3,636**	**872**	1.2	**1**
45.Ekomero	**Shirombe**	**Butere**	**6,332**	**1,476**	2.0	**2**
46.Galona	**Gisambai**	**Hamisi**	**6,502**	**1,382**	1.9	**2**
47.Gamoi	**Gisambai**	**Hamisi**	**5,106**	**1,157**	1.6	**2**
48.Gavudunyi	**Gisambai**	**Hamisi**	**3,854**	**855**	1.2	**1**
49.Gimomoi	**Gisambai**	**Hamisi**	**5,990**	**1,324**	1.8	**2**
50.Givole	**Jepkoyai**	**Hamisi**	**4,937**	**1,082**	1.5	**1**
51.Kapchemugung	**Jepkoyai**	**Hamisi**	**5,565**	**1,196**	1.6	**2**
52.Kitagwa	**Jepkoyai**	**Hamisi**	**3,419**	**781**	1.1	**1**
53.Tigoi	**Jepkoyai**	**Hamisi**	**5,134**	**1,136**	1.5	**2**
54.Kalwani	**Senende**	**Hamisi**	**3,446**	**757**	1.0	**1**
55.Senende	**Senende**	**Hamisi**	**4,552**	**953**	1.3	**1**
56.Jivovoli	**Shamakhokho**	**Hamisi**	**7,072**	**1,603**	2.2	**2**
57.Kisasi	**Shamakhokho**	**Hamisi**	**5,676**	**1,179**	1.6	**2**
58.Serem	**Shamakhokho**	**Hamisi**	**6,789**	**1,537**	2.1	**2**
59.Kaptech	**Muhudu**	**Hamisi**	**4,758**	**1,025**	1.4	**1**
60.Muhudu	**Muhudu**	**Hamisi**	**6,021**	**1,258**	1.7	**2**
61.Mulundu	**Muhudu**	**Hamisi**	**5,880**	**1,134**	1.5	**2**
62.Jeptulu	**Shaviringa**	**Hamisi**	**5,644**	**1,189**	1.6	**2**
63.Makuchi	**Shaviringa**	**Hamisi**	**7,072**	**1,484**	2.0	**2**
64.Shiru	**Shaviringa**	**Hamisi**	**9,618**	**2,092**	2.8	**3**
65.Gasianga	**Banja**	**Hamisi**	**4,500**	**980**	1.3	**1**
66.Givogi	**Banja**	**Hamisi**	**4,334**	**943**	1.3	**1**
67.Kapsotik	**Banja**	**Hamisi**	**6,394**	**1,389**	1.9	**2**
68.Kipchekwen	**Banja**	**Hamisi**	**7,307**	**1,615**	2.2	**2**
69.Gamalenga	**Tambua**	**Hamisi**	**4,085**	**777**	1.1	**1**
70.Gimarakwa	**Tambua**	**Hamisi**	**3,064**	**659**	0.9	**1**
71.Ivola	**Tambua**	**Hamisi**	**4,443**	**1,017**	1.4	**1**
72.Kiptaimes	**Tambua**	**Hamisi**	**3,049**	**660**	0.9	**1**

73.Mwembe	**Tambua**	**Hamisi**	**4,048**	**932**	1.3	**1**
74.Ikuywa	**Ivihiga**	**Kakamega E.**	**1,585**	**335**	0.5	**0**
75.Lukusi	**Ivihiga**	**Kakamega E.**	**6,656**	**1,381**	1.9	**2**
76.Lunyu	**Ivihiga**	**Kakamega E.**	**9,606**	**2,120**	2.9	**3**
77.Bulovi	**Kambiri**	**Kakamega E.**	**6,480**	**1,310**	1.8	**2**
78.Buyangu	**Kambiri**	**Kakamega E.**	**4,709**	**987**	1.3	**1**
79.Ivakale	**Kambiri**	**Kakamega E.**	**6,022**	**1,304**	1.8	**2**
80.Lubao	**Kambiri**	**Kakamega E.**	**6,285**	**1,227**	1.7	**2**
81.Kak.Forest	**Kak. Forest**	**Kakamega E.**	**83**	**22**	0.0	**0**
82.Malimili	**Ilesi**	**Kakamega E.**	**4,786**	**1,034**	1.4	**1**
83.Mugomari	**Ilesi**	**Kakamega E.**	**5,674**	**1,279**	1.7	**2**
84.Mukhonje	**Ilesi**	**Kakamega E.**	**8,952**	**1,865**	2.5	**3**
85.Lugose	**Khayega**	**Kakamega E.**	**6,079**	**1,280**	1.7	**2**
86.Museno	**Khayega**	**Kakamega E.**	**5,913**	**1,365**	1.8	**2**
87.Shidodo	**Khayega**	**Kakamega E.**	**10,804**	**2,338**	3.2	**3**
88.Shirulu	**Khayega**	**Kakamega E.**	**4,755**	**1,037**	1.4	**1**
89.Sitochi	**Khayega**	**Kakamega E.**	**8,256**	**1,882**	2.5	**3**
90.Itenyi	**Murhanda**	**Kakamega E.**	**4,733**	**1,006**	1.4	**1**
91.Mukulusu	**Murhanda**	**Kakamega E.**	**8,179**	**1,753**	2.4	**2**
92.Shisembe	**Murhanda**	**Kakamega E.**	**5,146**	**1,088**	1.5	**1**
93.Shiswa	**Murhanda**	**Kakamega E.**	**10,227**	**2,144**	2.9	**3**
94.Mukango	**Shibuye**	**Kakamega E.**	**6,416**	**1,325**	1.8	**2**
95.Shiasaba	**Shibuye**	**Kakamega E.**	**7,250**	**1,505**	2.0	**2**
96.Shing'ondo	**Shibuye**	**Kakamega E.**	**11,259**	**2,532**	3.4	**3**
97.Virhembe	**Shibuye**	**Kakamega E.**	**9,620**	**2,058**	2.8	**3**
98.Butali	**Matioli**	**Kakamega N.**	**3,647**	**756**	1.0	**1**
99.Mukavakava	**Matioli**	**Kakamega N.**	**3,230**	**578**	0.8	**1**
100.Shipala	**Matioli**	**Kakamega N.**	**1,409**	**291**	0.4	**0**
101.Tande	**Matioli**	**Kakamega N.**	**3,928**	**836**	1.1	**1**
102.Lukala	**Mugai**	**Kakamega N.**	**2,065**	**400**	0.5	**1**
103.Musungu	**Mugai**	**Kakamega N.**	**2,530**	**490**	0.7	**1**
104.Sundulo	**Mugai**	**Kakamega N.**	**3,454**	**654**	0.9	**1**
105.Malekha	**Shirugu**	**Kakamega N.**	**5,636**	**1,099**	1.5	**1**
106.Samitsi	**Shirugu**	**Kakamega N.**	**4,721**	**923**	1.2	**1**
107.Sheywe	**Shirugu**	**Kakamega N.**	**4,344**	**845**	1.1	**1**
108.Isanjiro	**Township**	**Kakamega N.**	**1,954**	**519**	0.7	**1**
109.Malanga	**Township**	**Kakamega N.**	**2,305**	**487**	0.7	**1**
110.Shivikhwa	**Township**	**Kakamega N.**	**4,204**	**907**	1.2	**1**
111.Chimoroni	**Chemuche**	**Kakamega N.**	**5,311**	**972**	1.3	**1**
112.Kimangeti	**Chemuche**	**Kakamega N.**	**4,024**	**767**	1.0	**1**
113.Lukhokho	**Chemuche**	**Kakamega N.**	**2,804**	**506**	0.7	**1**
114.Masungutsa	**Chemuche**	**Kakamega N.**	**1,197**	**213**	0.3	**0**
115.Musingu	**Chemuche**	**Kakamega N.**	**1,706**	**313**	0.4	**0**
116.Tumbeni	**Chemuche**	**Kakamega N.**	**2,695**	**530**	0.7	**1**
117.Fuvale	**Chesero**	**Kakamega N.**	**1,789**	**365**	0.5	**0**
118.Ikoli	**Chesero**	**Kakamega N.**	**9,698**	**1,907**	2.6	**3**
119.Kakunga	**Chesero**	**Kakamega N.**	**6,319**	**1,333**	1.8	**2**
120.Lwanda	**Chesero**	**Kakamega N.**	**4,853**	**913**	1.2	**1**
121.Chebwai	**Chegulo**	**Kakamega N.**	**5,706**	**1,157**	1.6	**2**
122.Mahusi	**Chegulo**	**Kakamega N.**	**4,921**	**974**	1.3	**1**
123.Matsakha	**Chegulo**	**Kakamega N.**	**4,553**	**940**	1.3	**1**
124.Namushiya	**Chegulo**	**Kakamega N.**	**4,482**	**875**	1.2	**1**
125.Cheptuli	**Shivanga**	**Kakamega N.**	**2,122**	**380**	0.5	**1**
126.Fuvuye	**Shivanga**	**Kakamega N.**	**5,450**	**1,011**	1.4	**1**
127.Muriola	**Shivanga**	**Kakamega N.**	**5,078**	**957**	1.3	**1**
128.Teresia	**Shivanga**	**Kakamega N.**	**4,157**	**783**	1.1	**1**
129.Manda	**Sirungai**	**Kakamega N.**	**5,581**	**1,071**	1.4	**1**
130.Shiandiche	**Sirungai**	**Kakamega N.**	**3,617**	**651**	0.9	**1**
131.Tombo	**Sirungai**	**Kakamega N.**	**6,189**	**1,223**	1.7	**2**
132.Mukhonje	**Mahira**	**Kakamega N.**	**3,207**	**592**	0.8	**1**
133.Muting'ong'o	**Mahira**	**Kakamega N.**	**2,643**	**499**	0.7	**1**
134.Mwera	**Mahira**	**Kakamega N.**	**4,185**	**798**	1.1	**1**
135.Shilongo	**Mahira**	**Kakamega N.**	**5,174**	**1,058**	1.4	**1**
136.Chevoso	**Shianda**	**Kakamega N.**	**5,506**	**1,118**	1.5	**2**
137.Ifwetere	**Shianda**	**Kakamega N.**	**2,465**	**466**	0.6	**1**
138.Lunyinya	**Shianda**	**Kakamega N.**	**4,997**	**998**	1.3	**1**
139.Sasala	**Shianda**	**Kakamega N.**	**4,978**	**1,079**	1.5	**1**
140.Shamberere	**Shianda**	**Kakamega N.**	**4,042**	**1,008**	1.4	**1**
141.Shamoni	**Shianda**	**Kakamega N.**	**6,176**	**1,236**	1.7	**2**
142.Burundu	**Burundu**	**Kakamega N.**	**3,014**	**574**	0.8	**1**
143.Mutsuma	**Burundu**	**Kakamega N.**	**2,095**	**408**	0.6	**1**
144.Sawawa	**Burundu**	**Kakamega N.**	**3,565**	**690**	0.9	**1**
145.Shimuli	**Burundu**	**Kakamega N.**	**1,573**	**310**	0.4	**0**
146.LukalaW.	**Lukume**	**Kakamega N.**	**3,973**	**814**	1.1	**1**
147.Lukume	**Lukume**	**Kakamega N.**	**5,110**	**995**	1.3	**1**
148.Shikutse	**Lukume**	**Kakamega N.**	**6,784**	**1,366**	1.8	**2**
149.Lunenere	**Isulu**	**Kakamega S.**	**5,681**	**1,311**	1.8	**2**
150.Mukongolo	**Isulu**	**Kakamega S.**	**3,710**	**849**	1.1	**1**
151.Musoli	**Isulu**	**Kakamega S.**	**6,161**	**1,297**	1.8	**2**
152.Shibuname	**Isulu**	**Kakamega S.**	**2,697**	**591**	0.8	**1**
153.Malinya	**Shirumba**	**Kakamega S.**	**5,585**	**1,278**	1.7	**2**

154.Shitoli	**Shirumba**	**Kakamega S.**	**4,729**	**1,100**	1.5	**1**
155.Shivagala	**Shirumba**	**Kakamega S.**	**7,300**	**1,624**	2.2	**2**
156.Mutaho	**Shisere**	**Kakamega S.**	**6,098**	**1,304**	1.8	**2**
157.Shikulu	**Shisere**	**Kakamega S.**	**5,500**	**1,195**	1.6	**2**
158.Shimanyiro	**Shisere**	**Kakamega S.**	**7,532**	**1,643**	2.2	**2**
159.Shiseso	**Shisere**	**Kakamega S.**	**6,731**	**1,506**	2.0	**2**
160.Lukose	**Eregi**	**Kakamega S.**	**2,271**	**513**	0.7	**1**
161.Shanjetso	**Eregi**	**Kakamega S.**	**2,673**	**605**	0.8	**1**
162.Shisejeri	**Eregi**	**Kakamega S.**	**3,596**	**637**	0.9	**1**
163.Ivonda	**Iguhu**	**Kakamega S.**	**6,157**	**1,320**	1.8	**2**
164.Lirhembe	**Iguhu**	**Kakamega S.**	**3,139**	**687**	0.9	**1**
165.Makhokho	**Iguhu**	**Kakamega S.**	**4,926**	**1,111**	1.5	**2**
166.Savane	**Iguhu**	**Kakamega S.**	**4,412**	**968**	1.3	**1**
167.Shiveye	**Iguhu**	**Kakamega S.**	**3,394**	**750**	1.0	**1**
168.Kaluni	**Shikumu**	**Kakamega S.**	**4,191**	**961**	1.3	**1**
169.Madivini	**Shikumu**	**Kakamega S.**	**4,990**	**1,142**	1.5	**2**
170.Shabwali	**Shikumu**	**Kakamega S.**	**3,196**	**752**	1.0	**1**
171.Kongoni	**Kongoni**	**Lugari**	**23,701**	**4,908**	6.6	**7**
172.Mawetatu	**Kongoni**	**Lugari**	**12,129**	**2,371**	3.2	**3**
173.Sango	**Kongoni**	**Lugari**	**10,724**	**2,109**	2.9	**3**
174.Seregeya	**Likuyani**	**Lugari**	**15,704**	**3,224**	4.4	**4**
175.Soy	**Likuyani**	**Lugari**	**11,539**	**2,517**	3.4	**3**
176.Matunda	**Nzoia**	**Lugari**	**12,342**	**2,909**	3.9	**4**
177.Moi'sBridge	**Nzoia**	**Lugari**	**7,569**	**1,467**	2.0	**2**
178.Musemwa	**Nzoia**	**Lugari**	**5,049**	**995**	1.3	**1**
179.Vinyenya	**Nzoia**	**Lugari**	**5,361**	**1,084**	1.5	**1**
180.Milimani	**Sinoko**	**Lugari**	**6,535**	**1,393**	1.9	**2**
181.Mwiba	**Sinoko**	**Lugari**	**3,256**	**633**	0.9	**1**
182.Namunyiri	**Sinoko**	**Lugari**	**7,080**	**1,447**	2.0	**2**
183.Nzoia	**Sinoko**	**Lugari**	**4,148**	**847**	1.1	**1**
184.Koromaiti	**Chekalini**	**Lugari**	**9,532**	**1,763**	2.4	**2**
185.Musembe	**Chekalini**	**Lugari**	**10,173**	**2,080**	2.8	**3**
186.Lugari	**Lugari**	**Lugari**	**12,593**	**2,465**	3.3	**3**
187.Marakusi	**Lugari**	**Lugari**	**18,788**	**3,775**	5.1	**5**
188.Munyuki	**Lumakanda**	**Lugari**	**15,417**	**3,288**	4.4	**4**
189.Mwamba	**Lumakanda**	**Lugari**	**14,538**	**3,113**	4.2	**4**
190.Mbagara	**Mautuma**	**Lugari**	**13,935**	**2,776**	3.8	**4**
191.Mukuyu	**Mautuma**	**Lugari**	**11,147**	**2,311**	3.1	**3**
192.Kiliboti	**Chevaywa**	**Lugari**	**7,320**	**1,407**	1.9	**2**
193.Kivaywa	**Chevaywa**	**Lugari**	**14,462**	**2,968**	4.0	**4**
194.Kulumbeni	**Chevaywa**	**Lugari**	**11,363**	**2,243**	3.0	**3**
195.Luandeti	**Luandeti**	**Lugari**	**8,162**	**1,545**	2.1	**2**
196.Mabunye	**Luandeti**	**Lugari**	**6,172**	**1,228**	1.7	**2**
197.Mahanga	**Luandeti**	**Lugari**	**5,787**	**1,107**	1.5	**1**
198.Maturu	**Luandeti**	**Lugari**	**7,625**	**1,503**	2.0	**2**
199.Chebwek	**Chepkube**	**Mt. Elgon**	**4,780**	**898**	1.2	**1**
200.Chepkube	**Chepkube**	**Mt. Elgon**	**7,344**	**1,456**	2.0	**2**
201.Cheptais	**Cheptais**	**Mt. Elgon**	**7,007**	**1,359**	1.8	**2**
202.Ngachi	**Cheptais**	**Mt. Elgon**	**9,657**	**2,059**	2.8	**3**
203.Chemondi	**Chesikak**	**Mt. Elgon**	**4,759**	**850**	1.1	**1**
204.Chesikak	**Chesikak**	**Mt. Elgon**	**9,566**	**1,872**	2.5	**3**
205.Sasur	**Sasur**	**Mt. Elgon**	**5,888**	**1,056**	1.4	**1**
206.Toroso	**Sasur**	**Mt. Elgon**	**3,849**	**751**	1.0	**1**
207.Kamtiong	**Elgon**	**Mt. Elgon**	**1,858**	**352**	0.5	**0**
208.Kibuk	**Elgon**	**Mt. Elgon**	**3,566**	**703**	1.0	**1**
209.Kimobo	**Elgon**	**Mt. Elgon**	**2,070**	**382**	0.5	**1**
210.Kamuneru	**Kamuneru**	**Mt. Elgon**	**3,659**	**678**	0.9	**1**
211.Sacho	**Kamuneru**	**Mt. Elgon**	**2,059**	**417**	0.6	**1**
212.Bugaa	**Kapsokwony**	**Mt. Elgon**	**2,644**	**521**	0.7	**1**
213.Chemeisus	**Kapsokwony**	**Mt. Elgon**	**4,076**	**762**	1.0	**1**
214.Kapsokwony	**Kapsokwony**	**Mt. Elgon**	**3,534**	**820**	1.1	**1**
215.Kipyeto	**Namorio**	**Mt. Elgon**	**1,987**	**341**	0.5	**0**
216.Koshok	**Namorio**	**Mt. Elgon**	**2,041**	**355**	0.5	**0**
217.Namorio	**Namorio**	**Mt. Elgon**	**4,683**	**839**	1.1	**1**
218.Sambocho	**Namorio**	**Mt. Elgon**	**2,242**	**397**	0.5	**1**
219.Chemoge	**Chemoge**	**Mt. Elgon**	**2,969**	**525**	0.7	**1**
220.Chemuses	**Chemoge**	**Mt. Elgon**	**3,161**	**579**	0.8	**1**
221.Chesito	**Kaboywo**	**Mt. Elgon**	**4,038**	**738**	1.0	**1**
222.Kaboywo	**Kaboywo**	**Mt. Elgon**	**4,724**	**823**	1.1	**1**
223.Kaborom	**Kaptama**	**Mt. Elgon**	**4,657**	**848**	1.1	**1**
224.Kaptama	**Kaptama**	**Mt. Elgon**	**5,116**	**993**	1.3	**1**
225.Kaptalelia	**Kongit**	**Mt. Elgon**	**3,879**	**713**	1.0	**1**
226.Kongit	**Kongit**	**Mt. Elgon**	**5,708**	**1,071**	1.4	**1**
227.Chepyuk	**Chepyuk**	**Mt. Elgon**	**5,238**	**892**	1.2	**1**
228.Kaimugul	**Chepyuk**	**Mt. Elgon**	**6,939**	**1,131**	1.5	**2**
229.Kubura	**Chepyuk**	**Mt. Elgon**	**3,168**	**555**	0.8	**1**
230.Chongeywo	**Chongeywo**	**Mt. Elgon**	**3,882**	**721**	1.0	**1**
231.Kapkurongo	**Chongeywo**	**Mt. Elgon**	**2,741**	**523**	0.7	**1**
232.Masaek	**Chongeywo**	**Mt. Elgon**	**4,097**	**714**	1.0	**1**
233.Chepkurkur	**Emia**	**Mt. Elgon**	**3,344**	**642**	0.9	**1**
234.Emia	**Emia**	**Mt. Elgon**	**2,365**	**462**	0.6	**1**

235.Korng'otuny	**Emia**	**Mt. Elgon**	**4,388**	**776**	1.0	**1**
236.Cheptonon	**Kapkateny**	**Mt. Elgon**	**3,725**	**739**	1.0	**1**
237.Teremi	**Kapkateny**	**Mt. Elgon**	**2,695**	**479**	0.6	**1**
238.Toywondet	**Kapkateny**	**Mt. Elgon**	**5,810**	**1,169**	1.6	**2**
239.Mt. Elgon Forest	**Mt. Elgon Forest**	**Mt. Elgon**	**2,464**	**500**	0.7	**1**
240.Agenga	**Agenga**	**Samia**	**4,383**	**897**	1.2	**1**
241.Bukiri	**Agenga**	**Samia**	**1,941**	**404**	0.5	**1**
242.Ojibo	**Agenga**	**Samia**	**3,662**	**797**	1.1	**1**
243.Sigalame	**Agenga**	**Samia**	**3,960**	**804**	1.1	**1**
244.Busembe	**Bwiri**	**Samia**	**4,347**	**854**	1.2	**1**
245.Busijo	**Bwiri**	**Samia**	**4,274**	**814**	1.1	**1**
246.Hakati	**Bwiri**	**Samia**	**5,668**	**1,101**	1.5	**1**
247.Namuduru	**Bwiri**	**Samia**	**5,497**	**1,164**	1.6	**2**
248.Buloma	**Namboboto**	**Samia**	**3,457**	**721**	1.0	**1**
249.Luanda	**Namboboto**	**Samia**	**4,221**	**889**	1.2	**1**
250.Mudoma	**Namboboto**	**Samia**	**2,986**	**640**	0.9	**1**
251.Namboboto	**Namboboto**	**Samia**	**2,424**	**522**	0.7	**1**
252.Nyakhobi	**Namboboto**	**Samia**	**3,165**	**646**	0.9	**1**
253.Ganjala	**Nambuku**	**Samia**	**2,267**	**470**	0.6	**1**
254.Ludacho	**Nambuku**	**Samia**	**2,802**	**581**	0.8	**1**
255.Lugala	**Nambuku**	**Samia**	**1,953**	**413**	0.6	**1**
256.Mango	**Nambuku**	**Samia**	**1,899**	**406**	0.5	**1**
257.Sibinga	**Nambuku**	**Samia**	**2,969**	**583**	0.8	**1**
258.Bukhulungu	**Nangosia**	**Samia**	**3,364**	**714**	1.0	**1**
259.Luchululo	**Nangosia**	**Samia**	**1,657**	**348**	0.5	**0**
260.Sigulu	**Nangosia**	**Samia**	**2,893**	**629**	0.9	**1**
261.Sirekeresi	**Nangosia**	**Samia**	**2,695**	**592**	0.8	**1**
262.Bujwanga	**Nanguba**	**Samia**	**5,696**	**1,158**	1.6	**2**
263.Nanderema	**Nanguba**	**Samia**	**3,117**	**625**	0.8	**1**
264.Rumbiye	**Nanguba**	**Samia**	**2,619**	**585**	0.8	**1**
265.Budalanga	**Odiado**	**Samia**	**1,171**	**246**	0.3	**0**
266.Kabwodo	**Odiado**	**Samia**	**1,349**	**306**	0.4	**0**
267.Odiado	**Odiado**	**Samia**	**3,003**	**613**	0.8	**1**
268.Wakhungu	**Odiado**	**Samia**	**4,061**	**873**	1.2	**1**
Total			**1,418,012**	**295,825**	**400.0**	**400**

Extracted from: https://www.opendata.go.ke/api/views/wd27-eki2/rows.xls?accessType=DOWNLOAD

Appendix 2: Table of randomly generated GPS coordinates in the order of degrees and decimal minutes used in selection of households

0.454, 33.901	0.726, 34.002	0.405, 34.074	1.058, 34.154	0.966, 34.244	1.121, 34.337	0.466, 34.411	0.968, 34.49	0.042, 34.576	-0.142, 34.658	0.18, 34.75	0.798, 34.819	1.17, 34.893	1.146, 34.97	0.553, 35.055	1.142, 35.134
0.519, 33.901	0.429, 34.003	-0.02, 34.075	0.62, 34.156	0.229, 34.244	0.087, 34.339	-0.047, 34.411	0.975, 34.491	0.777, 34.576	0.028, 34.659	0.609, 34.75	1.069, 34.82	-0.014, 34.894	1.019, 34.973	0.605, 35.055	1.141, 35.135
1.017, 33.903	0.41, 34.003	0.522, 34.076	0.256, 34.157	-0.083, 34.249	-0.073, 34.342	0.609, 34.411	1.032, 34.492	0.148, 34.576	0.296, 34.66	0.839, 34.752	0.78, 34.821	1.079, 34.894	0.388, 34.973	0.066, 35.057	0.089, 35.135
0.653, 33.903	1.123, 34.003	0.593, 34.078	-0.092, 34.158	0.967, 34.249	1.158, 34.343	0.525, 34.412	0.092, 34.494	-0.065, 34.578	0.376, 34.661	0.411, 34.753	-0.063, 34.822	0.995, 34.895	0.161, 34.973	0.906, 35.059	0.508, 35.137
0.239, 33.909	0.125, 34.004	1.138, 34.079	-0.069, 34.158	0.677, 34.253	0.678, 34.344	1.001, 34.412	0.763, 34.495	0.92, 34.579	0.457, 34.663	0.144, 34.753	0.212, 34.823	0.781, 34.896	1.082, 34.976	-0.144, 35.061	0.287, 35.14
0.146, 33.91	0.132, 34.004	0.52, 34.079	0.705, 34.162	0.321, 34.254	1.045, 34.344	0.085, 34.417	0.32, 34.496	0.125, 34.579	0.017, 34.664	0.229, 34.755	1.089, 34.823	0.792, 34.896	0.139, 34.98	-0.127, 35.064	0.307, 35.141
1.019, 33.912	0.745, 34.005	0.963, 34.081	0.426, 34.162	0.2, 34.255	-0.102, 34.345	0.384, 34.42	-0.084, 34.497	0.367, 34.579	0.969, 34.665	0.779, 34.755	1.032, 34.823	1.11, 34.897	0.707, 34.98	-0.152, 35.064	0.268, 35.144
1.02, 33.917	0.848, 34.006	0.058, 34.082	0.038, 34.163	0.298, 34.256	0.212, 34.346	0.31, 34.421	1.092, 34.498	1.094, 34.581	-0.13, 34.668	0.073, 34.756	0.166, 34.824	0.067, 34.897	0.518, 34.98	0.826, 35.064	0.985, 35.147
0.548, 33.918	0.752, 34.009	0.18, 34.083	0.624, 34.164	0.377, 34.258	0.504, 34.347	0.436, 34.422	0.104, 34.498	0.586, 34.582	0.694, 34.671	0.732, 34.756	-0.101, 34.825	0.082, 34.898	0.417, 34.981	0.175, 35.065	0.045, 35.147
0.681, 33.918	-0.024, 34.009	-0.075, 34.083	0.31, 34.165	0.837, 34.26	0.873, 34.348	1.02, 34.422	0.638, 34.498	0.705, 34.583	0.305, 34.675	0.2, 34.756	1.009, 34.827	0.886, 34.901	0.182, 34.988	0.809, 35.066	0.531, 35.147
0.265, 33.922	0.002, 34.01	0.758, 34.084	0.885, 34.166	-0.168, 34.26	0.505, 34.349	0.27, 34.423	-0.2, 34.499	0.061, 34.586	-0.067, 34.677	0.556, 34.757	0.189, 34.828	0.159, 34.902	0.381, 34.989	0.369, 35.068	-0.18, 35.147
0.117, 33.924	0.751, 34.01	-0.173, 34.085	1.08, 34.166	0.365, 34.262	0.153, 34.349	0.749, 34.424	1.162, 34.499	0.106, 34.587	0.551, 34.677	-0.112, 34.758	0.659, 34.83	0.852, 34.903	0.871, 34.99	0.066, 35.07	0.906, 35.148
-0.111, 33.925	0.645, 34.011	0.328, 34.091	0.265, 34.166	-0.083, 34.263	0.823, 34.352	1.185, 34.425	0.629, 34.504	0.858, 34.587	0.62, 34.678	0.535, 34.761	1.11, 34.835	1.117, 34.904	-0.194, 34.991	0.745, 35.07	0.53, 35.151
0.703, 33.927	1, 34.013	0.512, 34.091	0.473, 34.166	0.178, 34.267	0.122, 34.353	0.992, 34.428	-0.113, 34.505	0.426, 34.588	1.14, 34.68	0.385, 34.761	0.414, 34.837	0.386, 34.907	0.116, 34.991	0.789, 35.071	-0.055, 35.152
0.265, 33.928	0.116, 34.014	1.093, 34.091	0.744, 34.167	0.654, 34.271	0.702, 34.353	0.448, 34.43	0.564, 34.507	0.463, 34.589	0.503, 34.681	0.617, 34.762	0.475, 34.837	1.007, 34.907	0.452, 34.991	0.02, 35.071	0.727, 35.152
-0.177, 33.929	1.144, 34.015	1.188, 34.092	0.449, 34.169	0.779, 34.273	0.117, 34.353	0.685, 34.431	1.107, 34.51	0.093, 34.59	1.013, 34.684	0.403, 34.763	0.687, 34.838	-0.17, 34.907	0.147, 34.992	0.942, 35.071	0.511, 35.153
0.953, 33.93	0.893, 34.015	0.33, 34.092	1.14, 34.17	0.156, 34.276	0.016, 34.354	0.092, 34.432	-0.18, 34.512	1.129, 34.591	0.999, 34.688	0.713, 34.763	0.059, 34.839	0.286, 34.911	1.128, 34.992	0.744, 35.071	-0.039, 35.154
0.016, 33.931	-0.059, 34.018	0.401, 34.096	-0.053, 34.172	1.16, 34.277	-0.093, 34.355	0.931, 34.432	-0.046, 34.512	0.151, 34.596	-0.167, 34.689	0.971, 34.765	1.028, 34.84	0.705, 34.911	0.469, 34.994	0.461, 35.073	0.598, 35.155
0.702, 33.932	0.59, 34.02	1.062, 34.097	-0.159, 34.172	0.647, 34.278	-0.155, 34.356	0.082, 34.432	0.01, 34.513	0.463, 34.597	-0.117, 34.69	0.192, 34.766	1.029, 34.84	0.664, 34.913	0.433, 34.995	0.231, 35.073	0.172, 35.156
0.212, 33.934	0.319, 34.021	-0.159, 34.098	-0.083, 34.173	0.685, 34.281	1.058, 34.36	0.736, 34.432	0.362, 34.514	0.538, 34.597	0.422, 34.691	0.818, 34.767	0.12, 34.841	1.066, 34.915	0.814, 34.996	0.962, 35.075	0.92, 35.157
1.195, 33.939	0.71, 34.022	-0.091, 34.099	0.507, 34.173	0.245, 34.282	0.395, 34.364	0.736, 34.435	0.244, 34.519	-0.066, 34.598	-0.19, 34.692	0.935, 34.768	0.849, 34.845	0.361, 34.915	0.545, 34.997	0.151, 35.075	0.187, 35.158
0.297, 33.939	0.729, 34.022	0.038, 34.1	1.03, 34.175	-0.118, 34.283	0.483, 34.366	0.94, 34.436	0.647, 34.519	-0.077, 34.599	0.161, 34.692	1.172, 34.768	0.241, 34.846	-0.009, 34.916	0.092, 34.997	0.552, 35.075	1.009, 35.158
0.209, 33.94	0.892, 34.023	0.341, 34.101	-0.104, 34.177	0.152, 34.284	-0.05, 34.366	0.373, 34.437	0.419, 34.521	0.256, 34.6	0.521, 34.695	0.114, 34.768	-0.015, 34.847	-0.138, 34.919	0.646, 34.997	0.888, 35.077	-0.19, 35.16
0.646, 33.941	0.421, 34.024	0.484, 34.102	0.234, 34.178	1.132, 34.285	0.694, 34.368	0.581, 34.438	-0.074, 34.521	0.847, 34.605	0.178, 34.696	1.017, 34.769	1.101, 34.847	0.125, 34.919	1.187, 34.997	0.778, 35.078	0.476, 35.161
-0.177, 33.943	1.174, 34.024	0.716, 34.105	0.013, 34.178	0.912, 34.289	0.429, 34.369	0.907, 34.441	0.778, 34.523	0.802, 34.608	0.423, 34.697	0.455, 34.769	0.282, 34.847	0.347, 34.92	-0.112, 34.998	0.831, 35.078	0.073, 35.161
1.069, 33.946	0.369, 34.024	0.574, 34.106	-0.008, 34.179	1.109, 34.291	1.056, 34.372	-0.104, 34.441	-0.122, 34.527	0.949, 34.609	0.693, 34.697	0.726, 34.771	1.154, 34.848	0.055, 34.924	-0.133, 34.998	0.47, 35.079	0.137, 35.162
0.019, 33.946	0.133, 34.025	0.85, 34.107	0.765, 34.179	-0.132, 34.294	0.001, 34.373	1.098, 34.443	-0.175, 34.527	0.417, 34.61	0.641, 34.698	0.131, 34.772	0.92, 34.849	0.095, 34.924	0.883, 34.999	-0.103, 35.08	0.685, 35.162
0.837, 33.947	0.679, 34.025	0.019, 34.108	0.198, 34.179	0.714, 34.295	0.908, 34.374	0.048, 34.443	-0.168, 34.527	0.548, 34.612	0.484, 34.698	-0.086, 34.772	0.304, 34.851	1.123, 34.927	-0.166, 35	0.452, 35.081	0.215, 35.164
0.193, 33.947	0.007, 34.026	0.268, 34.109	1.199, 34.182	0.964, 34.295	1.072, 34.375	0.851, 34.443	0.191, 34.528	0.605, 34.613	0.527, 34.699	0.223, 34.772	0.221, 34.851	0.304, 34.928	-0.197, 35	0.082, 35.084	0.621, 35.166
0.9, 33.947	0.899, 34.026	1.039, 34.109	0.378, 34.185	0.2, 34.296	0.246, 34.376	0.148, 34.444	0.419, 34.529	0.543, 34.613	0.274, 34.703	-0.108, 34.773	-0.174, 34.851	1.159, 34.929	0.001, 35.002	-0.148, 35.084	0.252, 35.166
1.037, 33.95	0.971, 34.027	0.309, 34.111	0.423, 34.188	0.582, 34.297	0.628, 34.376	0.987, 34.444	0.512, 34.531	0.838, 34.618	0.018, 34.703	1.017, 34.775	-0.103, 34.851	0.689, 34.929	0.838, 35.004	0.01, 35.086	0.515, 35.168
0.428, 33.952	0.633, 34.027	0.39, 34.111	0.631, 34.189	0.114, 34.297	1.168, 34.376	0.839, 34.445	0.703, 34.531	0.074, 34.618	-0.121, 34.705	0.037, 34.776	0.631, 34.856	0.948, 34.93	0.227, 35.004	0.514, 35.09	0.458, 35.172
-0.121, 33.953	0.179, 34.027	0.971, 34.112	0.55, 34.191	-0.054, 34.304	0.768, 34.377	1.095, 34.447	1.03, 34.531	0.267, 34.619	0.587, 34.705	1.112, 34.779	0.341, 34.857	0.701, 34.93	0.725, 35.004	0.84, 35.092	1.003, 35.173
-0.121, 33.953	0.067, 34.028	-0.008, 34.112	0.577, 34.195	0.414, 34.305	0.699, 34.379	0.867, 34.449	0.241, 34.532	0.41, 34.624	1.127, 34.705	0.838, 34.779	1.102, 34.857	1.016, 34.93	-0.012, 35.006	0.216, 35.094	0.938, 35.174
0.638, 33.953	1.026, 34.029	0.34, 34.112	0.93, 34.197	0.821, 34.305	1.156, 34.379	0.227, 34.449	1.198, 34.533	0.182, 34.627	0.917, 34.707	0.601, 34.781	0.41, 34.857	0.231, 34.931	-0.147, 35.008	0.289, 35.094	0.002, 35.174
0.971, 33.955	-0.008, 34.032	0.931, 34.113	0.256, 34.2	0.779, 34.306	-0.144, 34.381	0.31, 34.455	0.762, 34.533	0.483, 34.627	1.1, 34.707	1.046, 34.781	0.539, 34.858	0.166, 34.931	0.727, 35.009	1.139, 35.094	0.353, 35.175
0.273, 33.959	-0.179, 34.032	0.839, 34.113	1.198, 34.201	0.816, 34.306	0.834, 34.381	-0.192, 34.456	0.146, 34.533	-0.052, 34.629	0.676, 34.709	0.76, 34.781	-0.074, 34.859	-0.156, 34.932	0.716, 35.011	0.199, 35.095	1.042, 35.176
0.974, 33.962	0.759, 34.032	0.006, 34.116	1.093, 34.201	1.137, 34.306	-0.07, 34.383	0.223, 34.457	0.851, 34.534	0.426, 34.629	0.919, 34.709	1.039, 34.781	0.913, 34.86	-0.097, 34.932	0.251, 35.011	0.814, 35.095	0.316, 35.176
0.104, 33.965	-0.011, 34.035	1.051, 34.12	-0.149, 34.203	0.218, 34.307	0.528, 34.383	0.529, 34.458	0.839, 34.543	0.889, 34.629	0.205, 34.709	0.073, 34.788	1.088, 34.86	1.003, 34.934	0.641, 35.013	0.162, 35.096	-0.15, 35.178
0.691, 33.966	0.319, 34.036	0.981, 34.122	0.804, 34.203	0.641, 34.308	1.057, 34.385	1.14, 34.461	0.151, 34.543	0.434, 34.63	1.072, 34.709	0.489, 34.793	0.752, 34.86	-0.144, 34.936	0.558, 35.013	0.216, 35.096	-0.078, 35.179
1.052, 33.966	0.484, 34.04	0.278, 34.123	-0.186, 34.204	-0.101, 34.309	0.691, 34.386	0.463, 34.462	0.186, 34.545	0.151, 34.63	0.164, 34.71	0.079, 34.793	0.531, 34.862	0.057, 34.937	0.537, 35.019	0.251, 35.096	1.174, 35.18
0.811, 33.966	0.718, 34.041	-0.072, 34.124	1.153, 34.204	1.129, 34.309	0.772, 34.389	0.891, 34.462	0.229, 34.546	1.152, 34.631	0.441, 34.71	-0.155, 34.794	-0.081, 34.862	0.92, 34.937	0.718, 35.019	0.39, 35.097	0.606, 35.181
1.035, 33.969	0.059, 34.041	-0.014, 34.124	0.649, 34.206	0.565, 34.312	0.585, 34.389	0.444, 34.463	0.406, 34.547	0.88, 34.631	0.333, 34.713	0.693, 34.795	0.39, 34.862	-0.137, 34.938	-0.152, 35.02	0.833, 35.097	0.931, 35.181
1.149, 33.97	0.605, 34.042	0.788, 34.124	0.529, 34.21	1.157, 34.312	0.713, 34.39	1.092, 34.465	-0.068, 34.547	0.051, 34.632	0.444, 34.713	0.262, 34.796	-0.117, 34.864	0.463, 34.94	0.839, 35.024	0.725, 35.097	0.099, 35.183
0.328, 33.973	0.975, 34.044	0.514, 34.125	0.544, 34.212	0.883, 34.313	0.918, 34.391	0.705, 34.465	0.042, 34.548	1.028, 34.632	1.022, 34.714	-0.136, 34.798	1.029, 34.865	1.002, 34.94	1.066, 35.024	0.911, 35.104	0.352, 35.185
0.996, 33.973	0.319, 34.044	0.692, 34.128	1.168, 34.215	-0.162, 34.314	0.527, 34.393	0.324, 34.465	0.482, 34.549	0.426, 34.633	0.174, 34.715	0.731, 34.799	0.786, 34.868	1.039, 34.941	0.46, 35.025	0.127, 35.104	0.646, 35.185
0.619, 33.974	0.66, 34.044	1.114, 34.129	-0.045, 34.215	0.259, 34.315	1.068, 34.394	-0.118, 34.467	0.313, 34.551	1.192, 34.633	0.761, 34.716	1.142, 34.799	1.192, 34.869	0.916, 34.941	-0.168, 35.028	0.606, 35.104	0.096, 35.187
0.538, 33.974	0.061, 34.044	0.245, 34.129	-0.104, 34.218	0.552, 34.315	1.156, 34.394	0.656, 34.468	0.985, 34.556	0.653, 34.635	0.578, 34.717	0.905, 34.8	-0.168, 34.87	0.181, 34.943	0.001, 35.028	0.628, 35.106	0.531, 35.187
0.801, 33.975	0.001, 34.045	0.809, 34.13	0.843, 34.219	0.194, 34.315	0.642, 34.395	0.068, 34.47	0.746, 34.558	-0.136, 34.636	1.134, 34.717	-0.094, 34.804	0.091, 34.873	0.508, 34.945	0.268, 35.031	0.978, 35.106	0.18, 35.187
0.295, 33.975	0.225, 34.047	0.69, 34.131	0.076, 34.219	0.959, 34.319	0.472, 34.396	0.285, 34.474	[redacted]	1.077, 34.636	-0.136, 34.718	0.63, 34.805	0.158, 34.873	1.025, 34.945	0.56, 35.032	0.005, 35.107	1.199, 35.188
0.509, 33.977	1.143, 34.048	0.738, 34.131	0.837, 34.22	0.386, 34.323	0.26, 34.397	-0.032, 34.476	1.122, 34.56	0.481, 34.639	0.378, 34.721	0.426, 34.805	0.97, 34.873	0.299, 34.947	0.643, 35.034	0.895, 35.109	0.47, 35.189
1.155, 33.978	0.221, 34.048	0.674, 34.132	1.108, 34.221	-0.113, 34.323	-0.153, 34.397	0.662, 34.476	0.513, 34.56	0.508, 34.641	0.227, 34.722	0.881, 34.805	0.741, 34.877	0.73, 34.948	0.991, 35.034	-0.08, 35.11	0.72, 35.19
0.168, 33.979	0.742, 34.049	0.859, 34.134	0.973, 34.224	0.645, 34.324	0.773, 34.397	0.232, 34.477	0.405, 34.56	0.274, 34.641	1.005, 34.724	1.198, 34.806	1.123, 34.877	0.201, 34.949	0.666, 35.036	0.311, 35.113	0.394, 35.192
0.205, 33.98	0.765, 34.049	0.419, 34.135	0.29, 34.225	0.673, 34.324	0.479, 34.398	-0.19, 34.478	0.913, 34.56	0.529, 34.642	1.167, 34.726	0.821, 34.806	0.476, 34.877	0.233, 34.951	0.732, 35.037	0.589, 35.116	0.252, 35.192
-0.04, 33.981	0.148, 34.053	0.086, 34.135	1.166, 34.226	1.169, 34.325	1.19, 34.398	0.761, 34.479	0.193, 34.562	0.279, 34.643	0.349, 34.726	0.531, 34.806	-0.127, 34.877	0.8, 34.952	0.516, 35.037	0.808, 35.122	0.329, 35.193
0.003, 33.982	0.437, 34.055	1.143, 34.136	-0.049, 34.229	0.647, 34.326	-0.102, 34.402	0.743, 34.48	0.459, 34.563	0.457, 34.643	-0.054, 34.729	0.628, 34.807	0.66, 34.88	1.079, 34.955	0.679, 35.039	1.197, 35.122	0.901, 35.193
0.092, 33.982	0.315, 34.055	0.755, 34.137	0.664, 34.229	0.578, 34.328	0.76, 34.402	0.349, 34.48	0.404, 34.564	0.207, 34.645	1.081, 34.733	-0.165, 34.808	-0.002, 34.88	0.226, 34.956	0.669, 35.04	0.82, 35.123	1.179, 35.193
1.083, 33.983	0.211, 34.059	0.455, 34.141	0.378, 34.231	0.943, 34.328	0.089, 34.403	0.273, 34.481	-0.049, 34.565	1.045, 34.646	-0.022, 34.734	1.033, 34.809	0.811, 34.883	1.185, 34.957	1.111, 35.046	-0.021, 35.126	1.133, 35.194
0.163, 33.987	0.755, 34.062	0.42, 34.143	0.199, 34.231	0.194, 34.329	1.165, 34.404	-0.059, 34.485	0.137, 34.565	0.284, 34.646	0.103, 34.734	0.39, 34.81	-0.122, 34.887	1.196, 34.957	0.033, 35.047	1.126, 35.127	-0.105, 35.194

Appendix 3: Pilot Study Checklist

i. Effectiveness of study administration and data collection and management

ii. Clarity of aims and objectives of the study

iii. Collected data are consistent and in line with goals and objectives

iv. Sample size is justified

v. How long it takes to complete one interview

vi. Things that are innovative or new about the findings

vii. What steps to be taken in case the collected data is not as expected

viii. Any recommendations from the respondents

Appendix 4: Introduction Letter

20th April 2014

Dear Participant,

My name is Iddi Webukha Juma and I am a doctoral candidate for the degree of Doctor of Philosophy of the Department of Library, Records Management and Information Studies, Moi University.

I am in the process of writing my doctoral dissertation and am collecting data for that purpose. For my dissertation I am very interested in investigating the contribution that the mobile phone technology has made towards enabling rural communities improve their lives and explore ways of maximising its development and application for a more empowered society. I hope to share my findings widely through publications, conferences and seminars with relevant stakeholders to help in the uptake of mobile phone technology in the rural setups. However, all the data collected will be treated with utmost confidentiality and used solely for the purpose of this study.

The purpose of this letter is to ask for your assistance as a participant in this study. Please feel free to ask any questions that you have about participating in this project at any time. I would like you to have the information you need to make a decision that is best for you. Attached are: Research permit from the National Council for Science and Technology, research authorisation letter from the Provincial Commissioner, Western Province, Kenya and Research authorisation letter from National Council for Science and Technology for your own records.

This exercise will require approximately 30 minutes to complete. There is no compensation for responding nor is there any known risk. To ensure that all information will remain confidential, you are not required to mention or include any names of people. Copies of the project will be provided to the School and the National Council for Science and Technology. If you choose to participate, please answer all questions as honestly as possible and return the completed questionnaires promptly. Participation is strictly voluntary and you may refuse to participate at any time or point. Where necessary, return your responses to the candidate's address below.

Candidate: Iddi Webukha Juma, Reg. No.: IS/DPHIL/07/10, School of Information Sciences, Moi University, P. O. Box 3900, Eldoret - Kenya Tel: +254 722864343

Name of Supervisor: Dr. D. Odero, Department of Library, Records Management and Information Studies, School of Information Sciences, Moi University, P. O. Box 3900, Eldoret - Kenya Tel: +254 53 43620

Name of Supervisor: Prof. D. Gichoya, Department of Information Technology, School of Information Sciences, Moi University, P. O. Box 3900, Eldoret - Kenya Tel: +254 53 43620

Appendix 5: Questionnaire/Interview Schedule for Mobile Phone Users

Introduction

This questionnaire/interview schedule is part of a research project on The Role of Mobile Phone Technology in the Empowerment of Rural Communities in Western Kenya. The study aims to investigate the contribution that the mobile phone technology had made to the quality of life of rural communities and explore ways of optimising its development and uptake for a more knowledgeable and empowered society. All the responses will be used exclusively for this study and treated with utmost confidentiality. Kindly respond to all questions by filling in the blank spaces or ticking where appropriate. Use the acronyms NS for not sure and N/A for not applicable where necessary.

1. Gender
   - Male Female
2. Residence: Sub-Location _____Location _____District _____
3. Occupation _____
4. Number of members of household you belong to _____
5. Name or describe any mobile phone dealers you know in your district _____
6. Have you ever owned a mobile phone?
   - Yes No
7. Starting with yourself (in column marked 1) kindly give the following details for members of your household who own mobile phones:

Variable	**Household Members**											
	1	2	3	4	5	6	7	8	9	10	11	12
Gender (M for Male & F for Female)												
Age Bracket												
Number of phones owned currently*												
Phone brand(s)												
Phone model(s)												
How the 1st phones were acquired (use G for gift, O for offer, P for prize, L for lost and found property												
Type of phone(s):** BP for basic phone, CP for camera phone, MP for Music phone, VP for video phone, SP for smart phone and PP for Pocket PC device												
Average market price in Ksh												
Year when owned the first phone												
Number of SIM cards owned												
Service Provider(s) (SP)												
Affiliation to SP (use L for locked and U for unlocked)												
Service Plan (use PR for prepaid and PO for post-paid)												
Average signal strength from your house (on scale of 1-6)												
Approx calls per day												
Av. Call time per day in Ksh												
Internet Capability (tick for yes)												
Use Internet (tick for yes)												
Use Money Transfer (tick for yes)												

* Mark in separate adjacent column for each phone or SIM card owned by a member

** **Basic Phone:** *has basic operating system for calling, some music capabilities and service provider (SP) specific applications.* **Camera phone:** *allows taking of pictures.* **Music or MP3 mobile phone:** *can save a number of songs in several formats and allow some form of entertainment while not using the phone* **Video phone:** *allows to record and play videos* **Smartphone:** *non-touchscreen devices that offer a mobile operating system, and can send and receive emails and allow document editing and file storage.* **Pocket PC Device:** *Smartphones with touch-screen capabilities*

8. Please rate the usefulness of mobile phone technology to you. (Use NS for not sure)

Very unuseful	Unuseful	neither useful nor unuseful	useful	very useful	Not sure
1	2	3	4	5	

8.1 If your response above is useful by any degree, state the various ways in which the mobile phone is useful to you

i. :
ii. :
iii. :
iv. :
v. :
vi. :

9. Do you think the mobile phones have in any way empowered you to a better position in life?

□ Yes □ No

9.1 If yes, state the modes of empowerment

i. Communication
ii. Information/Knowledge
iii. Economically
iv. Socially
viii. Politically
v. Culturally
vi. Entertainment
vii. Other (specify)

10. State the features available on your phone(s)

Connectivity	**Imaging**	**Messaging**	**Entertainment**	**Extras**
3G Wi-Fi Bluetooth Infrared USB	Camera Camera Flash Video Camera	Predictive Text Multimedia Messaging Service E-mail	Media Player FM Radio Ringtones Headphone Jack Games	Memory Card Organiser Touchscreen Vibrator Video Calling Internal Memory
Others				

10.1 Which of the features in question 10 are active in your locality

10.2 If there is any active feature you are unable to use in your locality, please list and state why you re unable to use?

11. What mobile phone technology systems and services are available to you in your locality

SYSTEMS	SERVICES
Phone hand sets	Calling
Communication masts	SMS
Boosters	Mobile banking and money transfer
Satellite systems	Radio
WiFi systems	Television
Fibre optic cabling	MMS
others	Photography
	Music
	Games
	Data and keeping
	Service and maintenance
	Phone sales
	Advertising
	Phone charging
	Ring tones
	Others

11.1 Which of the mobile phone systems, services and features do you use most often?

SYSTEMS	SERVICES
□	
□	

11.2 Which of the systems, services and features do you think you do not need?

SYSTEMS	SERVICES

12. Please rate the popularity of the various modes of usage of mobile phone technology in your area

Purpose	Popularity Scale					
	Very unpopular	unpopular	Neither popular nor unpopular	Popular	Very Popular	Not sure
	1	2	3	4	5	
Making and receiving calls						
SMS						

Mobile banking and money transfer						
Radio						
Television						
DSTV						
Media Messaging System						
Photography						
Music						
Games						
Record keeping						
Phone service						
Phone sales						
Advertising						
Phone charging						
Ring tones						
Others						

12.1 Does any of these modes of mobile phone use enhance your ability to share information and / or do things better?

 Yes No

12.2 If yes, state the mode and explain how

Mode	how it enhances information sharing	how it enhances capacity to do things better
Phone Calling		
SMS		
Mobile Banking And Money Transfer		
Radio		
Television		
Mms		
Photography		
Music		
Games		
Record Keeping		
Phone Service		
Phone Sales		
Advertising		
Phone Charging		

Ring Tones		

13. State at most any four major events, information or news items that have changed the way mobile phones are used and state the effect

Event/news item	**Effect**

14. How did you learn to use your mobile phone?

- Use of manuals
- Trial and error
- Taught by supplier
- Internet
- Peer education
- Other(s); state: _____

15. How do you rate your knowledge of how to operate the phone you own?

Very low	Low	Neither low nor high	High	Very high	Not sure
1	2	3	4	5	

15.1 If your answer in the question above is not "very high", state what you have done to cope with the resultant knowledge gap _____

16. Do you experience any problem related to the use of mobile phone?

- Yes
- No

16.1 If no, move to the next question. Otherwise state the problems you experience in using your mobile phone (tick the applicable response)

- Lack of maintenance facilities
- Disruption
- Unreliability of Service
- Short battery life
- MMS Lack of signal
- Inadequate signal strength
- Recharging of phone
- Lack of electricity
- High cost of airtime
- Relationship issues
- Stress
- Others; Specify: _____
- High cost of handsets
- Frequent breakdowns
-
- Email
- Others

17. In your own experience what would you say are the major advantages and disadvantages of using mobile phones?

Advantages	**Disadvantages**
1 2 3 4	1 2 3 4

18. In your experience is there any new or emerging issue that has affected the way mobile phone technology is used?

□ Yes □ No

18.1 If yes state at most the four most fundamental issues and their effects

issue	**effect**

19. In your own experience, have you encountered any challenge in using mobile phone technology?

□ Yes □ No

19.1 If yes, state at most 4 most fundamental challenges and their possible remedies

Challenge	**Possible Remedies**

20. Are you aware of any serious risks associated with the use of mobile phone phones?

□ Yes □ No

20.1. If your response above is yes, please state the risks. Otherwise skip to 20

_____

_____

_____

20.2. What has been your response to the stated risks?

□ Stopped using phone □ Sought expert attention

□ Reduced usage of phone □ Other; State: _____

□ Sought further information

21. Have you ever taken your phone for repairs?

□ Yes □ No

21.1 If your response is yes, name the major problems that led you to take the phone for repairs

21.2 To whom (repairer) _____ and where (place repairer is situated) _____ do you normally take the phone for repairs

21.3 In percentage terms, what is the success rate of such repairs:

22. How frequently do you use key features found on or supported by your phone? Leave blank where inapplicable

Feature	**Very infrequently**	**infrequently**	**Neither frequently nor infrequently**	**Frequently**	**Very Frequently**	**Not sure**
Voice call						
Internet						
Emails						
Voicemails						
Short Messaging Services (SMS)						
Media Messaging Service (MMS)						
Instant Messaging (IM)						
Camera						
Audio						
Video						
Radio						
Calculator						
Clock						
Alarms and reminders						
Word processing						
Others						

23. What is your level of satisfaction regarding the degree to which mobile phones meet your information and communication needs?

Very Dissatisfied	Dissatisfied	Neither Satisfied nor Dissatisfied	Satisfied	Very Satisfied	Don't Know
1	2	3	4	5	

24. What would you say are the major phone specific barriers that prevent you from maximising your use of mobile phones:

_____

_____

_____

25. What would you say are your own personal limitations that prevent you from maximising your use of mobile phones:

_____

_____

_____

26. In your view, what needs to be done to increase your level of satisfaction in the usage of mobile phones?

□ Use of local languages in phones □ Simplify menus

- Increase user education
- Lower the cost of airtime
- Lower the cost of mobile phones
- Add local content
- Others; Specify: _____

27. In your own experience, are there any new or emerging issues affecting the development of mobile phone technology?

Issues	**Effect on development of mobile phone technology**

28. If you got a chance to advise the mobile phone manufactures, what additional features both real and imaginary would you wish the phone to have?

29. Apart from the conventional ways of using mobile phone technology, how else do you think the technology could fundamentally be used to spur greater levels of information sharing and empowerment?

30. Do you have any recommendation(s) that can further enhance the development and application of mobile phone technology in information sharing and empowerment?

Appendix 6: Questionnaire/Interview Schedule for Mobile Phone Dealers

Introduction

This questionnaire/interview schedule is part of a research project on The Role of Mobile Phone Technology in the Empowerment of Rural Communities in Western Kenya. The study aims to investigate the contribution that the mobile phone technology has made to the quality of life of rural communities and explore ways of optimising its development and uptake for a more knowledgeable and empowered society. All the responses will be used exclusively for this study and treated with utmost confidentiality. Kindly respond to all questions by filling in the blank spaces or ticking where appropriate. Use the acronyms NS for not sure and N/A for not applicable where necessary.

1. Year of Establishment as a mobile phone sales agent _____
2. City/Town of operation of you business_____
3. Area of Coverage of your business_____
4. Main business activities _____
5. Compared with urban clients, approximate the percentage of your rural clients? _____%
6. In your own assessment, what is the average level of competence of mobile phone users in using available phone systems and services:

Very low	Low	Neither low nor high	High	Very high	Not sure
1	2	3	4	5	

7. As a company or agency, what is the main mechanism you have put in place to try and reduce existing knowledge gaps in the use of mobile phone technology?

_____
_____
_____

8. What are the major challenges you face in the course of serving your clients

_____ _____
_____ _____
_____ _____

9. Do you think the mobile phones have in any way empowered users to access information in a more effective way?

□ Yes □ No

9.1 If yes, state the modes of empowerment

i. Communication
ii. Information/Knowledge
iii. Economical
iv. Social
viii. Political
v. Cultural
vi. Entertainment
vii. Other (specify)

10. In your view, what are the emerging issues that are already affecting or are likely to affect the use of mobile phones both positively and negatively?

Issues	Effect
Positive 1 2 3 4	 1 2 3 4
Negative 1 2 3 4	 1 2 3 4

11. Do you offer mobile phone repair services to your clients?

 Yes No

12. If your answer in the foregoing question is yes, name the 4 most common problems that lead your clients to bring to you their phones for repairs

_____ _____

_____ _____

12.1 In percentage terms, what is the success rate of the repairs you undertake? ___%

13. Please rate the degree to which you think your mobile phone clients' information and communication needs are satisfied?

Very unsatisfied	**unsatisfied**	**Neither satisfied nor unsatisfied**	**Satisfied**	**Very satisfied**	**Not sure**
1	2	3	4	5	

14. In your view, what needs to be done to increase the level of satisfaction in the usage of mobile phones?

15. If you got a chance to advise the mobile phone companies, what additional features both real and imaginary as expressed by the needs and demands of your clients would you wish mobile phones to have?

_____

_____

16. Apart from the conventional ways of using mobile phone technology, how else do you think the technology could fundamentally be used to spur greater levels of information sharing and empowerment?

_____

_____

17. Do you have any recommendation(s) that can further enhance the development and application of mobile phone technology in information sharing and empowerment?

Appendix 7: Questionnaire/Interview Schedule for Mobile Phone Service Providers

Introduction

This questionnaire/interview schedule is part of a research project on The Role of Mobile Phone Technology in the Empowerment of Rural Communities in Western Kenya . The study aims to investigate the contribution that the mobile phone technology has made to the quality of life of rural communities and explore ways of optimising its development and uptake for a more knowledgeable and empowered society. All the responses will be used exclusively for this study and treated with utmost confidentiality. Kindly respond to all questions by filling in the blank spaces or ticking where appropriate. Use the acronyms NS for not sure and N/A for not applicable where necessary.

1. Year of Establishment of your parent company as a mobile phone service provider _
2. City/Town of operation of your western provincial office _____
3. Area of Coverage for your office _____
4. Main Business activities _____
5. Approximate number of your active clients nationwide? _____
6. Approximate number of your active clients in Western Province? _____
7. Relative to your urban clients, what is the percentage of your active rural clients in Western Province? __%
8. In your own judgement, what can you say is your investment priority

[ ] Rural [ ] Urban [ ] Other (Specify) _____

8.1 What is the justification for the model of investment specified above?

9. In your own assessment, what is the average level of competence of mobile phone users in your jurisdiction with regard to using available phone systems and services

_____

Very low	Low	Neither low nor high	High	Very high	Not sure
1	2	3	4	5	

9.1 As a company, what is the main mechanism you have put in place to try and mitigate any degree of incompetence in question 9 among your clients ?

_____ _____

_____ _____

_____

10. Do you think the mobile phones have in any way empowered users to access information in a more effective way

□ Yes □ No

10.1 If yes, state the modes of empowerment

i. Communication
ii. Political
iii. Cultural
iv. Entertainment
v. Economical
vi. Social
vii. Information/Knowledge
viii. Other (specify) _____

11. In your view, what are the emerging issues that are already affecting or are likely to affect the use of mobile phones both positively and negatively?

Issues	Effect
Positive 1 2 3 4	 1 2 3 4
Negative 1 2 3 4	 1 2 3 4

12. Please rate the degree to which you think your mobile phone clients' information and communication needs are satisfied?

Very unsatisfied	unsatisfied	Neither satisfied nor unsatisfied	Satisfied	Very satisfied	Not sure
1	2	3	4	5	

13. In your view, what needs to be done to maintain or increase the level of satisfaction in the usage of mobile phones by your clients?

_____ _____

_____ _____

14. As a company, what challenges do you experience in serving your rural clients?

_____

15. What proposals would you make to solve the challenges in question 14?

_____

16. If you got a chance to advise the mobile phone companies, what additional features both real and imaginary as expressed by the needs and demands of your clients would you wish the phones to have?

_____

17. In your own view, what are the future prospects of rural mobile phone users in the mobile phone industry?

_____

18. Any additional comment(s) or recommendation(s) that could enhance the role of mobile phone technology in the empowerment of your clients:

_____

_____

Appendix 8: Research Authorisation letter from National Council for Science and Technology

REPUBLIC OF KENYA

NATIONAL COUNCIL FOR SCIENCE AND TECHNOLOGY

Telephone: 254-020-2213471, 2241349, 254-020-2673550
Mobile: 0713 788 787 , 0735 404 245
Fax: 254-020-2213215
When replying please quote
secretary@ncst.go.ke

P.O. Box 30623-00100
NAIROBI-KENYA
Website: www.ncst.go.ke

Our Ref: **NCST/RCD/13/013/37**

Date: **15th May, 2013**

Iddi Webukha Juma
Moi University
P.O Box 3900-30100
Eldoret

RE: RESEARCH AUTHORIZATION

Following your application dated **30th April, *2013*** for authority to carry out research on "***The role of mobile phone technology in information sharing and empowerment of rural communities in Western province, Kenya.***" I am pleased to inform you that you have been authorized to undertake research in **Western Province** for a period ending **31st December, 2014.**

You are advised to report to **the Provincial Commissioner and Provincial Director of Education, Western Province** before embarking on the research project.

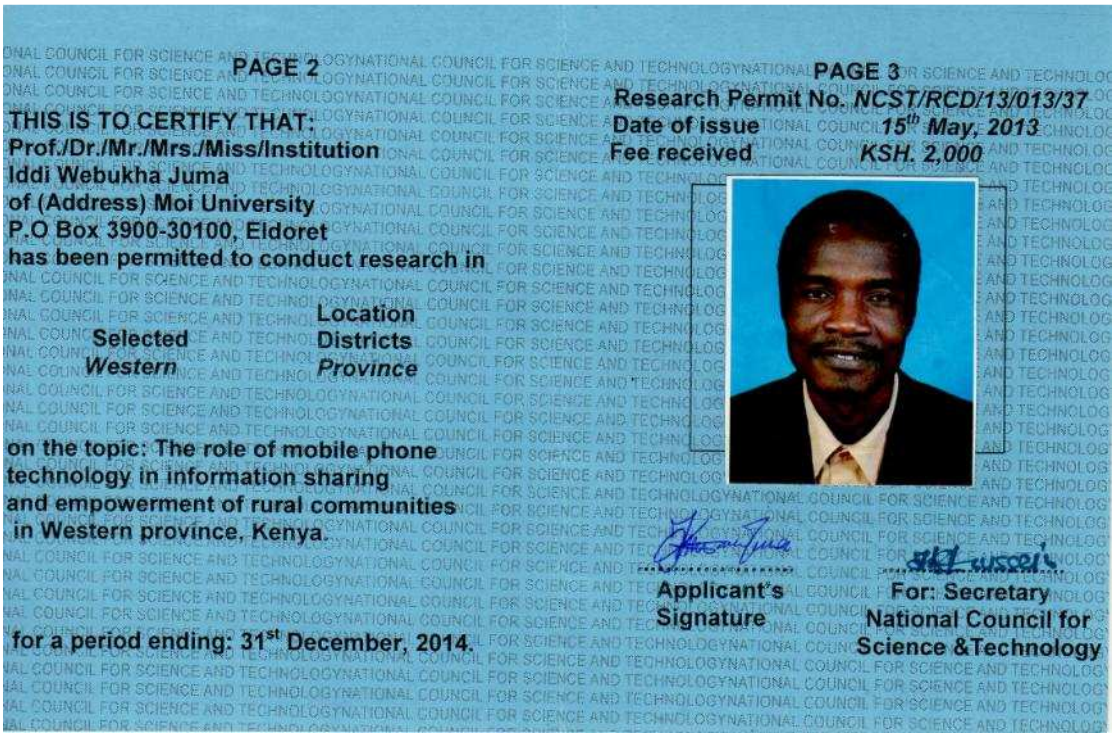
On completion of the research, you are expected to submit **two hard copies and one soft copy in pdf** of the research report/thesis to our office.

SAID HUSSEIN
FOR: SECRETARY/CEO

Copy to:

The Provincial Commissioner
The Provincial Director of Education
Western Province

Appendix 9: Research Permit from the National Council for Science and Technology



PAGE 2

THIS IS TO CERTIFY THAT:
Prof./Dr./Mr./Mrs./Miss/Institution
Iddi Webukha Juma
of (Address) Moi University
P.O Box 3900-30100, Eldoret
has been permitted to conduct research in

Location
Selected Districts
Western Province

on the topic: The role of mobile phone technology in information sharing and empowerment of rural communities in Western province, Kenya.

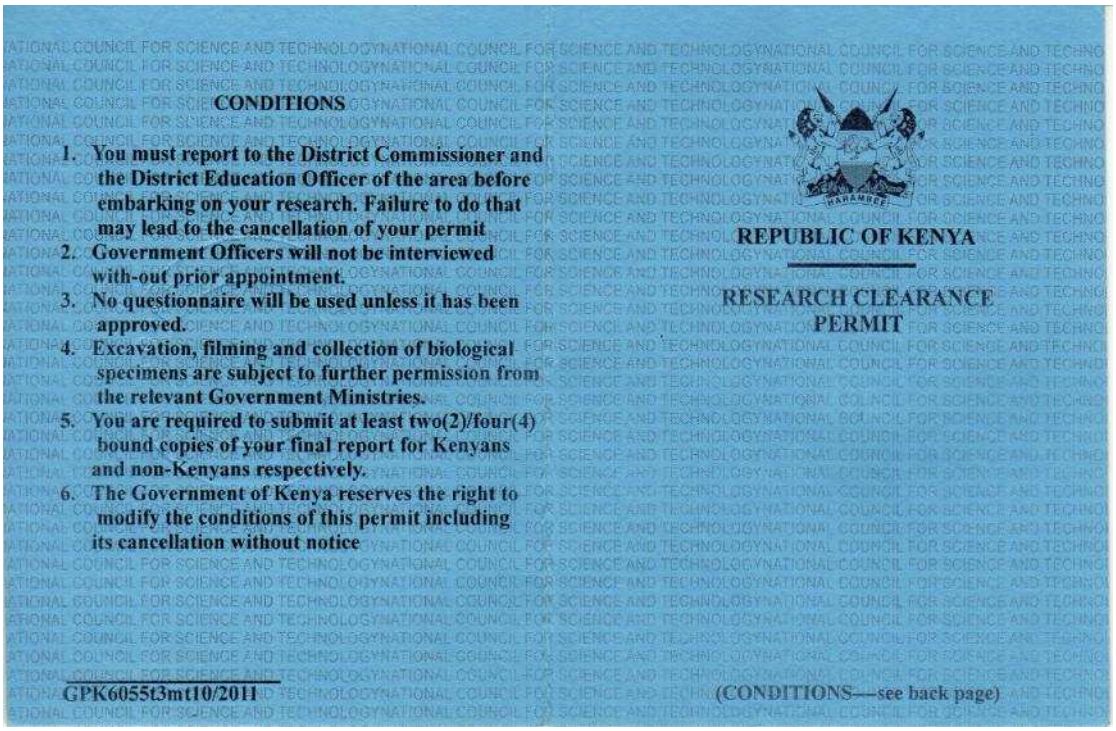
for a period ending: 31st December, 2014.

PAGE 3

Research Permit No. NCST/RCD/13/013/37
Date of issue 15th May, 2013
Fee received KSH. 2,000

Applicant's Signature

For: Secretary
National Council for
Science &Technology



CONDITIONS

1. You must report to the District Commissioner and the District Education Officer of the area before embarking on your research. Failure to do that may lead to the cancellation of your permit
2. Government Officers will not be interviewed with-out prior appointment.
3. No questionnaire will be used unless it has been approved.
4. Excavation, filming and collection of biological specimens are subject to further permission from the relevant Government Ministries.
5. You are required to submit at least two(2)/four(4) bound copies of your final report for Kenyans and non-Kenyans respectively.
6. The Government of Kenya reserves the right to modify the conditions of this permit including its cancellation without notice

REPUBLIC OF KENYA

RESEARCH CLEARANCE PERMIT

GPK6055t3mt10/20H

(CONDITIONS—see back page)

Appendix 10: Research Authorisation letter from the Provincial Commissioner, Western Province, Kenya

REPUBLIC OF KENYA

OFFICE OF THE PRESIDENT

Telegrams "PROVINCER" Kakamega
Telephone: 056-31011
Fax: 056-30327
Email: pcwestern@jambo.co.ke
When replying please Quote
Ref No. ADM.15/1 VOL. VII/118

PROVINCIAL COMMISSIONER
WESTERN PROVINCE
P.O. Box 218
KAKAMEGA

21 May 2013

Iddi Webukha Juma
Moi University
P. O. Box 3900-30100
ELDORET

RE: RESEARCH AUTHORIZATION

Our office is in receipt of CEO Secretary's – **National Council for Science and Technology** letter dated 15/05/13 ref. NCST/RCD/13/013/37 on the above stated.

You are hereby authorized to carry out research on "**The Role of Mobile Technology in information sharing and empowerment of rural communities in Western Province, Kenya**" within the Province for a period ending 31st December, 2014.

NJOKA J.K.
For: PROVINCIAL COMMISSIONER
WESTERN PROVINCE

Cc:
The Secretary,
NC ST- (Yours ref. NCST/RCD/13/013/37 refers)