Barriers to Broadband Market Development in Rural Zambia: A Case Study of Lusaka Rural Broadband Market

By

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Dedication

This document is dedicated to my parents Stavy Bernard and Joyce Mwanankuwa who supported me throughout my studies.

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I, Ristone Mwanankuwa, do hereby declare that the content of this document is my own and all other works by other people have been duly referenced, and that this work has not been previously presented to another university for the same purpose.

09th December, 2016

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Ristone Mwanankuwa Date

Certificate of Approval

This dissertation of Ristone Mwanankuwa has been approved as fulfilling the requirement for the award of Master of Engineering in ICT Policy, Regulation and Management by The University of Zambia.

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Abstract

The popularity of the Internet has resulted in the demand for telecommunications networks that are capable of delivering high-speed data transfers which can meet the communication needs of today's users.

However, the rural community in Zambia has continued to suffer from social exclusion since much of the broadband infrastructural deployment has mostly been concentrated in urban areas. This research investigates the Barriers to Broadband market development in the rural district of Chongwe located in Lusaka province.

From the research, it was observed that Chongwe has very scanty broadband access infrastructure owing to its low population density and high acquisition and operational costs. About 60% of the respondents suggested that the high cost of end user equipment such as Laptop computers and smart phones is a hindrance to broadband market development in rural areas. In Chongwe, only 9% out of the 136 respondents own Desktop computers, 21% own laptops and some own other types of gadgets for internet access. It was also noted that about 50% would adopt broadband connection if it addressed local needs such as education, healthy and agriculture.

It is recommended that broadband service providers, government and other stake holders should consider helping the rural community be taken on board and have access to broadband services. A more non-profit municipal approach where broadband is delivered alongside traditional utility services such as electricity and water would be able to address some of the barriers to broadband market development in rural Zambia. This will not only make broadband available but will also make it affordable to most of the rural residents.

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List of Abbreviations

3GPP……...3rd Generation Partnership Project

ADSL……. Asymmetric Digital Subscriber Line

BSP……. Broadband Service Provider

BTS……. Base Transceiver Station

BYOD……. Bring your own device

CSO……..…Central Statistics Office

DSL……. Digital Subscriber Line

DSLAM..... Digital Subscriber Line Access Multiplexer

GPON……. Gigabit Passive Optical Network

GSM……. Global System for Mobile Communication

HFC……. Hybrid Fiber Coax

HSPA……High Speed Packet

ICTs……. Information and Communication Technology

ISP……. Internet Service Provider

ITU……International Telecommunications Union

LTE……Long Term Evolution

MTN……. Mobile Telephone Network

OECD……Organization for Economic Co-operation and Development

OFC……. Optic Fiber Cable

PUC……. Power Utility Company

POTS.....Plain Old Telephone Service

SME……Small to Medium Enterprise

UMTS……. Universal Mobile Telephone Network

UNESCO……United Nations Educational, Scientific and Cultural Organization

VDSL……Very High Bit Rate Digital Subscriber Line

ZICTA……Zambia Information and Communication Technology Authority

CHAPTER 1

1.0 Introduction

Internet has been described as one of the most influential platforms that the whole world has ever experienced because of its transformative power in the area of information exchange. A very good Internet speed at an affordable price is the desire of most individuals and organizations. It is interesting to note that certain countries have already made internet access a legal right just like other utilities such water and electricity (Banda, 2010). Finland is one of the world's most connected countries, with about 96% of its citizens online. However, the communications minister, Suvi Linden, stated that the directive was found necessary in an effort to step up the availability of internet in Finland's remote rural areas (Arthur, 2010). The population of Finland stands at about 5 500 000 and happens to be the third most sparsely populated countries in Europe (Statistics Finland, 2015). Whether internet access is made a legal right or not, the social and economic benefit it delivers cannot be over emphasized. There is need to deliberately come up with measures that can bring about and promote broadband penetration in rural communities of Zambia if the country is to develop. Zambia's Telecommunications sector has continued to transform over the years and has become a strong point of focus in today's broadband business. Most applications in the key sectors of the economy such as manufacturing, mining and agriculture have dependence on broadband interconnections with other data processing systems accessible via the network. Different telecommunications service providers have since emerged in the country following the liberalization of the sector through an act of parliament in 1994. The use of the Internet as a communication platform for both data and voice has formed an indispensable significant part of the telecommunications market within and outside Zambia. Fornefeld et al (2013)

noted that broadband internet is a general-purpose technology with a strong impact on knowledge-intensive activities in all economic sectors. It is very much necessary to the creation of sustainable jobs and economic activity in a very rapid-growing and high-value-added economic sector. The use of the internet has also continued to act as a repository and dissemination system for both knowledge and culture. It is able to store information as well as distribute to the rest of the world within the shortest period of time.

Koboldt (2013) also observed that the International Telecommunications Union (ITU), the United Nations specialized agency for Telecommunications and Information and Communication Technologies (ICTs), remains very committed to playing a leading role in the development of the digital economy by extending the benefits of developments in broadband and getting hold of the much needed opportunities that would be unleashed. Katz (2010) reported that the ITU in conjunction with UNESCO launched the Broadband Commission for Digital Development which was aimed at encouraging governments to implement national broadband plans and to increase accessibility to broadband services. All targeted groups, institutions and communities are expected to have access to some form of broadband if this implementation is to be fully and successfully realized. It is a call on all stakeholders to concentrate their efforts and resources towards achieving meaningful broadband accessibility in the whole world.

Koutroumpis P. et al (2013) noted that there is a strong consensus that broadband has material positive impacts for national economies. The cited routes to economic impact include the construction effects which are normally associated with the installation of network infrastructure and productivity growth which comes as a result of enhanced business innovation. It should be mentioned here that international trade has also grown

rapidly as a result of broadband deployment. E-commerce which is basically the buying and selling of products and services including the transfer of funds using the internet, has become very prominent for both domestic and international trade. E-commerce has the advantage of being able to facilitate business communications that may result into business transactions at any time from any part of the world.

Different countries have had their own experiences in as far as market development of broadband Internet is concerned which has resulted in the undoubted benefits of social communication and hence making the world a better place. Gorp (2006) stated that Internet Service Providers (ISP's) have played a critical role in the market development of broadband Internet. Globally, the broadband market has continued to grow from strength to strength following the vast investments that most companies and countries have made in the in upgrading much of their core and access infrastructure.

The Zambian population as of the 2010 census is estimated at 14.5 million people and all broadband Internet Service Providers need to appropriately segment the market and get a sustainable share out of it. According to Kim et al (2010), there are currently more than 1 billion broadband subscriptions world wide of which 465 million subscriptions being wireline broadband subscriptions and 575 million being wireless high speed data subscriptions. ZICTA, an organization which also monitors the Zambia's broadband market, reports from its website that by end of Quarter 3 in 2014, there are 23000 customers on fixed and 3,362,056 on mobile broadband representing adoption of about 0.2% and 23% respectively across the entire population in the country (ZICTA, 2014). Despite Broadband Internet Service having been in Zambia for some years now, only a small percentage has access to the internet via this technology. The majority of the Zambians are still not yet

connected to this service, a matter which should draw the attention of all stakeholders. It should be mentioned here that Broadband Internet will continue to blanket larger portions of the country's landscape, with an estimated coverage to hit as high as 74.1 percent of households by the year 2017, which is equivalent to some 94.7 million houses in the United States (King, 2014:11). An increase in broadband penetration can significantly contribute to the availability of healthcare, education and banking services in both urban and rural areas. Broadband can be delivered through traditional copper wires using Digital Subscriber Line (DSL) and Asymmetric Digital Subscriber Line (ADSL). Cable technology uses coaxial (also called coax) cable and wireless broadband uses the air space as the media of propagation. However, in the recent past, the market has witnessed the introduction of high speed mobile internet connections using 3rd and 4th Generation technology which enables users with compatible handsets to access the internet. Regardless of the changing means of access, the internet has continued to be collaborative and inclusive through the use of different applications and end user devices.

ITU (2012) revealed that innovative new models that promote competition, innovation and market growth are now needed to make the broadband opportunity reachable for all world citizens. The market growth of Broadband Service Providers can be attained by extending their products into new market segments or introducing new functionalities to the already existing product in order to capture even more clients in established segments. The main reason for marketing new technology is to ensure that the intended users of the technology are kept informed of its availability and how best it can enhance their processes towards a better economy in the country. Sometimes the usage of certain technologies may also bring about unforeseen problems and challenges. However, it should be mentioned here that the

mere existence of technology does not necessarily result in wide spread adoption and usage across all sections of society in any country. Different market forces and service flavors come into play and in a competitive environment, other or similar products may alternatively be preferred as better options. It is for this reason that a strong marketing team needs to be put in place so that the current and potential customers may be informed, educated and enticed to buy the broadband service being offered through new technology. Different operators may opt to position their services differently, depending on strategic business decisions and the regulatory environment within which internet provision is being conducted (Gillet and Lehr, 1999).

Cerf (2009) recalled that in the past, there was universal service whose purpose was to simply assure that everybody could get telephone service. However, in the 21st century, it was proposed that the universal service that everybody needs is broadband access to the Internet. Ibid (2009) observed that the flexibility of broadband Internet is so great, that having lots of it around would definitely stimulate new applications, new products and services. This is because the economics of digital information is rapidly transforming a lot of industries, and in some obvious cases interfering with their business models.

Budde (2010) argued that the universal broadband inclusion for all will bring about a significant economic and social change that will be able to address the problems that the millennium development goals aim to achieve and shall become a game-changer as regards addressing rising concerns such as healthcare costs, delivering digital education for all, and mitigating the effects of climate change.

1.1 Problem Background

Central Statistics Office reports on selected Socio-Economic Indicators that Zambia's population distribution comprises 60.5 percent (7,919,216) in rural areas and 39.5 percent (5,173,450) in urban areas (CSO, 2013). The report also revealed that the majority of the Zambian population is found in rural areas and out of this total population, the majority which translates into 76.8% happen to be under the age of 18 (ibis, 2013). Therefore, the rural community forms a significant part of Zambia's population whose contribution to national development can never be ignored.

Nyirenda-Jere (2015) noted that there are serious concerns that most of the available bandwidth is concentrated in urban and major metropolitan areas. Rural and remote communities in Africa continue to suffer from a serious lack of connectivity and the benefits of Internet access. This development also implies that despite the information age cutting across most of the countries in the world, some Zambians may still continue to suffer from social exclusion if the necessary interventions are not carried out to rectify the situation. Despite the recorded growth in the ICT sector following its liberalization in 1994, access to ICT services such as internet and related technologies are more biased to urban population leaving out the rural areas that comprise over 60% of the country's population (SATNET, 2009).

Enriquez et al (2015) observed that the growth in the number of online users has so far benefited mainly developed countries, but to some extent it has also advanced urban areas in developing nations. Further growth of the online population is expected, especially in emerging markets. However, because of structural barriers, more than 4.2 billion people worldwide are likely to be still unconnected in 2017. These people, who are mostly in developing countries, will be missing out on the benefits of the Internet society. It is very

evident that developing countries around the world have challenges in terms of having the majority of their citizens to get connected to reliable broadband internet service as compared to those in developed countries. Even though some of the challenges may already be known to the ICT sector, it still remains important to establish their existence from an academic research perspective.

Some of the countries such as Denmark, the Netherlands, Switzerland, Korea, Norway, and Iceland among others, have recorded significant achievement in market penetration of broadband. Unfortunately, most of the countries are still lagging behind in as far as improving their world rankings is concerned. Currently the Organization for Economic Cooperation and Development (OECD) ranks the United States as the 15th country in the world for broadband adoption, down from 4th in the year 2001. Low broadband penetration has also been recorded in Latin America despite the noticeable potential of rapid growth. Other parts of the world such as Asia and the Middle East have however recorded high broadband market penetration. Delivered broadband speeds vary from one service provider to another, much of the broadband infrastructure currently available around the world today comprises of relatively slow connections which may range from 500kbps to 8Mbps. However, countries such as Japan are leading the world in high speed broadband services, with widespread availability of services going up to as high as 100Mbps.

However, Sinkondyobwe (2012) observed that despite rural connectivity spreading at a fast rate in the developed countries, its potential is still yet to be tapped in developing countries such as Zambia. Almost 60% of the world's population most of whom live in developing countries are still offline. Close to 70% of households in the developing world do not have

Internet access, and while Internet penetration rates have increased dramatically in recent years, the pace of change seems to be slowing (Affordability Report, 2015).

The majority of the population which is still offline may have their own reasons for remaining unconnected. Despite most of the studies revealing that access prices are dropping around the globe, it was discovered that the cost of fixed broadband has remained at about 40% of an average citizen's monthly income across the 51 countries that were covered in one study, while the price for an entry-level mobile broadband package hovers at just above 10% of monthly incomes (ibid, 2015).

Sinkondyobwe (2012) noted that it was quite comforting that some rural parts of Zambia are a society which thirsts for knowledge and desire to improve their daily lives. Kottler (2006:75) also pointed out that the main demographic factor which marketers must monitor is population in the location within which they intend to conduct their business. This is because people are basically the ones who make up markets and there is a very strong relationship between market size and the age distribution of the population within a particular location. ISP's need to be considerate concerning population growth rate and also the age mix in a particular area should be able to make the entrepreneur be considerate in formulating business penetration strategies for such a location.

This research aims to establish the Barriers to Broadband Market Development in Rural Zambia. It is a Case Study of the Lusaka Rural Broadband Market. It endeavors to show the potential of extending availability, accessibility and affordability of broadband services to a wider population found in the outskirts of urban areas irrespective of their incomes and social status. It highlights interventions that can be able to further reduce the digital divide currently

being experienced between urban and rural areas by making recommendations that will foster the deployment, adoption and use of broadband services all across Zambia.

1.2 Significance of the Study

The researcher intended to establish the major barriers in the development of Broadband Market in Rural Zambia. The research results were aimed to help Local and Central Government to identify points of intervention to enable broadband technologies be accessible to a wider community in rural Zambia. It was meant to influence the managers of Internet Service Providers to come up with better marketing models and broadband solutions that will effectively and profitably carter for the rural population in Zambia. It also delves into providing insight into regulatory and policy issues which would be able to address and stimulate the deployment of the broadband echo system and market development in rural Zambia. Furthermore, it is expected to contribute to the academic body of knowledge and form a basis for more detailed research work on the same or similar research topics in future.

1.3 Aim of the Study

This research is an effort to determine some of the barriers to broadband market development in rural Zambia, and also to recommend the policy and regulatory issues that could lead to enhanced accessibility of broadband services across rural Zambia. It helps us to establish the reasons as to why certain countries have succeeded in making broadband services to be more affordable, more accessible and universal, and what steps Zambia can follow in order to quickly catch up and further reduce the digital divide. The research also intended to establish the availability of the broadband infrastructure and determine the key drivers that would enhance its demand and adoption in the rural areas of Zambia.

1.3.1 General Objective

- To establish major hindrances to market development of Broadband in rural Zambia and therefore recommend the possible solutions to overcome the challenges.

1.3.2 Specific Objectives

The specific objectives of this study are:

- To establish the availability of broadband access infrastructure in Chongwe
- To determine how cost of end user equipment impacts on market growth
- To establish the impact of local content on the adoption of broadband services
- To determine how pricing of broadband services affects affordability of the service
- To establish how digital literacy impacts on adoption of broadband services
- To develop a Business Model for broadband service providers targeting rural markets

1.6 Research Questions

- Has broadband access infrastructure been rolled out in Chongwe?
- How does the cost of end user equipment affect market growth for broadband?
- What impact has local content got on the adoption of broadband services?
- Are broadband services generally affordable to rural customers?
- How does digital literacy impact on adoption of broadband services?
- What business model would suit Chongwe broadband market?

1.4 Scope of the study

For the purpose of this study the rural district of Chongwe in the Lusaka province was identified as a representation for the rural communities of Lusaka. The town is well known for agriculture and hosts a number of farmers and general traders. The town also has some civil servants serving in government ministries such as education, agriculture and health. It is located about 31km from Airport round about along the Great East Road.

The general reference to other towns or rural settlements that are contained in this document were only made for the purpose of providing enough background to the research that was being undertaken.

1.5 Area of study / Context of the Study

The focus of this research was mainly concentrated on the barriers to broadband market development faced by the rural population of Chongwe district in the Lusaka province. It delves into commenting on the additional steps that would be undertaken in order to accelerate rural deployment of broadband service.

1.7 Definition of terms

Barrier: Refers to circumstances or obstacles that prevent progressive movement or access. It hinders market penetration and accessibility of broadband services in rural Zambia.

Broadband: refers to a local access link whose performance is not a limiting factor in a user's capability for running today's applications.

Digital Divide: This refers to an economic and social inequality a given group of people in their access to, or knowledge of information and communication technologies. It signifies the technological gap that exists between the developed and non-developed communities or

countries. It clearly shows the contrasts that exist between those who have access to the information technologies and those who do not have.

Internet: This is the interconnection of computers in a Local Area Networks and Wide Area Networks to enable users to access online services such as email and the World Wide Web.

Local loop or Last Mile/Meter: refers to either the wireless or wired connection between the nearest node of the service provider and the Customer Premises Equipment.

Market: This refers to a situation where the ISP meets clients in order to sell broadband services

- Are there available rural markets?
- What are their specific needs?
- Is there demand for broadband service in rural markets?
- Is there satisfaction resulting from the use of the service?

Investment: This refers to the use of resources such as money, time, equipment etc. to bring profit or earn interest.

- Is it a profitable venture or to invest in the roll out of broadband access infrastructure in rural areas?

Rural: This is a settlement in an open swath of land which is characterized by few homes or other buildings and whose population density is low.

Strategy: This is an integrated long-range plan for achieving the company's objectives as it commits its resources to the business venture.

- Are there any business strategies outlined for a company to penetrate and sustain the rural market?

Base Transceiver Station (BTS): refers to a node that is located closer to users in the Mobile Telephone Network through which access to broadband and voice services is made available.

Footprint: is the perimeter on the earth's surface within which a satellite can offer communication services

Local Content: This refers to programs that are produced or services that are offered within the country as opposed to imported ones.

Fiber Optics: This refers to the use of very thin but flexible fiber strands of glass or other transparent solids for the transmission of light signals in telecommunications.

Broadband Access Infrastructure: This is the equipment at the provider's side to which clients terminate in order to access internet service.

Telecommunications: This is the exchange of information over a distance and may use telephone, telegraph or other forms of transmission.

Policy: This is the course of action that may be adopted or proposed by government, an organization or individual.

TV White Spaces (TVWS): The white space technology employs the unused spectrum in bands that are allocated to television broadcasting services, that is to say those chunks of spectrum which are normally reserved as buffers in between digital TV channels in unlicensed devices are permitted to operate (Harrison K, 2011).

1.8 Organization of Thesis

This thesis has been organized into five major parts. The introduction discusses the problem background, problem statement, research questions, study objectives, scope and significance

of the study. Chapter two goes on to review the literature from books, journals, articles and web pages that has been recorded on the subject matter and Chapter three looks at both the theoretical and conceptual framework while chapter four discusses the results obtained from the collected and processed data. Chapter five highlights the conclusions and recommendations that have been drawn from the entire study.

1.9 Chapter Summary

Broadband remains one of the fundamental services that can foster social and economic growth even in rural areas. Despite the majority of Zambia's population being rural, much of broadband access is only concentrated in urban areas. The rural district of Chongwe has continued to face service availability challenges and this study generally aims to establish major hindrances to market development of Broadband in rural Zambia and therefore recommend the possible solutions to overcome the challenges.

In this study, the rural district of Chongwe in the Lusaka province was identified as a representation for the rural communities of Lusaka.

CHAPTER 2

2.0 Literature Review

Bates et al (2012) stated that a competitive and sustainable broadband industry is driving innovation, community and economic development, education, health care, and government services. Individuals, governments, and commercial institutions can now connect not only with a variety of different technologies but also use technology to broaden and extend as much of their capabilities as possible. This industry which has been around for a few decades has since become a platform for community and economic development.

McCalla et al (2009) revealed that government and citizens are using broadband networks as a foundation for delivering improved government services, for increasing public program effectiveness, and for increasing transparency and accountability of government to citizens. E-Government has been a priority of many governments for many years. E-Government is all about improving client services and the outcome of government programs through the effective and efficient use of technology. A resilient and high performing broadband connection may be used to seek or receive medical advice over an operation which is hundreds or thousands of km from where the patient is located.

Bates et al (2012) also noted that many organizations have since shifted from providing users with simple voice and email services to video interactions, data exchanges, powerful search capabilities, e-commerce, and social networking. Using today's technologies, broadband services are far more than just for entertainment in that they aid in keeping in touch with others and offering a platform for information sharing. They facilitate access to quality educational services and deliver health care. Through broadband users are able to successfully interact with both local and central government services. Daily banking and

trading transactions are equally and easily conducted through broadband. It is therefore an important service of which the United Nations has already gone ahead to declare its access as one of the basic human right (McKenney, 2016). It is considered a basic human right in that a lot of communication needs would not be met or would be very difficult to meet in the absence of broadband services. Because of the variety of communication needs that broadband is able to meet, it has been noted that the need for affordable access to broadband cannot be overemphasized. The digital divide needs to be narrowed further by making the service be available to as many people as possibly could in Zambia. This can only be achieved by overcoming the barriers to broadband market development.

These access challenges are felt more acutely among certain populations as a result of geographic, economic, gender and socio-cultural factors, with marginalized or vulnerable groups often the hardest hit. Rural Internet users have very limited access when compared with their urban counterparts; low-income populations are disproportionately underrepresented online; and persistent income gaps, coupled with engrained social and cultural norms, keep women and other marginalized populations both from being able to afford Internet services and from being able to use the Internet freely (Affordability Report, 2014).

Kim et al (2010) noted that the broadband ecosystem includes the networks, the services that are carried by the networks, the applications that are delivered and the users of the applications. Some scholars have defined broadband in relation to bandwidth and speed. However, others argue that broadband needs to encompass the entire Internet echo-system and should consider issues of policy and data services from both the demand and supply side of it. Broadband allows users to download and upload web pages and files much faster than

traditional dial up connection and facilitates new applications such as streaming audio/video and interactive services such as video conferencing and Internet telephony (Gillet and Lehr, 1999). The demand side looks at the market size and the specific needs that would be able to equitably satisfy such needs within these markets. The supply side involves the ability of the service providers to make available such services in a more affordable manner to profitably capture as many customers as possible.

FCC (2013) defines broadband as a high speed internet access technique which allows simultaneous data transfer over a wide band of frequencies and is always on. The technique enables voice, data or video to be transported over a single medium simultaneously. FCC has over the years continued to redefine broadband and in its recent postings broadband has been defined as a connection with benchmark speeds of up to 25Mbps for downloads and 3Mbps for uploads. However, it was argued that, the term broadband may not necessarily be used to mean broadband access to the Internet, but to simply mean broadband transport (Cerf, 2009).

ITU and the OECD have defined broadband as a capacity of at least 256 kbps in the uplink or downlink speed. The Broadband Commission for Digital Development has defined broadband using a cluster of concepts, as high-speed Internet access which is always-on and capable of multiple service provision simultaneously. In terms of speed, steady growth continues in both theoretical and actual access speeds or data throughput capacity. Broadband in general electronics and telecommunications language is a term used to explain the signalling method which involves a relatively wide range of frequencies that would be divided into channels or frequency bins (Anatory and Theethayi, 2010).

Xavier (2002:10) stated the United States Computer Science and Telecommunications Board defines broadband as a local access link whose performance is not a limiting factor in a user's capability for running today's applications. It would be noted that this definition is purely based on functionality as opposed to bandwidth. Users run different kinds of applications and their local access link should accord appreciable levels of performance that should result in the satisfaction of individual and business needs. Broadband's "always on" nature also promises significant economic and social benefits to its users and prompts the need to understand its efficient and affordable deployment.

Telecommunications technologies that are considered as "broadband" include Asymmetric Digital Subscriber Line(ADSL), Very High Bit-rate Digital Subscriber Line(VDSL), fiber optics, wireless, cable modem, mobile broadband (Universal Mobile Telecommunication System[UMTS], High Speed Packet Access [HSPA]) internet through the electric power transmission network and satellite internet.

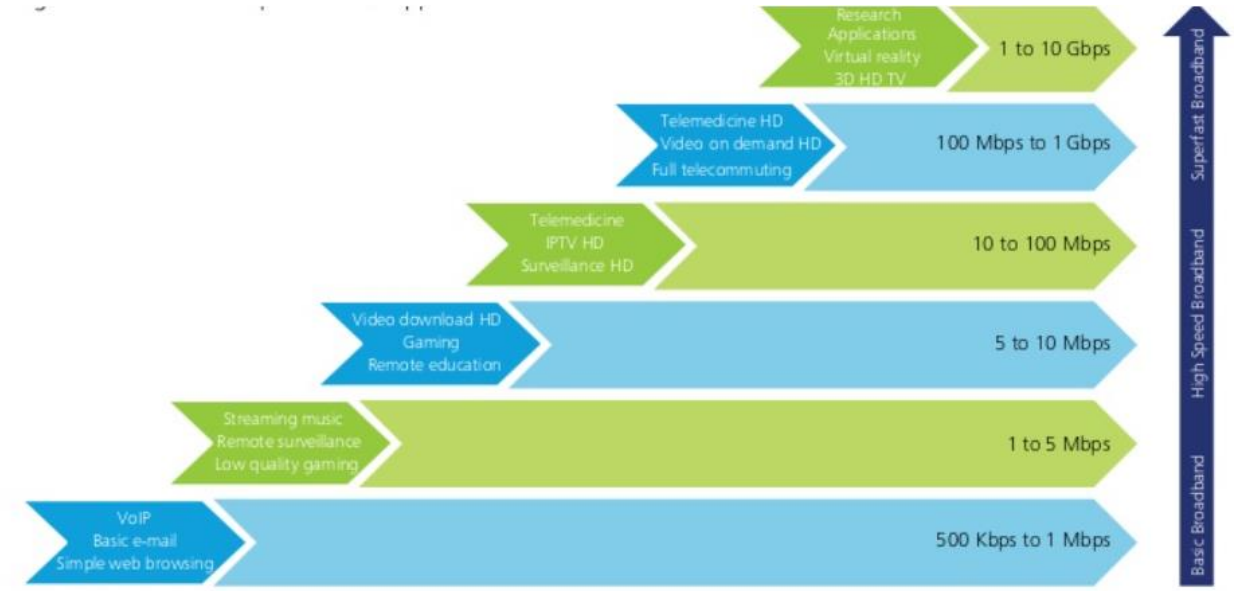
2.1 Bandwidth

According to Banda (2006) bandwidth is defined as the maximum quantity of information that a transmission link is capable of conveying. Channel capacity therefore determines the maximum

amount of telecommunications traffic that a network can accommodate and transfer at any one instant as well as their service quality.

Figure 1: Bandwidth requirement for applications[1]

[1] Deloitte (2014): Broadband, the lifeline of Digital India, www.deloitte.com/in



Above in figure 1 are the bandwidth requirements for different applications that run on client and server machines. Some applications require more bandwidth than others and hence the performance of the local loop should not be hindrance for such applications to run effectively to the satisfaction of the user. Low bandwidths introduce bottlenecks in the network which also results into quality of service. VoIP, basic mail and simple web browsing would only need 500 kbps to 1Mbps while telemedicine and video on demand requires a range from 100Mbps to 1Gbps as also illustrated in figure 1 above. The bandwidth demand of online applications has been increasing; for example, the average web- page size has grown 110 times since 1995 (King, 2012). As a result, residents of developing rural regions access the web with inadequate connectivity for the bandwidth requirements of modern content. These opposing trends in content growth and limited capacity render Internet access frustrating or even unusable in many developing areas (Du et al, 2011). The service provider may have the capacity to allocate as much bandwidth as the customer may need but this is usually limited by the customer's ability to pay.

2.2 Review of Zambia's Information and Communications Act of 2009

In the Information and Communications Act (2009) it is enshrined that the Communications Authority should continue to exist and be re-named as the Zambia Information and Communication Technology Authority; to make provision for the regulation of information and communication technology; to facilitate access to information and communication technologies; protect the rights and interests of service providers and consumers; repeal the Telecommunications Act, 1994, and the Radio Communications Act, 1994; and provide for matters connected with or incidental to the foregoing. In this act, not only does ZICTA have to look at regulation issues of the industry, but also the act mandates it to provide regulation which includes;

1. Economic regulation
2. Consumer protection
3. Technical regulation
4. Legal, and
5. Universal access.

Furthermore, the Authority inspects operators in order to ascertain that their licenses are operating within their agreed terms and conditions. In this act, ZICTA as an institution also mandated to facilitate access to information and communication technologies whilst protecting the rights and interests of both service providers and consumers for their mutual benefits. This can be evidenced from their involvement in the Universal Access Project where the Authority is spearheading the installation of BTS's in remote and undeserved areas.

According to Banda (2010), the act established an Advisory Committee unto which customers of telecommunication services can air their concerns, complaints and comments concerning the services that they may be receiving from their providers. Part VII of the Act provides for consumer affairs under which issues as such quality of service are highlighted and enforcement of procedures are prescribed.

The Act also focusses on the need to extend the provision of telecommunication services, throughout all urban and rural areas of Zambia, of such telecommunication services as satisfy all reasonable demands for them including, in particular, emergency services, public call box services, directory information services and maritime services (The Laws of Zambia Chapter 469, 1994: 6). All service providers need to comply with this requirement in their pursuit to meet customer needs.

2.3 The Necessity of Broadband

Despite the fact that web browsing, email messaging, audio streaming etc. could be achieved with use of narrowband connection, it should be noted that their performance can greatly be enhanced if broadband is employed. Broadband is characterized by high-speed, 'always on' connection and has greater capacity to support several applications which include e-commerce, education, health care, entertainment, and e-government. Through broadband, one is able to stream both audio and video content over the Internet at a much higher speed and quality as compared to narrow band. It also offers a unique platform on which service providers can have the ability to design, develop and deliver new content of software and technology. Not only new applications but also existing services can be accessed more easily and with convenience through broadband technologies (Xavier, 2002:11).

2.4 General Broadband Technologies

The broadband access infrastructure refers to that part of network where the provider connects the customer for the last mile. It is basically the interface between the last mile and the core. Different technologies are employed on the last mile depending the users' preferences and financial capabilities. Below are some of the technologies employed on the last mile for broadband connections.

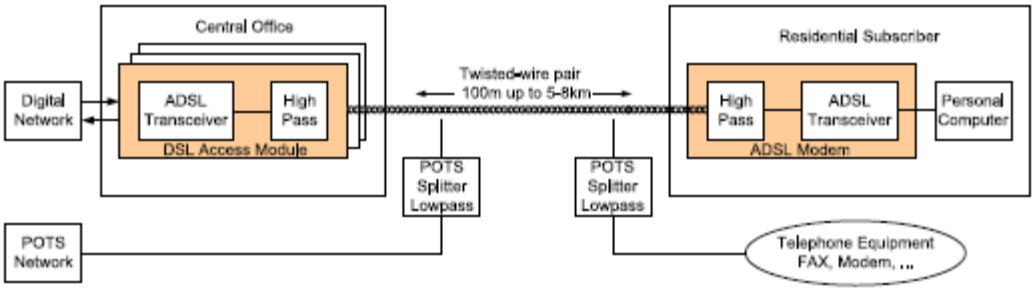
2.4.1 Asymmetric Digital Subscriber Line (ADSL)

This is a technology that enables faster download speeds using copper wires and makes use of frequencies that remain unused during a voice telephone call. The technology employs a splitter that is mounted at the customers' premises which filters or separates voice and data to enable them be transported over the same pair simultaneously (Reusens et al, 2001). The ADSL is designed to deliver more bandwidth downstream (that is to say from the central office to the customer premises) than upstream. The downstream rates range from 1.5 to 8Mbps, whereas upstream bandwidth ranges from 16 to 640 kbps. However, the technology only works well within a specified distance of 5,488 meters over a copper twisted pair and beyond that distance, the signal degrades and the service is unusable.

ADSL has the advantage of easy installation as it does not require highly skilled personnel to set it up at the customer premises. It is quite often to use a web based modem or wireless router which can easily be configured using a wizard.

Figure 2: A block diagram of ADSL access, with splitters, DSLAM, and POTS network[2]

[2] http://www.springer.com/978-3-642-34542-5



Zamtel introduced ADSL in 2006 after installing three DSLAMS in Lusaka and another one on the Copperbelt. However, the company could not cope with demand as the equipment could only take up a total of 100 customers a number that fell well below the number of potential customers that applied and needed the service. It was not until 2011 that the company finally invested in the Next Generation Network (NGN) and raised its ADSL customer base to 6000 by end of year 2013. It should be mentioned here that Zamtel is currently the only ADSL service provider in Zambia and has continued to enjoy the monopoly with the advantage of using an already set up copper cable network which is a hundred percent under their control.

None of the other players on the Zambian market are offering this remarkable broadband technology especially that it's only the incumbent that already has an existing copper cable network upon which the service rides. However, it should be noted here that during Dial-up deployment, Zamnet did use the Zamtel copper network to provide their service to its customers.

2.4.2 Very High Bit-rate Digital Subscriber Line (VDSL)

VDSL is much faster than ADSL and offers downstream rates up to 52Mbit/s and 16Mbit/s on the upstream. These speeds are achieved using copper wires and if coaxial cable is used, downstream and upstream speeds of up to 85Mbit/s.

Eriksson Per-Erik and Odenhammar Björn (2006) noted that the very high-speed digital subscriber line (VDSL) standard from ITU-T promises to deliver 100Mbps symmetrical traffic on short copper loops. The greater bandwidth of VDSL has since given telecommunications operators an extra ability to deliver advanced services such as multiple streams of interactive standard and high-definition IP Television over the already existing copper network infrastructure.

The technology demands that the service provider invests in a distributed network with smaller nodes that need to be strategically located less than 1.5 km away from end users.

2.4.3 Fibre Optics

Fibre Optic connections are also gradually becoming a common form of internet access especially in urban areas where providers have gone to the extent of rolling out Fiber to The Home (FTTH). This has been necessitated by the demand for higher bandwidth as todays' applications are becoming more and more dynamic with bandwidth intensive content.

Alwayn (2004) noted that ISP's use optical fiber in order to transmit Plain Old Telephone Service (POTS) and data across their countrywide networks. Optical fiber offers reliable voice, data and video transmission from a few meters to hundreds of kilometers whilst providing very high bandwidth. The fiber media does not suffer from electromagnetic interference and is suitable for interconnecting devices that may exhibit voltage variations on their terminals.

Zamtel has embarked on a country wide project to interconnect its local exchange centers to its national backbone via fiber. The company has also advanced in connecting most of its cabinets in Lusaka and Livingstone via fiber in an effort to increase internet speeds as customers will only have a few meters of copper cable to access the service. Liquid telecoms has also launched the FTTH project and has already began hooking up customers to their Gigabit Passive Optical Network (GPON). According to Lippis (2012), it was noted that GPON cuts down on floor space within an office and is able to lower electricity usage by 95% as compared to traditional copper networks.

Africonnect, a Vodacom group of companies and Zamnet, which offer broadband solutions, have also incorporated fiber connections to their Base Transceiver Stations (BTS) to enable them offer wireless broadband services to their clients. The most notable Optic Fiber Backbone which runs across much of the country with Interconnections to countries such as Namibia and Tanzania is owned and maintained by the Zambia Electricity and Supply Corporation (ZESCO). However, ZESCO only has a carrier of carriers' license and does not offer broadband services to individual customers. Hence it only offers interconnections for ISP's within and outside the Country.

Despite the benefits of broadband access through fiber being known and understood, Zambia has not yet done much in the deployment of fiber networks as compared to other countries. The Indian government for instance, has already taken keen interest to get the last mile of the country connected using one of its initiatives dubbed National Optic Fibre Network (Khedekar, 2013). India has demonstrated its commitment to strive for countrywide broadband connectivity through various government and private organizations. further noted the recent successful implementation of Google Fiber project in Kansas City of the United

States of America. The project has delivered very high Internet speeds of up to 1 gigabit per second, a development which has undoubtedly pushed the envelope for most of the ISPs in the United States of America (ibid 2013).

2.4.4 Wireless Technology

According to Odinma et al (2007), it was noted that there are a lot of driving factors that have been addressed and have led to the rapid and continuous change of the wireless networks worldwide. The aspect of mobility has been cited as a major driving factor for mobile broadband networks in that most of the mobile professionals have continued to demand real time remote access to their corporate networks and infrastructure from anywhere around the globe and at any time. Wireless aids access to data irrespective of the users' geographical point access and regardless of where the data is actually stored.

Amega-Selorm (2008) asserted that wireless networks are the most cost effective and affordable options for connectivity because developing countries would not need to spend a fortune of their scarce resources on building and installing broadband infrastructure. The very fact that there exist low-cost equipment and ones that can be made from local materials gives wireless networks an added advantage over competing last mile technologies. The technology may employ a non-licensed frequency band and the transmission media has no maintenance cost. The use of non-licensed frequency band implies that the operator does not need to seek prior approval and permission from the regular before deploying the wireless network. The service provider is only concerned about the Access Points and the customers' end equipment. This proves to be much cheaper and the service can easily be rolled out to many people within more reasonable time as opposed to other wired last mile implementations such copper and fiber.

Wireless networks have exhibited great value when it comes to internet and email access as it allows collaboration among professionals, colleagues and workmates that may located across wide spans of distances. Wireless networks support the idea of bandwidth sharing which could be a very scarce and expensive network commodity in most developing countries. Any given community may buy bandwidth which can then be shared to enable them access broadband services.

Quadratek (2013) observed that the increased mobility factor both enables and facilitates what is termed as Bring Your Own Device (BYOD) phenomenon, which most of the organizations and businesses are now taking advantage of. Electronic devices such as Laptops, Palmtops, Tablets, and Smartphones which are owned by individual members of staff are now being brought into the company premises and are being allowed to have access to the cooperate intranet via wireless network. As well, as making it more convenient for employees to carry out their tasks, BYOD also represents a potential cost saving, as businesses no longer have to fund the hardware cost of the devices themselves.

Ibid (2013) also noted that wireless connections promote a safe and healthy environment for employees as it drastically reduces the number of cables that may pause a danger of being stumbled upon. Nonetheless, strong encryption techniques should be employed in order to enhance the security of all nodes and servers on the wireless network. It should also be mentioned her that despite the slow speeds that wireless connections, most of the individual and Small to Medium Entrepreneurs (SME's) customers are able to carry their businesses sufficiently.

2.4.5 White Space Technology

This is a relatively new technology which has not yet received large scale of meaningful commercial deployments up to date. White space technology would operate using license-shared spectrum. The white space technology employs the unused spectrum in bands that are allocated to television broadcasting services, that is to say those chunks of spectrum which are normally reserved as buffers in between digital TV channels for the purpose of preventing interference or in geographic locations where the spectrum is not being utilized for broadcasting. A wide range of services and devices can be supported by opening up the white space spectrum and allow more wireless spectrum for data transmission (Global Internet Report, 2015).

According to Zennaro (2013), TV White Spaces (TVWS) technology has the potential to make connectivity both technically and economically feasible in rural Africa where affordable access has continued to be a challenge. The superior propagation characteristics of TVWS technology makes it particularly well suited to connecting remote communities. In a study that was conducted in Malawi and Zambia, it was revealed that most UHF spectrum is already available in urban and also in rural areas and could be used to provide broadband Internet connectivity to customers (ibis, 2013). The broadcast Infrastructure is only carrying TV signal without realizing its full capability of equally carrying the broadband service to customers.

2.4.6 Cable Modem

Cable modems have been designed to transparently transport data using a combination of Hybrid Fiber Coax (HFC) which in turn connects to different types of Data Networks. It also has the capability of filtering certain types of traffic such as LAN broadcasts, except for DHCP which is meant for host network configuration (Sabatino, 2000). The modem

provides data communication using radio frequencies in both directions and takes advantage of the available high bandwidth. The technology allows a customer to connect a Personal Computer to a local Cable TV and get data at 1.5Mbps and may even be integrated with a set top box that provides the TV set with channels for internet access. According to Rouse (2015), cable modems may either be internal or external that are furnished as part of the cable access service and are not purchased directly and installed by the subscriber. Ibid (2015) also reviewed that the actual bandwidth for Internet service over a cable TV line goes up to 27Mbps downstream to the subscriber and about 2.5Mbps of bandwidth for interactive upstream direction.

Even though Cable modem has a disadvantage of flapping whenever the link goes offline, it is one of the technologies that appears to be one of the most cost effective and practical method of delivering broadband service (Sabatino P, 2015). It should be mentioned here that in this era of Voice over IP (VoIP) technology, some Cable Modems have been made to integrate telephone service and the allow companies that offer TV service to also offer telephone service.

2.4.7 Mobile Broadband (Universal Mobile Telecommunication System (UMTS))

Brown (2015: 5) stated that Mobile phone service has now been made available to more than 90% of the world's population and has made a significant leap-frog in countries which lacked the fixed service in the past years. Mobile phone communication has also experienced tremendous adoption at a breathtaking rate. The process of upgrading networks to offer mobile Internet has been an incremental step that is globally being adopted faster than mobile telephony has ever been. The term mobile broadband has now become a marketing term to mean the access of internet services through portable devices such as Smart phones, Laptops

and Tablets. Nonetheless, despite the faster speeds that this technology offers, the cost of upgrading sites to 3G has remained quite high. Rao (2009) noted that the Universal Mobile Telecommunications System (UMTS) with its high speed packet access (HSPA) enhancements was deployed as the primary mobile broadband solution by most operators worldwide. In order to ensure consistent competitiveness of the Global System for Mobile Communications (GSM) family of technologies in the world market, the 3rd Generation Partnership Project (3GPP) was quickly standardizing the long term evolution (LTE) of UMTS, with notable performance enhancement targets as compared to HSPA. The technology has been deployed across the globe and is a fast moving broadband solution for many users. It has also been using the 225MHz to 375MHz frequency spectrum range. With voice revenues constantly being under pressure and mobile data use soaring, operators have been forced to evolve both their networks and their business models (http://www.ericsson.com/ourportfolio/telecom-operators/growth-codes?nav=marketcategory002).

According to Rysavy (2007), noted that there is no doubt that mobile broadband 3G technology will be able to sufficiently cater for both enterprise and individual consumers, as a very cost-effective and affordable option which can successfully compete with Asymmetric Digital Subscriber line (ADSL), for home use. The service can be offered to a big group of users by a single 3G Base Transceiver Station (BTS) within its coverage area. Ibid (2007) affirmed that 3G systems are capable of offering throughputs of about 1Mbps which is in the same line as compared to what many users normally experience with DSL or cable-modem service. However, it should be noted that the overall capacity of wireless systems is in general terms lower than it is with fixed wireline systems. Mobile broadband

supports voice, video and other data related services which may be on the prepaid or postpaid plan. In keeping up with the increasing range of broadband services, mobile phones have equally transformed from being mere talking devices in earlier generations to the current form where they are multimedia face to face communication tools (Banda, 2004).

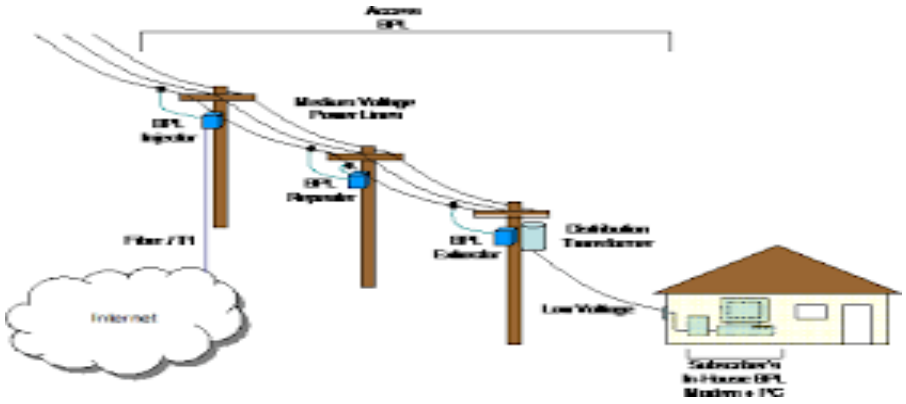
First, as with mobile telephony, the mobile Internet does not just liberate us from the constraints of a wired connection, but it offers hundreds of millions around the world their only, or primary, means of accessing the Internet. Second, the mobile Internet does not just extend the reach of the Internet as used on fixed connections, but it offers new functionality in combination with new portable smart devices (Global Internet Report, 2015:9).

The mobile Internet is of interest partly because it represents an evolution in the Internet. Where Internet access is largely independent of the Personal Computer, the operating system, and the browser. But also, many people still associate the mobile Internet with their smartphone or tablet; in turn, they associate their smart device with a specific platform, consisting of an operating system and app store; and they largely associate their usage with the apps that they have chosen (ibid, 2015:14).

2.4.8 Broadband on Power Line

This is a kind of connection which allows high speed digital data content to be transmitted over the public electricity power distribution lines. According to Woodford (2014), Broadband on Power Line (BPL) is a way of piping the broadband service into one's home or office and channeling it from one room to another using the standard electricity supply lines. BPL is also known as "Networking over the mains".

Figure 3: Power lines transmitting broadband[3]



Anatory and Theethayi (2010) noted that ICT's have made it possible that broadband services could now be used to bridge urban-rural areas in a more efficient and economic manner through the use of readily available and largely distributed power-line infrastructure. The transmission of a wide range of data service can be achieved by employing today's power line networks as transportation media. The usual services such as low speed data, energy information systems, and broadband services such as 'Last Mile', 'Last Meter' high-speed internet access and VOIP can be transmitted without the need for fiber optic cables as is the case with traditional telecommunication lines. Indoor applications such as digital entertainment systems can also ride on BPL.

Copperbelt Energy and ZESCO are Zambia's renowned power utility companies with their power line infrastructure spread around much of the Copperbelt and all over the rest of the Country respectively. However, it is surprising to note that despite having such distribution platforms, the two companies are not involved in the provision of broadband access to the final consumer and thereby making their infrastructure to be underutilized. It should also be

[3] http://www.cybertelecom.org

mentioned that the Zambian government has embarked on Rural Electrification project through the Rural Electrification Authority to connect the rural community to the National Hydro Power Grid in an effort to deliver development to such areas.

2.4.9 Satellite Internet

This is the access of internet through the use of geostationary satellite that offer high data speeds of even up to 50Mbps. Satellites are used to interconnect heterogeneous network segments and to provide ubiquitous direct Inter- net access to homes and businesses (Yurong Hu and Victor O. K. Li, 2001). Satellites are launched in the geosynchronous orbit about 36000km above the earth surface (precisely 35,786 km above the equator) and they appear to be stationary from a fixed reference point on the earth's surface as it rotates on its axis. The perimeter within which a satellite can offer communication services is referred to as the footprint of that particular satellite.

Ibid (2001) noted that a satellite communication system distinguished by its global coverage, inherent broadcast capability, bandwidth-on-demand flexibility, and the ability to support mobility, is a preferred candidate to provide broadband integrated Internet services to globally scattered users. In this regard, the technology would be ideal in sparsely populated places such as rural areas that lack terrestrial communication infrastructure.

2.5 Review of Universal Access Fund

According to Ladcomm (2013), Universal Service Funds (USF), also known as Universal Access and Service Funds (UASF) are funds that are intended to serve as a financial incentive for operators to provide universal service. These are the funds that are often used

in competitive markets to supplement market-based policies and in order to address access gaps and possible market failures in remote and under-served locations.

In an effort to foster accessibility to ICT's, RSA (2005:15) revealed that the Electronic Act makes provision for the application of Universal Service and Access Fund for the purpose of financing the construction or extension of electronic communications networks in underserviced areas. Owing to the fact that the private sector is not willing to invest in such areas especially because of their inability to generate enough return on investment, it is incumbent upon the State to find ways and means of lowering the entry costs for operators and make the rural markets a bit attractive. In Zambia, the Universal Access Fund is managed by ZICTA and provides funding to universal access projects across the country (SATNET, 2009). ZICTA had in 2008 raised more than 14 billion Kwacha (US$4 million) for rural information and communication technology to be used for the provision information and communication technology (ICT) services in rural areas. The money had been raised through service charges slapped on mobile-phone service providers and Internet service providers (ISPs) operating in the country by ZICTA (Malakata, 2008). The Authority has been mandated by the Telecommunications Act of 1994 to ensure the extension of telecommunication services across the whole country and the National ICT Policy of 2006 also further outlines the necessary direction concerning rural connectivity and the provision of access to ICT services (ibid, 2009).

With regard to the use of the Universal Access Fund, ZICTA has since developed an implementation road map which basically focuses on both ICT infrastructure development and accessibility as a model for the delivery of ICT services to rural and unserved areas of Zambia. Furthermore, the Authority provided for the formation of a Rural ICT Development

Fund which was meant to ensure that goals and objectives of the Universal Access are met accordingly.

The funding is sourced from licensed operators and other stakeholders and is used as a subsidy in the provision of ICT services in rural and underserved areas. According to SATNET (2009) the notable Universal Access projects that ZICTA has embarked upon in line with infrastructure development and accessibility of ICT services include the following but not limited to:

1. The installation of sharable infrastructure i.e. Communication Towers in rural and unserved areas throughout the country.
2. The creation of Points of Presence (POPs) for Internet Connectivity.
3. Financing the establishment of Multi-Purpose Community Tele-centers which meet the basic ICT needs for the local people in rural areas.
4. Public-Private Partnerships projects with NPDOs (Non Profit Distribution Organizations) to specifically spearhead the development of solutions with reference to particular ICT needs in rural areas.

ZICTA has been actively involved in the setting up of sharable infrastructure and had in 2011 set aside over USD 10 million from the Universal Access Funds for the installation of communication towers throughout Zambia. The Authority has also embarked upon setting up Multi-Purpose Community Telecentres (MCTs) in various rural outposts which are spread across the country in different chiefdoms (ibis 2009). The Universal Access funds have also been used in the provision of last mile optic fiber connections among the three public universities under the Zambia Education and Research Network (ZAMREN) project.

2.6 Review of Current Business Models

According to Casadesus-Masanell and Ricart (2009) business model refers to the logic of the firm, the way it operates and how it creates value for its stakeholders. In order to come up with workable business models, both fixed and mobile operators need to understand the needs of their customers so as to develop processes and products that meet such needs. Al-Debei and Avison (2010) also stated that a business model is an abstract representation of an organization. This may be conceptual, textual, and/or graphical, of all core interrelated architectural, co-operational, and financial arrangements designed and developed by an organization presently and in the future, as well all core products and/or services the organization offers, or is going to offer, based on the arrangements that are needed to achieve its strategic goals and objectives. Notably in this definition is that value proposition, value architecture, value finance, and value network portray the primary dimensions of business models. What business models have Broadband Service Providers (BSP) employed in order to remain afloat and evolve their revenue streams on the rural broadband market. Using business models, investors are able to quiz company executives on how they intend to make create value for their investment. This back-and-forth increases the odds that businesses will succeed, investors will make money, and everyone will learn more from their experiences (Forster et al, 2009).

However, not only should the focus be on the operator's business model, consideration should also be made to understand some of the model's that regulators employ in their pursuit to promote and attain universal access. Different companies may have different business plans for successful operation which clearly outlines the sources of revenue, the

target market, their product portfolio and details of how financing of the business is going to be achieved. Below is a review of some of the business model that are implemented.

2.6.1 Nonprofit / Public Utility Model

According to Luckert (2015) a nonprofit refers to an organization that is formed for the purpose of serving a public or mutual benefit rather than the pursuit or accumulation of owner or investor profit. In this way, community institutions are able to assist a low-income population by providing them with broadband internet service using a publicly owned network (Siefer, 2015). This model is often fully or partially implemented by municipal authorities in partnership with libraries, schools and shopping malls. It depicts a very convenient method for Internet access provision for specific areas. It also increases digital inclusion among all low income citizens and delivers to everyone the benefits of being connected to the global network. Productivity can be increased by allowing city officials such as police officers, immigration and fire fighters remote access to information via municipal broadband service.

However, it would be noted that this model would not be common amongst operators in that their primary aim is to make profit and increase share value for their investors. It only advantages the users by giving them an opportunity to be part of the world's largest communication platform upon which they are able to carry collaborate with others. In 2000, the Federal Communications Commission endorsed municipal broadband as a "best practice" for bringing broadband to underserved communities (FCC, 2000). This is simply because of the non-profit approach to the provision of broadband services to rural communities and the municipal's view of broadband as just one of the vital services which is expected in the public domain as opposed to being for a privileged few.

Nelson and Dam (2015) reported that in France, a law was passed in 2004 to allow local authorities act as telecom service providers. A sum of €2.1 billion which was sourced from public financing was invested in backhaul networks to service sparsely populated areas. Municipalities and even housing associations had already been investing in local access networks across Europe such that by December 2009, nearly 60 percent of FTTH/B projects across were being spearheaded by Municipalities, Utilities or Housing Associations. This meant that the incumbent and alternative telecom providers accounted for a total of 40% of the entire network (ibis, 2015).

A non-profit business is built on an underlying business model whose success indicators are measured by the positive social impact that the organization and its programs would have on the community. Sometimes non-profit organizations often struggle to scale up their businesses due to lack of adequate access to the growth capital. The income for nonprofit organizations is raised from donors and hence the nonprofits are expected to make use of their funding in such a manner that increases and prolongs user benefits to their targeted recipients. Contributors to nonprofit organizations are offered tax incentives by the government for the donations that are made for the wellbeing of the community (Ingram, 2015).

One factor contributing to this degree of advanced deployment is Iowa's legal environment, which has encouraged municipal involvement in the deployment of advanced telecommunications services. The state of Iowa actively has supported legislation and legal interpretations to overcome barriers that have restricted municipal entry into high-speed provision in some other states. As a result, there are now some thirty Iowa communities that provide facilities-based telecommunication services (FCC, 2000:61).

2.6.2 For-Profit Business Model

In this model, a Broadband Service Provider constructs the fundamental broadband infrastructure such as trenches, conduits, aerial cables and Provider Edge and Access equipment with the intention of making profit based on the predetermined internet needs of potential customers. According to Ingram (2015), for-profit companies are generally founded to generate income for entrepreneurs and their employees and offer products and services that are valued according to the market forces. The profits acrued from these proceeds are then shared amongst the Shareholders, the Employees, and the Company itself. Companies using the for-profit model depend on the cash and recievables realised from sales revenue which are nomally subjected to taxes based on the prevailing fiscal policy.

Lenders and suppliers may provide credit fascilities to profit organization and this arrangement finances their operations.

2.6.3 Hybrid Model

According to Battilana et al (2012) a Hybrid model refers to a business model that uses product sales to fund its social mission and thereby reducing dependence on donations, grants, and subsidies that are also needed to scale up the organization and its operations. It combines the social welfare logic of a nonprofit and the commercial logic of a for-profit business entity. A Broadband Service Provider can implement a hybrid model that produces both social value as well as tangible commercial revenue through a single and unified management strategy. In this regard, the service provider aims to attain a self-sustaining approach to broadband service provision by embracing the strengths of both for-profit and nonprofit models and also suppressing as much as possible their associated weaknesses.

However, the hybrid model has the disadvantage of not being able to attract as much investment as compared to the for-profit model in that venture capitalists may not show interest because of the charity component in the model. The model portrays the ability to effect positive social and environmental change and employs a blur boundary between for-profit and nonprofit worlds (Haigh and Hoffman, 2012).

2.6.4 Passive-Layer Open Model (PLOM)

Mattson et al (2014:28) stated that in this model, an entity (e.g. a local cooperative, or a private investor) builds and operates passive infrastructure to be made available to all market actors under fair and non-discriminatory conditions. The passive layer includes the ducts, hand-holes, manholes and fiber or copper network that spans across a municipal or a city. The Private Investor owns and maintains the network whilst allowing Broadband Competitors to deploy active equipment in the access nodes of the areas where they intend to give service to.

The private investor who in this case is the Physical Infrastructure Provider (PIP) is responsible for designing, building and operation of the passive layer infrastructure. When each operator constructs its own fiber network, there is often duplication of fiber infrastructure on some routes while there is lack of access to fiber infrastructure in other areas (NCC, 2013). The constructed passive layer can then rent out to operators on a client-by-client basis (ibis, 2013).

2.6.5 Active-Layer Open Model (ALOM)

OEDC (2015) describes an ALOM as a model in which an entity deploys and operates the passive and active layer, placing active equipment in all access nodes and builds an open, operator neutral network over which all service providers can deliver their services to end

users The active equipment essentially implements the technology and establishes the platform upon which the services are delivered.

The active layer will comprise of routers, switches, control and management servers. In this model, an entity provides both the passive and active infrastructure and the digital service is provided by the other entities to whom the active layer has indiscriminately been availed (ibis, 2015). Additionally, the passive/active layers are used by operators to troubleshoot and measure their network performance (Mohan et al, 2011).

2.6.6 Vertically integrated model

Sadowski and Nucciarelli (2008) describe Vertical Integration Model as a model in which the network owner also acts as a service provider. In this model, a broadband provider expands its business operations into different steps on the same production path, such as when a manufacturer owns its supplier and/or distributor. The provider basically consolidates various steps and performs tasks that are usually undertaken by wholesalers and traders by controlling the supply chain up to the end user.

Kokemuller (2016) noted that the main advantage sought by companies that get into vertical integration is more control over the value chain. When retailers decide to acquire or develop a manufacturing business, they get more control over the production part of the distribution process. The model allows the firms to have access to information along different points within the supply chain and also across different markets that would otherwise not be easily available to them.

2.7 The Digital Divide

This refers to an economic and social inequality a given group of people in their access to, or knowledge of information and communication technologies. It signifies the technological gap that exists between the developed and non-developed communities or countries. It clearly shows the contrasts that exist between those who have access to the information technologies and those who do not have. The digital divide manifests itself between countries and also exists within countries creating a gap between those who have access to broadband and those who do not have access. Bridges.org reports that domestic divides tends to manifest themselves in ICT in terms of education, income, race, gender, age, language, and also disability (Bridges.org, 2001, p. 25)

2.7.1 Population of Chongwe District

CSO (2010), revealed that between 2000 and 2010, the overall population in Zambia grew by 2.8%. The population in the rural and urban areas grew at 2.1 and 4.2 percent per annum, respectively.

Table 1: Population Density by District, Lusaka Province, 2010[4]

District	Total Population	Land Area (km^2)	Number of Persons per Square Km
Lusaka Province Total	**2,191,225**	**21,896**	**100.1**
Chongwe	192,303	8,669	22.2
Kafue	227,466	9,396	24.2
Luangwa	24,304	3,471	7.0
Lusaka	1,747,152	360	4,853.2

As can be seen from table 1 above, the total population of Chongwe is 192,303 according to the 2010 census. The district covers a total of 8669 km^2 of land with 22.2 number of persons

[4] Source: 2010 Census of Population and Housing

per square kilometer. This represents 8.8% of the total population of Lusaka province. Lusaka province is most densely populated province in Zambia owing to its share of industries and the opportunities of both trade and career development that it offers. The other two districts in the province Kafue and Luangwa account for a population of 227, 466 and 24, 304 respectively. The population growth of Lusaka city has also been largely affected by its being the country's capital city and having all government ministries and departments.

2.8 Review of Broadband Market

2.8.1 Review of the Broadband Global Market

The global proportion of people using the Internet rose to 38.1% of the global population in 2013, up from 23.2% in 2008, which represented a Compound Annual Growth Rate (CAGR) of 10% over the period. The report also further revealed a global base of Internet users of 2.7 billion in 2013, and the ITU predicted almost 2.9 billion users by the end of 2014, meaning that 3 billion users was likely to have been surpassed in May 2015 (ISOC, 2015).

Table 2: World internet usage[5]

World Regions	Population (2015 Est.)	Internet Users Dec. 31, 2000	Internet Users Latest Data	Penetration (% Population)	Growth 2000-2015	Users % of Table
Africa	1,158,355,663	4,514,400	327,145,889	28.2 %	7,146.7%	9.8 %
Asia	4,032,466,882	114,304,000	1,611,048,215	40.0 %	1,309.4%	48.1 %
Europe	821,555,904	105,096,093	604,147,280	73.5 %	474.9%	18.1 %
Middle East	236,137,235	3,284,800	123,172,132	52.2 %	3,649.8%	3.7 %
North America	357,178,284	108,096,800	313,867,363	87.9 %	190.4%	9.4 %
Latin America	617,049,712	18,068,919	339,251,363	55.0 %	1,777.5%	10.1 %
Australia	37,157,120	7,620,480	27,200,530	73.2 %	256.9%	0.8 %
WORLD TOTAL	7,259,900,800	360,985,492	3,345,832,772	46.1 %	826.9%	100.0 %

[5] Source: http://www.internetworldstats.com/stats.htm

According to the November internet usage statistics report, it has revealed that Internet Users Latest Data has already hit as high as 3,345,832,772 representing a growth of 826.9% since year 2000. Asia recorded the highest number of internet users of 1,611,048,215. From table 2, it is also noted that the population of the Asian region currently stands at 4,032,466,882 and may be greatly contributing to the high number of users. However, it should be noted that in terms of internet penetration North America has continued to lead with 87.9% which also represents a growth 190.4% between year 2000 and 2015. Africa has the lowest penetration of 28.2 % which corresponds to a growth rate of 7,146.7% between year 2000 and 2015.

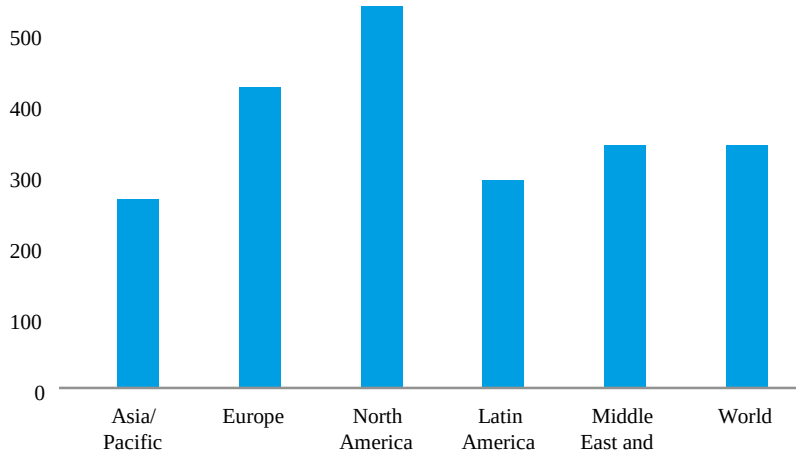
2.8.2 Review of the Smartphone Global Market

The smart phone is one of the popular devices that most people use for internet access. Smartphones combine Internet access and telephony in a pocket-sized form. Its support for mobility and portability makes it more preferred as compared to its competitors. The Analysys Mason forecasts reveal that while the total number of smart devices handset shipments continue to grow, there has been a change in handset technology, with smartphones making up the majority of mobile handsets shipped since September 2013 globally, and even in developing countries since September 2014 (ISOC, 2015).

The difference between smartphone and non-smartphone handset shipments is expected to increase, with shipments of smartphones forecast to reach 1.67 billion in 2018 at which point other handset shipments will stand at only 0.47 billion (ibid, 2015). This expected increase will be facilitated by the deployment 3G and LTE which some of the operators have already embarked upon. The smart phone exhibits the features of a Personal Computer, with added advanced multimedia capabilities and also allows the customer consumer to install on it

third-party software of the customer preference. Clark (2015) stated that "everyone wants a smartphone, everyone wants to be on social networks, and the prospects for market development are immense."

Figure 4: Smartphone prices in different parts of the world[6]



Globally, the average selling price for smartphone was USD 337 in 2013. This price fail from USD 387 according to 2012 pricing list. This represents a reduction of 12 % and the number of high-end smartphone users is expected to grow in geographic areas such as America and Europe (ISOC, 2015). It is hoped that the reduction will continue to be significant so that it results into affordability of the commodity to a wider section society especially those in rural areas. Such handsets can still give smartphone experience such as the camera, the applications, and the processing speed.

A forecast by the research firm IDC indicates smartphone sales of 1.5 billion units in 2015, a rise of 12.2 percent from the current year's estimate. That would mean growth falling by more than half from the 26 percent pace of 2014. Significantly, smartphone prices are likely

[6] Source: Global Internet Report 2015

to drop from an average selling price of $297 in 2014 to $241 by 2018. Emerging markets like India will see much lower smartphone prices $135 in 2014 and $102 by 2018 (IDC Research, 2014).

2.8.3 National Information and Communication Technology Policy

Linknet (2011) reported that on March 28th, 2007, Zambia launched the National Information and Communication Technology Policy. The document outlines various guidelines for the sustainable development and steady growth of the sector. The Policy mainly focuses on issues of competition and convergence of various technologies and Services. In this document, the GRZ intends to transform the country into an Information and knowledge-based society and economy that would be greatly supported by the continued development and pervasive access to ICTs by all citizens by the year 2030. This also similar to the Lisbon strategy whose aim was to make the European Union "the most dynamic and competitive knowledge-based economy in the world" by the year 2010. At the mid-term review of the Lisbon strategy, the European Commission and the European Parliament simplified and refocused the Lisbon agenda on the creation of growth and jobs in a future-oriented European knowledge society (Fornefeld et al, 2008). The National Information and Communication Technology Policy was re-launched in 2005 and refocused on the creation of growth and jobs (ZICTA, 2014). Nonetheless, there also remains need to assess the implementation of this policy and the impact that it has had on the availability, accessibility and affordability of broadband services especially in rural Zambia.

Following this launch, efforts have been and continue to be made by various stake holders to develop Zambia's ICT sector. The country has since gained access to the international submarine Fibre Optic Cables in a bid to significantly make broadband services more

accessible and affordable (Bude, 2013). The three mobile operators Airtel, Zamtel and Mobile Telephone Network (MTN) have already rolled out their 3rd Generation (3G) and in selected instances Long Term Evolution (LTE) (or 4th Generation, 4G). These technological advancements in the Mobile Communications sector are therefore expected to spark meaningful access to broadband communication across the whole country. It should be mentioned here that ZICTA has also embarked on a rural Base Transceiver Stations (BTS) project to extend mobile and ICT services to rural areas not reached by the operators. It has targeted chiefdoms and is installing Towers upon which operators can freely install antennas to service the surrounding communities. This project is meant to promote Universal Access and reduces the operator's overall cost of extending ICT services to rural and undeserved areas.

2.8.4 Review of Zambia's Fixed Broadband Market

Fixed broadband is the high speed data transmission which involves the use of DSL, T1 or Fiber Optic between the service provider the customer.

Table 3: Fixed Broadband Internet Subscriptions from 2005 – 2015[7]

[7] http://www.zicta.zm/index.php?option=com_content&view=article&id=58&Itemid=56

Year	Subscribers'000	Subscribers Per 100 Inhabitants
05	11	0.10
06	12	0.10
07	18	0.15
08	18	0.15
09	18	0.14
10	10	0.08
11	20	0.14
12	16	0.11
13	18	0.14
14	29	0.19
15-Q1	33	0.21

In Zambia, there are only two most prominent service providers when it comes to fixed broadband via fiber optics and these are CEC Liquid telecoms and Zamtel. Currently Zambia's fixed broadband customer base stands at 33000 subscriptions as shown in the table 1 below. These statistics were obtained by ZICTA at end of quarter 1 in 2015. It can be noticed from table 1 that fixed broadband market had stagnated between 2007 and 2009 at 18000 subscriptions and a drop to 10000 was recorded in 2010. However, between 2005 and end of quarter 1 2015, the subscriptions registered a growth of 66%.

2.8.5 Review of Zambia's Mobile Broadband Market

Zambia's mobile broadband market is currently estimated at 4,315,056 subscribers across all networks. The deployment of 3G BTS's has mainly been concentrated in densely populated areas along the line of rail and hence making it difficult to for the majority of rural settlers to access broadband services using this technology.

Table 4: Mobile Internet Users[8]

Year	Users	Penetration
2011	379,888	3
2012	2,314,983	16
2013	2,517,132	17
2014	3,741,615	24
15-Q1	4,315,056	28

As can be seen in table 2 above, Zambia's mobile internet market has grown from 379 888 subscribers in 2011 to 4 315 056 subscribers at the end of quarter 1 in 2015. Its penetration rate currently stands at 28%. Third Generation (3G) mobile broadband services have been launched and national fiber networks are being rolled out by four different service providers. The first commercial LTE network launches have been undertaken, which has dramatically increased the number of mobile broadband subscribers in the country (Budde, 2015).

2.8.6 The Economic Value of Broadband

Broadband has been able to change economies for several countries around the world. Its impact can easily be noticed and a country like Zambia can equally tap and excel in similar benefits if broadband market growth was to be enhanced. The user experience that it offers can easily be employed in terms of reducing business operational costs that tend to escalate as a result of its unavailability. According to Macharia (2013) these include e-learning which is enabling long distance learning for students, e-health which is enabling new ways for doctors to communicate, e-government which is changing the way government interacts with

[8] Source: http://www.zicta.zm/index.php?option=com_content&view=article&id=58&Itemid=56

the public. All these applications have been made possible not only by broadband infrastructure but also by access to affordable broadband services.

Broadband is a key economic growth driver "for developing countries in the low and middle income" brackets (Budde, 2011: 6). Zambia being a developing country in the low income brackets is therefore the likely candidate to undertake such technological implementations. The implications for broadband are enormous with an international estimate of 1.3% additional growth that was experienced in 70 different countries with the national gross domestic product (GDP) for every 10% increase in broadband penetration (Budde, 2010). Notably, broadband can drastically transform the health sector through its ability to facilitate remote diagnosis for Medics. El- Darwiche et al (2011:11) wrote about the critical role that broadband plays in the provision of e-health services at reasonably reduced costs and also suggested that the U.S. patient monitoring market including home tele-health and hospital wireless telemetry monitoring segments will reach nearly $ 4 billion by 2017.

Table 5: Impact of Broadband on Employment[9]

Macro effects	Specific impact	Description	Sectoral impact
Construction effects	Direct jobs	Employment generated in the short term in the course of deployment of network facilities	- Telecommunications technicians - Construction workers - Civil and RF engineers
	Indirect jobs	Employment generated in the short term in industries supplying inputs to network deployment sectors	- Metal products workers - Electrical equipment workers - Professional services
	Induced jobs	Employment created by household spending based on	- Consumer durables - Retail trade - Consumer services

[9] Source: Broadband Strategies Toolkit

Macro effects	Specific impact	Description	Sectoral impact
		the income earned from the direct and indirect effects	
Network externalities	Productivity	Improvement of productivity as a result of the adoption of more efficient business processes enabled by broadband	- Marketing of excess inventories - Optimization of supply chains
	Innovation	Acceleration of innovation resulting from the introduction of new broadband-enabled applications and services	- New applications and services (telemedicine, Internet search, e-commerce, online education, VOD and social networking) - New forms of commerce and financial intermediation
	Outsourcing	Attract employment from other regions as a result of the ability to process information and provide services remotely	- Outsourcing of services - Virtual call centers - Core economic development clusters

With even a limited number of medics, government's aim of providing affordable health care for its citizens can easily be archived through broadband. This is so because the few medics can attend to more patients that may even be in rural areas if broadband connections are made available.

The agricultural sector is composed of different activities that range from production to marketing, broadband can play a critical role in the dissemination of information amongst all stake holders. El- Darwiche et al (2011) also pointed out that farmers in the agricultural communities can benefit from broadband which can be used as a medium to share information that relate to weather forecast and promptly getting up to date information on market prices for crops and animals. He furthermore argued that this brings about the

benefits of removing the middleman from the chain of production and creates market information asymmetry. The removal of these middlemen also results in the maximization of profits by the farmers.

Broadband adoption is also a cost saving measure for organizations and appreciably raise both their productivity and efficiency levels. Qiang et al (2009) stated that the ability of an organization to put together its strategies is important and when fully absorbed, broadband drives intensive, productive uses of information and communication technology (ICT) and online applications and services making it possible to improve processes, introduce new models structures, drive innovation and drive business links.

Tim et al (2009) also suggested that broadband is increasingly the primary mechanism for accessing information. Information is a public good which is necessary for all forms of economic activity and good governance. Broadband provides access to new technologies, which enable organizations to explore new business opportunities, access customers and obtain information about market prices. Easy and affordable access to information makes markets to operate in a more efficient manner and raises the income of producers. Ready access to information about the performance of government and politicians helps improve government accountability and improves quality of service provision.

Darwiche et al (2011) also highlights the role that broadband plays in e-government by highlighting a study by the European Union which indicated that if the government moved to electronic invoicing the European tax payers could save more than € 15 billion (US$20 billion). According to the U.S. Department of Commerce (2002) revealed that broadband represents the next phase in the evolution of the Internet and experts also predicted that broadband will enable applications and services that transform our economy and its

accessibility will significantly impact the global competitiveness of nations and businesses in the future."

2.9 Case Review

2.9.1 The Case of Australia

Australia's National Broadband Network (NBN) project, through a combination of major governmental investment in infrastructure supported by strong Government policies, aims to connect all Australian households and businesses to a high–speed broadband network. This is a vital component of Australia's National Digital Economy Strategy and it is aimed at transforming Australia into one of the world's top five digital economies by 2020 (Dias, 2012). The government of Australia has not just ended at formulating the policy but has gone further into the provisioning of infrastructural investment that would make the implementation of this policy a reality. It is a commitment that is addressing both profitable and non-profitable areas alike and aims to deliver a minimum download speed of 12Mbps with a standard entry level price. The Australian government has taken a practical approach towards setting the National direction for broadband and also being able to participate in solving the challenges that would arise in the implementation process with regard to infrastructural investment. One other interesting thing is that the government has set a benchmark in terms of the minimum download speed that this project is expected to deliver. This is important because broadband cannot be broadband if the performance of the local access loop continues to hinder the user from running today's applications. A minimum speed of 12Mbps can suffice for broadband connectivity.

It should also be mentioned here that government is a better placed institution to embark on rural broadband access infrastructural deployment as it does not necessarily seek to make

profit but simply commits itself to narrow the digital divide as much as possible. Rural and undeserved areas need to be exposed to the same technologies if access to information is to be enhanced in every part of our society. The NBN is an all-inclusive approach to see to it that even the marginalized and non-profitable areas are covered within the project. Upon completion, it is expected ninety–three percent of the population will be served by the nation–wide fiber optic network and the remainder shall be served by wireless and satellite technologies. It is estimated that 70 percent of premises in regional Australia will have access to the faster, wired fiber optic service and the NBN is also expected to be completed by 2015 at an estimated total cost of over 35 billion Australian Dollars (ibis, 2012).

Deloitte (2015:9) alluded that the National Broadband Network has been a huge success in Australia in bridging the digital divide. Because of mobile broadband the economy has grown by an extra 0.28% every year since 2007. Australia's GDP was $33.8 billion larger by the end of 2013 than it would have been without mobile broadband representing a 2.28% growth.

2.9.2 The Case of Switzerland

Swisscom, the incumbent telecommunications carrier acquired 32% of Cablecom, the largest cable operator in 1995 with over half of all its subscribers. In 1998, despite the opposition of Swisscom, Cablecom begun to build its own broadband network. In 1999, Swisscom sold its stake in Cablecom and started providing its own DSL services in 2000 (Ismail and Wu, 2003).

The country of Switzerland has a total number of 6.8 million subscribers and is ranked 49th in the world. It has a higher penetration rate of 85.2% of its population already connected to broadband subdivided as 3.3 million mobile and 3.3 million fixed respectively (ITU, 2013).

The country has enjoyed extensive roll out of broadband infrastructure that has led to wide adoption of broadband services from which developing countries can learn.

2.9.3 The Case of Mauritius

ITU (2012) reported that the Government of Mauritius has been at the forefront in driving ICT access and use at all levels of society and has also implemented a number of ICT projects with a two-fold approach in terms of infrastructural deployment and take-up of services. These initiatives were defined in 1989 within the context of a long-term strategy of promoting ICTs and their use within Mauritius.

This development demonstrates the political will from the government of Mauritius to deal with challenges relating to broadband access. Through the Information and Communication Technology Authority which regulates ICTs in Mauritius, the Government ensures that broadband services are reasonably accessible at affordable rates nationwide. It has also demanded performance standards that are practically able to meet the social, educational, industrial, commercial and other needs of Mauritius (ibis, 2012).

O'Neill (2012) revealed that in Mauritius, broadband is part of the bigger plan to create a Cyber Island and make ICT into a "fifth sector" of the national economy. The Island recorded an Internet Population Penetration Rate of 78.18% as of June 2016. The government recognizes the Internet as a fundamental right for all citizens.

2.9.4 The Case of Kenya

Mayton (2015) reported that Microsoft will connect rural residents in Nanyuki, a market town in Laikipia County in central Kenya, with low-cost wireless Internet in a move that aims to deliver affordable Internet service to under-served regions of the country. The Internet service is made possible by utilizing TV White Spaces.

Scanell (2011) noted that since 2007, Kenya had been experiencing a significant influx of new, cheaper low- to mid-range phones to the market. Broadband subscriptions increased remarkably by 36.7 per cent during the fourth quarter to reach 10.8 million subscriptions up from 7.9 million subscriptions recorded in the preceding quarter. This resulted to broadband penetration level of 24.5 per cent. The increase in broadband subscriptions is attributed to high uptake of Internet enabled mobile phones that are affordable and readily available in the market (CA, 2016)

2.10 Broadband and Rural Development

Cloke (1990) stated that being rural is measured by an index which is derived from statistical analysis of diverse variables such as population density, migration, employment, housing condition, land use and remoteness. The rural areas are usually characterized by the extensive use of land with regard to agriculture and forestry. It also exhibits low population density, high involvement in primary industries and low commuting for employment. It is basically the population living in those districts and municipalities that are not within the commuting zone of larger urban centers.

According to Sinkondyobwe (2012), it was noted that it was quite comforting that some rural parts of Zambia are a society which thirsts for knowledge and desire to improve their daily lives. Internet connectivity was a very rare service in most rural parts of Zambia and the situation was worsened by lack of infrastructure, electricity supply, and the high cost of internet charges, illiteracy, and lack of awareness. The country's telecommunication companies have continued to gradually spread out the main cities providing both voice and data services. However, the pace at which this development is taking place in rural areas remains a matter of concern. World Bank (1975) views rural development as a strategy that

enables a specific group of people mainly men and women to gain for themselves and their children a more of what they need. It involves helping the poorest among those who seek a livelihood in rural areas to demand and control more of their benefits to development. The group includes small scale farmers, tenants and the landless. In other words, there are conditions that surround the rural population whose transformation is of great concern to what is herein termed as development. Governments in most part of the world are also recognizing the importance of residential broadband in driving economic and social growth of their nations (Gharakheili and Sivaraman, 2013:27)

While there has been an explosion of broadband growth and innovations being experienced globally, developing countries continue to lag behind and the digital divide continues to be a barrier to the economic growth and social development of these countries. As disparity continues to stand between regions in internet usage, the ITU estimates the Internet user penetration to be eight times higher in Europe than in Africa with the EU countries and North America contributing to half of the global subscriptions while South Asia and Southern Africa contribute to less than 3 percent of the subscriptions (Kim, Kelly, & Raja, 2010, p. 2).There is need to understand whether or not the advent of broadband could unlock development in rural settlements and further contribute to poverty reduction in rural areas. Kozma (2012) noted that Information, communication, and technology plays a unique role in the social and economic development of rural areas. Ibid (2012) also stated that information is the raw intellectual material that supports development. Communication is the social, interpersonal process by which information is transferred, exchanged, and disseminated. Technology is the means to extend human capability and support these processes. Broadband has largely supported small office home office kind of work where

members of staff do not necessarily need to physically report for work, but can remotely log onto the corporate network and do the same work that one would do when physically present in his or her office. This has enabled staff that may be physically challenged and whose work premises may not support their needs to simply work from the comfort of their homes. Much of the work related tasks are now accessible online, and those particular employees without access to broadband Internet may not be in a position to complete their work up to company's expectation. By encouraging its adoption, broadband helps to improve delivery of government services in rural areas and also establish a strong relationship between policymakers and rural settlements by fostering better citizen engagement. Cities in the United States of America are increasing their residents' use of broadband by bridging the digital gap, providing government services, and facilitating transparency of information to the public (Bates, 2012:7).

2.11 Broadband and Adoption

Allowing content, applications and services which are relevant and innovative to customers would be very helpful in driving the demand for broadband and also aid in creating a vibrant broadband ecosystem (Kelly & Rossotto, 2011:18). Like any other product and service, broadband internet access needs to be marketed in order to foster adoption among potential users. The demand drivers need to appeal and remain attractive to the customer or adoption too much. This entails the need to educate the general public in all sectors of society to make them be aware of the benefits and the security concerns that broadband may bring forth. Kottler (2011) defines marketing as the management process where goods and services move from concept to the customer or the process through which consumer value is created into goods or services. The potential adopters must perceive the economic, social, and political

advantages of adopting broadband service. Largely an awareness issue, this component affects many different populations that find themselves on the disadvantaged side of the digital divide. It presents challenges for policymakers, technologists, and other stakeholders, because "perceived utility" is a difficult metric to quantify and target for demographic groups in a community (Bates et al, 2012). However, it would also be helpful to understand the factors that contribute to the non-adoption of broadband services. This would help in understanding why non-adoption would still exist in the event where barriers to service availability have been overcome.

A study by Dutz et al (2009:4) revealed that consumers receive more benefits from the use of broadband and that it is increasingly an everyday necessity in today's world. One of the benefits that broadband users enjoy is the ability to facilitate direct access to global markets irrespective of the user's location. Buhalis and Main (1998: 201) actually predicted that the internet is particularly suited to small business, where it enables them to keep doors open 24 hours a day, at a minimal cost to customers all over the world.

2.12 Chapter Summary

This chapter has analyzed some of the literature on broadband access technologies and further reviewed Zambia's Information and Communications Act of 2009. It also reviewed how the Universal Access Fund is being used to finance infrastructural roll and facilitate access to ICTs in rural areas. The chapter reviewed some of the business models that are being used by operators in their delivery of broadband services to their customers. It further analyzed specific cases of developed and developing countries in relation to how they have fared concerning broadband infrastructural deployment and market development.

CHAPTER 3

3.0 Research Methodology

The methodology that was used through this research work was essentially an examination through literature searches and the analysis of data collected from the field through questionnaires and interviews. The data sources did contribute to the objectives resulting in conclusions and recommendations being drawn from the critical analysis of the collected of data.

3.1 Research Approach and design

The mixed method approach was employed during the research in order to get the benefits of both qualitative and quantitative research designs. The research used both primary and secondary data sources and it involved the collecting of data with the use of self-administered questionnaires. The questionnaire was designed with reference to the literature reviewed on Broadband Market Development. The respondents were asked to answer the omitted questions upon checking for completeness of the questionnaires.

The respondents among the broadband customers were the primary sources of data while the published and unpublished books and articles formed the secondary data sources. The secondary data sources were analyzed based on the facts that were presented in various articles and books that have covered similar topics. One hundred structured questionnaires were circulated to the randomly selected customers and face to face interviews were conducted with some employees of organizations such as the Zamtel, Airtel, MTN, ZICTA and the Ministry of Works Communications and Transport.

3.2 Research settling

The research settling refers to the place where data was collected from. The non-experimental research design was implemented because the research was conducted in an uncontrolled and natural setting of business life. It involved randomization. Probability sampling design and the stratified random sampling method were used because the population was spread in different parts of Chongwe.

It should be mentioned here that for more accurate results, the disproportion stratified sampling was used. This is because it looks at a population on a "50-50" basis and the procedure accurately estimated the general perceptions and experiences of the entire population.

3.3 The Study Population and Sample (The sampling criteria)

Population in this case refers to the total number of respondents that were selected to participate in this study. The population comprised of internet subscribers, employees of Zamtel, Airtel, MTN ZICTA and Ministry of Works Communications and Transport. The total number of people in this particular study was 150. And out of the hundred respondents, 70 questionnaires were circulated to individuals and the other 30 was circulated to the selected employees of targeted companies and organizations.

3.4 Instrumentation

The instruments that were used in the collection of data included a self-administered questionnaire, flush discs, internet, cell phone, pen and notebook.

3.5 Data Collection (Data Collection instrument, Data Collection procedure)

The collection of data was achieved through self-administered questionnaire, removable discs, internet, cell phone, pen and notebook:

a) The questionnaire was quite convenient to both the respondents and the researcher.

b) The respondents were free to answer the questions at their own convenient time.

c) The questionnaire allowed a small amount of time on the part of the researcher and provided consistency in the manner and standard that questions were asked.

The questionnaires were personally given to the randomly selected respondents and collected after being completed.

3.6 Pretesting the questionnaire

Grimm (2010) stated that pretesting is a very important step in survey research as it ensures that all kinds of errors associated with survey research are reduced. It helped the researcher to see if the respondents understood the questions or not whist also giving a rough idea as to how long each respondent could take to answer the questionnaire. This was achieved by randomly selecting a small number of respondents from the target population and having them to fill out the questionnaire during the arranged short sessions. The respondents were able to state which questions were not clear and this helped to improve the quality of the collected data significantly.

3.7 Ethical Consideration

Resnik et al. (2011) noted that research ethics promote a variety of other important social values such social responsibility, human rights, compliance with the law and health and

safety. In this study, the fundamental ethical principles were upheld in order to reflect an honest attempt to accurately show the results without being biased. It was also intended to show valuable results that were observed in an ethically conducive and acceptable natural broadband business environment. In this research work it was noted that some of the information received from the respondents was critical to the image of the organizations that they represented and hence the need to maintain confidentiality. The respondents still maintained their right to withhold sensitive information if they saw it necessary.

3.8 Data Analysis

Statistical Program for Social Sciences (SPSS) package was employed in the research in order to aid in the analysis and interpretation of data. This software did make it easier to analyze the various variables and also facilitated the presentation of information in the form of bar chart, and percentages. The program was preferred because:

- It is user friendly.
- The researcher has had some knowledge on how to use the package.
- It has enough memory capacity for a long range of numbers.
- Easy to process and quantify information

Questions on the questionnaire had to be coded in order to process the pieces of information and quantifying the data by using SPSS statistical package. This facilitated the analysis of data and this was later exported to Microsoft Excel for presentation purposes.

3.9 Limitation of Study

- Some respondents unnecessarily took long in answering the questionnaire. This delayed the whole process of data collection and analysis.

- Some of the questionnaires were not completely answered and others were incorrectly answered. Thus all such were rejected and discarded. This in turn increased the initial total expenditure as many more questionnaires had to be reprinted and Chongwe had to be visited repeatedly.
- It was also limited by the fact that some of the words were technical in nature and thus pausing a communication barrier between the respondent and the researcher.
- Logistical problems were also encountered as Chongwe is about 45Km from Lusaka and it required traveling to and from.

3.10 Chapter Summary

This Chapter dealt with the methods that were employed in the collection of data. The research used a mixed method approach in order to get the benefit of both the qualitative and quantitative design. It showed how the methodology used would address the issues raised in the research questions. It further highlighted the instruments that were used during the data collection and also reviewed some of the limitations that were encountered during process.

CHAPTER 4

4.0 Data Presentation and Analysis

In this study, different numerical codes were assigned to represent different findings in the Statistical Package (SPSS). The following are the numerical codes which were used in order to represent different findings in the research:

- The number **-9** represents the **'unanswered questions'**
- The number **12** represents 'more than one option listed in the questionnaire were ticked'
- The number **11** represents 'all options listed in the questionnaire were ticked'

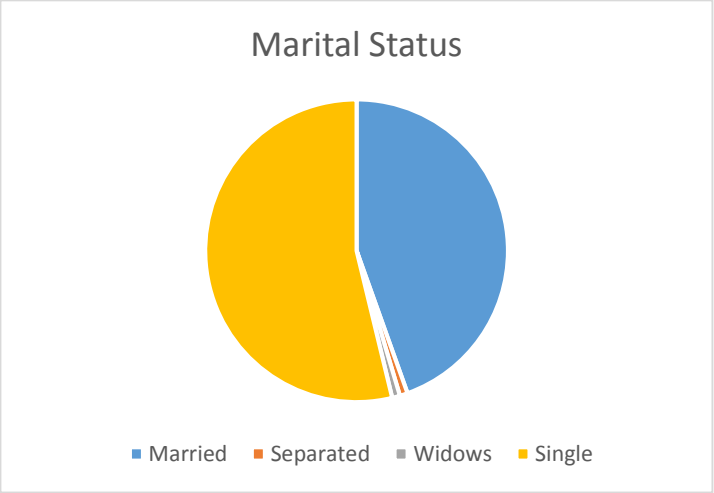
After analyzing the data collected using SPSS and MS Excel, the following were the results: the demographic findings, as shown in table 6 below, from the research revealed that 74 were male representing 54.4% were male and 62 were female representing 45.5% were female of the participants in the research. There were more male respondents than the female in the sample.

Table 6: Gender distribution of respondents

Gender	Frequency	Percentage
Male	74	54.4
Female	62	45.6
Total	136	100

Those who are married accounted for 45.4%, 53.8% were those who are single and the rest of the participants on marital status equally shared a total of 1.6%.

Figure 5: Marital Status of Respondents



It is worth noting that 74% of the sample had families against 26% which did not, and the study also revealed that out of these families 44% have a family size of 4 people and above. The study showed that the oldest respondent was 83 years of age and the youngest was 18 years old. There were multiple modes of 23 and 26 years of age with representation of 8.3% and 9.2% respectively from the sample.

This study has revealed five major hindrances to the growth of broadband market in rural Zambia. These are:

a) Non-availability of Broadband Access Infrastructure

b) High cost of end user equipment

c) Lack of content which addresses local needs

d) High pricing of broadband services

e) Digital Illiteracy

4.1 Non-availability of Broadband Access Infrastructure

The study revealed that the deployment of 3G sites in Chongwe from the three mobile operators has not sufficiently covered the district. The district lacks infrastructure such as MSAG's, DSLAMs and MSANs and hence cannot offer ADSL and VDSL. The copper cable network only services a few business houses around the central district area with only two customers connected via fiber optic cable. Despite having an estimated population of 192, 303 settlers, Chongwe district still suffers from a scant broadband access infrastructural investment a matter which operators have generally attributed to long payback period as well as higher operational costs for very little or no profits at all. The telecommunications operators revealed that remote settlements are usually characterized with very low broadband penetration percentages and hence the operators are not so keen about such markets. Furthermore, it was noted that broadband access infrastructure together with the entire broadband echo system is so expensive and operators need to be cautious as they seek to extend their dominance into rural markets. Macharia (2012) also argued that the building of a broadband network across a country is a capital intensive venture and the low return on investment in rural and undeserving areas was perceived as unattractive by operators and not suitable for investment. It was noted that much of our rural population are scattered and hence making it very expensive and difficult for service providers to take broadband to such areas. He further stated that it is more affordable to provide broadband in urban areas as most residents and business houses are grouped within well designated communities and business centers. Hence the establishment of Points of Presence in these locations results into the capability of providing broadband services to as many people as the population and

connectivity resources can support. This however, is rarely the situation in rural areas since sunk costs are relatively higher.

According to Gillet et al (1999) Broadband access infrastructure is needed for broadband to achieve its full potential, and its delivery of all services is more likely to have very important implications that would even extend to competition for communication services in the last mile. The last mile enables customers to connect to the internet and the capacity of its pipe to the gateway also contributes to the overall browsing experience of the customers. High capacity pipes especially in the range of gigabits per second and above, tend to reduce bottlenecks on the network and can accommodate more customers. With many players now implementing last mile technologies, customers have options of connecting through a provider of their own choice who is able to meet their needs. The interconnection between the broadband access infrastructure and the Customer Premises Equipment (CPE) may include but not limited to radio, 2 pair copper cable and fiber cable.

Dias (2012) noted that the fragmented distribution of broadband access infrastructure, where key economic metropolitan regions are prioritized based on profitability, drives a digital divide within the country. As can be observed about Chongwe, the key determining factor for any service provider to deploy infrastructure is the amount of profit that would be realized afterwards. Those living in rural areas are usually unable to have affordable and effective access to broadband services and this has primarily been because of the barriers related with infrastructure deployment in rural areas which usually tend to give rise to very limited access opportunities for the local population. From the study, it was revealed that the earning potential of an operator within any rural settlement is normally used to determine the possibility for broadband network rollout and expansion.

Macharia (2012) reveled that most operators have supported GSM and 2G coverage in most of rural areas while 3G coverage in rural areas was not widely distributed. The operators justified by stating that broadband services do not operate in the same way as the voice service does. This is because in the voice service despite having few calls originating from the rural settlements, the operator would still generate revenue from those urban settlers who originate calls to those in rural areas. The ability to support two-way conversation makes voice circuits more preferred in terms of deployment as opposed to broadband. Currently, the rural district of Chongwe only has three 3G sites for Zamtel which is practically not sufficient considering the coverage which is for the entire rural district. Two 3G sites for Airtel and MTN also has three 3G sites. All this is out of a required number of five 3G sites which from estimation are needed to effectively cover the district with very minimal grey areas.

Those interviewed from Zamtel reviewed that the Eastern fiber backbone which was laid by Zamtel in 2008 passes through Chongwe but prematurely ends up in Rufunsa District in route from Lusaka to Chipata. Despite having been underground and ready for use, the cable has never been terminated for usage and hence has had no economic significance to the rural district for the past seven years. From a Zamtel point of view, the district only has one E1 connection into Lusaka for Fixed broadband customers which explains the slow speeds that are experienced in the area. It clearly shows that Chipata was the main aim for laying this fiber and not Chongwe owing to the much needed revenue that the company would have realized from Chipata as opposed to Chongwe. According to Macharia (2012), the fiber backbone network rollout is not a priority for rural areas and the fiber backbone network

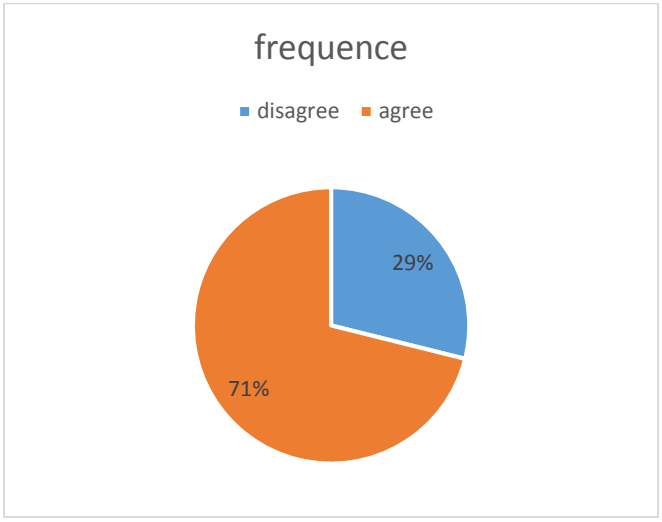
currently being rolled out by operators has been prioritized mainly to connect the metro hubs aimed at creating traffic hubs to interconnect the major cities of the country.

Furthermore, the research revealed a lack of collaboration in the delivery of broadband and other essential services such as housing electricity and water which are traditionally delivered by the local authority. There seems to be no unified plan on how the delivery of each service will be achieved with respect to the other and this creates a likelihood of some installations being a barrier to broadband delivery if not well planned in the initial stages.

4.2 Cost of End User Equipment

The research findings revealed that the cost of end user equipment has a negative impact on the growth of broadband market as evidenced by the pie chart in fig 7 below

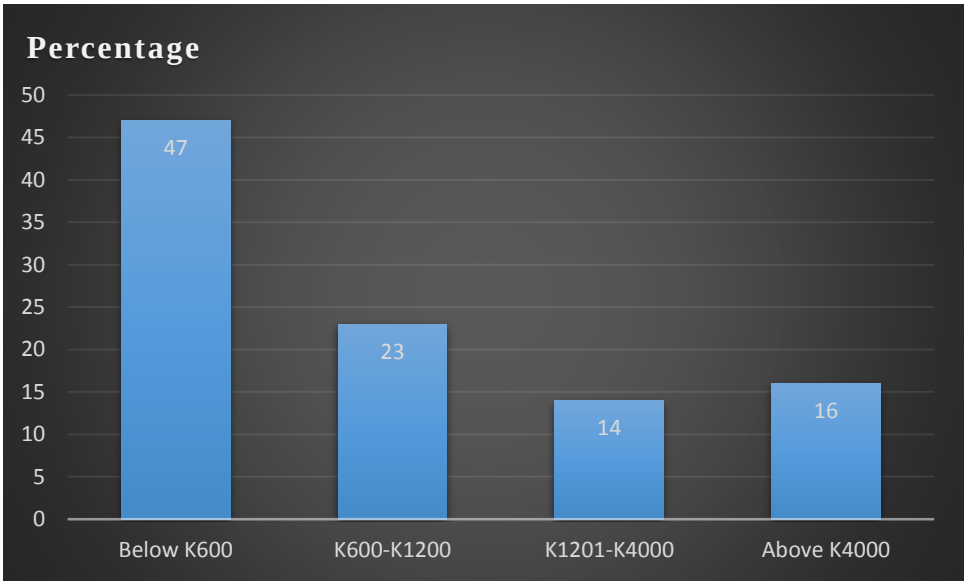
Figure 6: Cost of end user equipment



It was observed that 71% of the respondents agreed to the fact that the cost of end user equipment has been a prohibiting factor in as far broadband market growth is concerned. Those interviewed also affirmed that the majority of Chongwe settlers cannot afford user gadgets like smart phone, laptops as these normally cost way beyond their monthly earnings.

The rural district of Chongwe does not even have a well-established dealer that sells the required end user devices for broadband access and hence the few that would afford them needed to procure them from Lusaka or other towns. This is also attributed to the fact that the buying power of end user devices from the rural population is so low to push for smaller and more affordable gadgets. This in turn increases the cost of acquisition of end user devices for Chongwe settlers as compared to their urban counterparts.

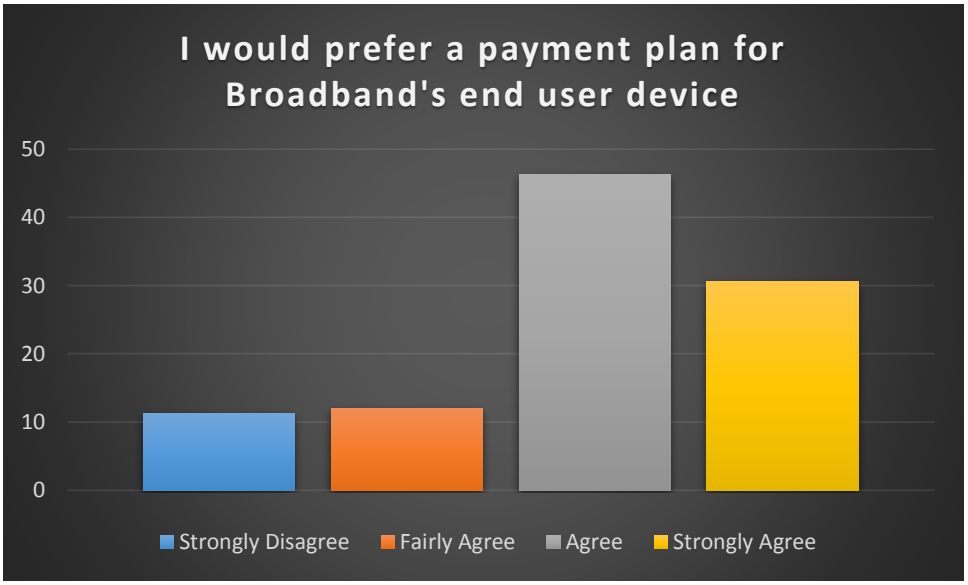
Figure 7: Monthly Income Earnings



The research also reviewed that 63% of the of the sample population generate their income from personal businesses that they run within the district, and 47% representing the majority of the sample stated that their monthly income is below K600.00 as can be noticed from figure 8. A survey undertaken from Lusaka's major shopping malls also reviewed that on average smart phones and laptops a cost around K3000.00 and K3500.00 respectively. Even the few that would afford have to travel to Lusaka to buy laptops as there is no shop dealing in electronics in Chongwe. This also implies that extra costs have to be incurred in terms of transport. It shows therefore from the results that based on the income of an average

Chongwe resident, the acquisition of customer end equipment such as smart phones and computers is a barrier towards the growth of broadband market in the area. From the income statistics that have been shown in figure 7, it can be noted that, the rural population would be more interested in issues of survival as opposed to concentrating on knowing what broadband internet could deliver to meet their immediate needs. Sinkondyobwe (2012:3) also observed that by connecting to the internet, organizations with money depend on digital wireless local loop which is beyond the means of local people who have to decide between having broadband service and meeting basic needs such as food and shelter. Better internet will be essential to unlocking the potential from low-cost smartphones in areas without LTE or 3G service. Android One, Google's program to standardize and improve low-cost Android devices, can help push the cost of a pocket computer down to affordable levels, but without reliable internet access, the power of a smartphone is hampered (Leswing, 2014)

Figure 8: Payment plan preference for end user device

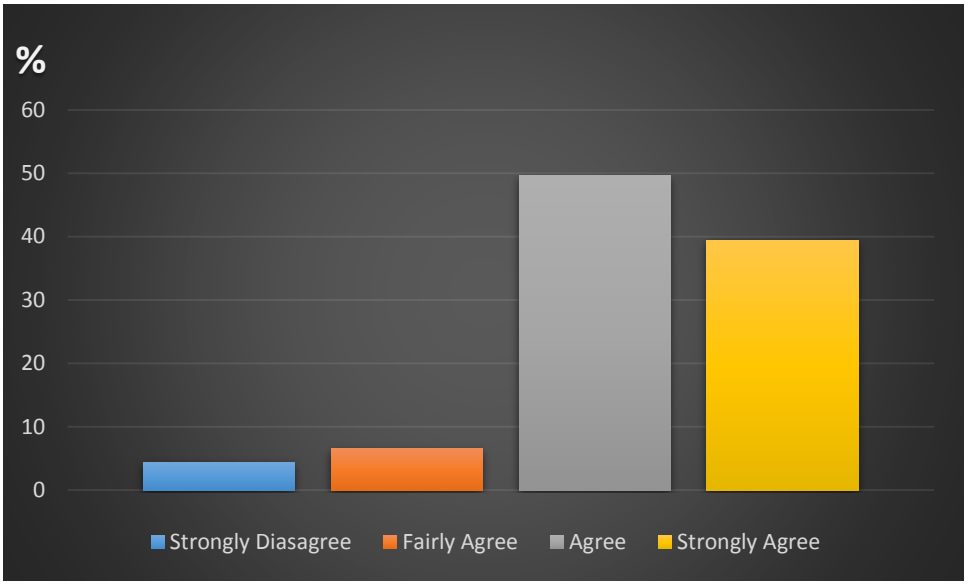


Owing to the high cost of end user devices, the majority of the respondents expressed the need for payment plans as opposed to buying on cash basis. This preference is depicted in figure 9 shown above.

4.3 Lack of Content Which Addresses Local Needs

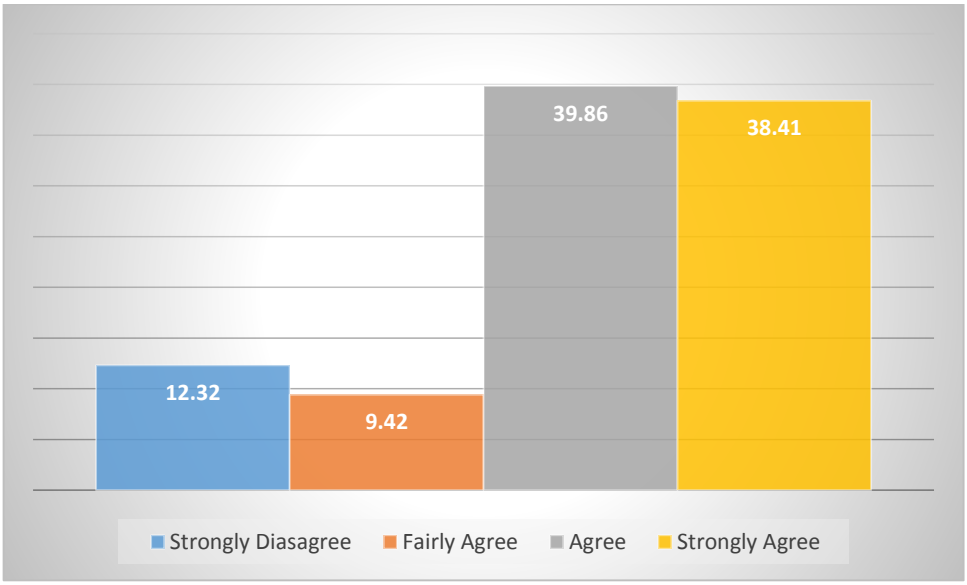
It was noted in Chongwe that language was a major barrier to online communication in that English was not the first language for the majority of the residents. The most widely spoken language in Chongwe are Soli, however, we don't have online software that can translate from foreign languages such as English to Soli. And also there is no ISP that currently offers customer support in Soli and thereby making it very difficult for users to communicate with their service providers. As can be seen from the graph in figure 10 below, over 50% respondents stated that broadband would be quickly adopted if content was able to address the social needs of the people. It was further noted that in order to address the problem of accessing content that is in English and be able to drive broadband adoption, there is need for online content and applications to be provided in a local language that would be understood and appreciated by the majority. And that government needed to play a vital role in the provision of locally relevant content to the public via broadband and make its services available and accessible to the rural communities. The content providers also need to spear head the implementation of online translators and educate the general public on their availability and train them on their usage.

Figure 9: Adoption based on meeting local social needs



From those interviewed in Chongwe, it was observed that the informational needs of these settlers is in most cases related to agricultural business and productivity. Information on weather and climate change, fertilizing, weeding, seeds, planting, and harvesting, animal breeding, feeding, and treatment of diseases. Current information on market prices for agricultural inputs and products were also highly valued. But there were needs beyond farming that were noted as well. These related to water energy efficiency, health, nutrition, culture, local news and sports.

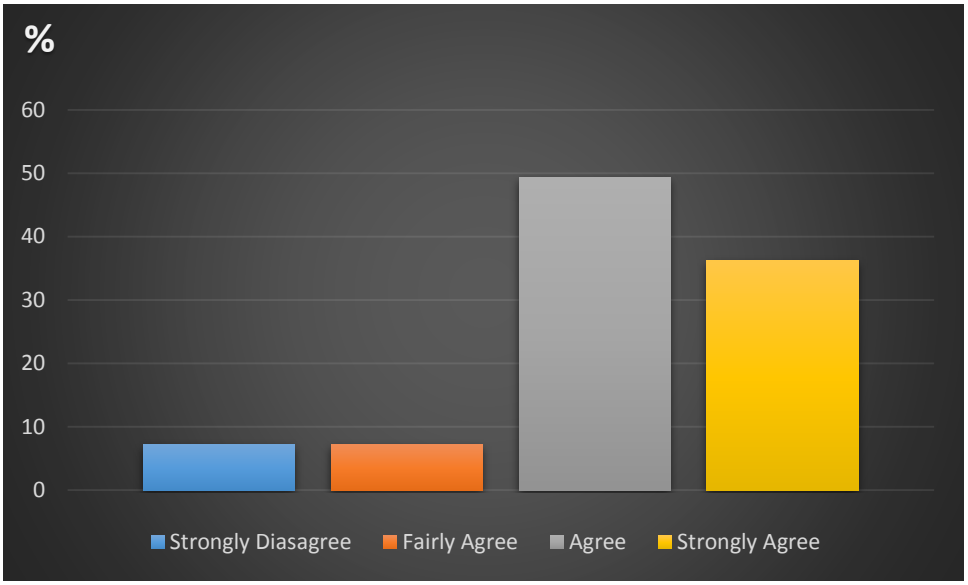
Figure 10: Adoption based on meeting local agricultural needs



As noted in figure 11, broadband would be more adopted in Chongwe if it met the local agricultural needs of the people.

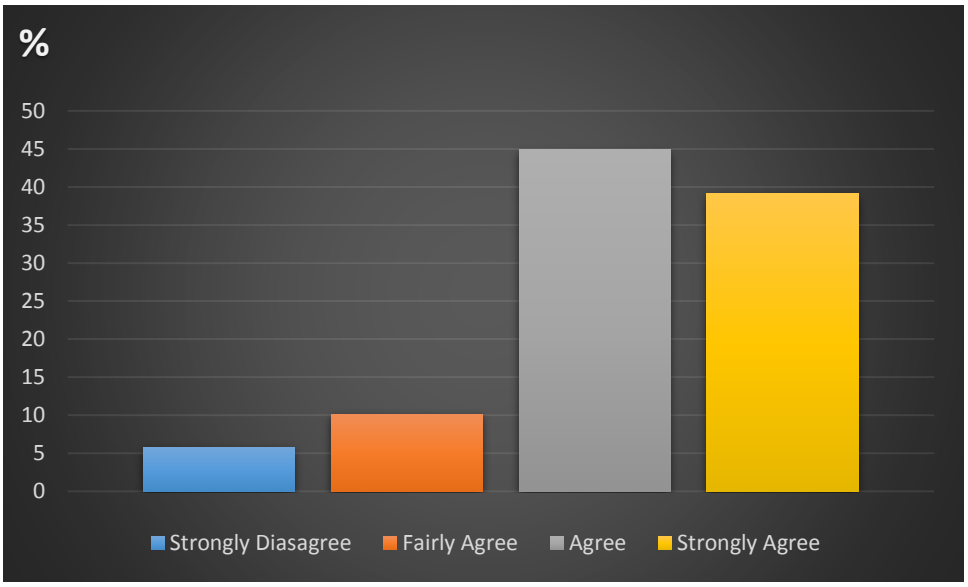
It was further observed that the people of Chongwe would need broadband service that will enhance a sense of belonging and make them remain connected to other members of the society within their own set up. Local needs vary from agriculture, healthy, education and social aspects of life. Broadband services are able to support the recognition, preservation, creation, communication and usage of local content Worldwide. In the recent past, it has been observed that through developments such as the printing press, the phonogram, telephony, radio, television, photocopying machines, recording media, mobile phones and personal computers, among others, has greatly improved the ability to create and share content (Bruegge et. al, 2011:4).

Figure 11: Adoption of broadband based on health needs



Other local needs related to business and health as depicted by figure 12 and figure 13 respectively. In as much as the internet can offer connectivity to various data centers, it is also important to see to it that these connections are able to meet the specific needs of certain groupings in our society who equally make the market.

Figure 12: Adoption of broadband based on business needs

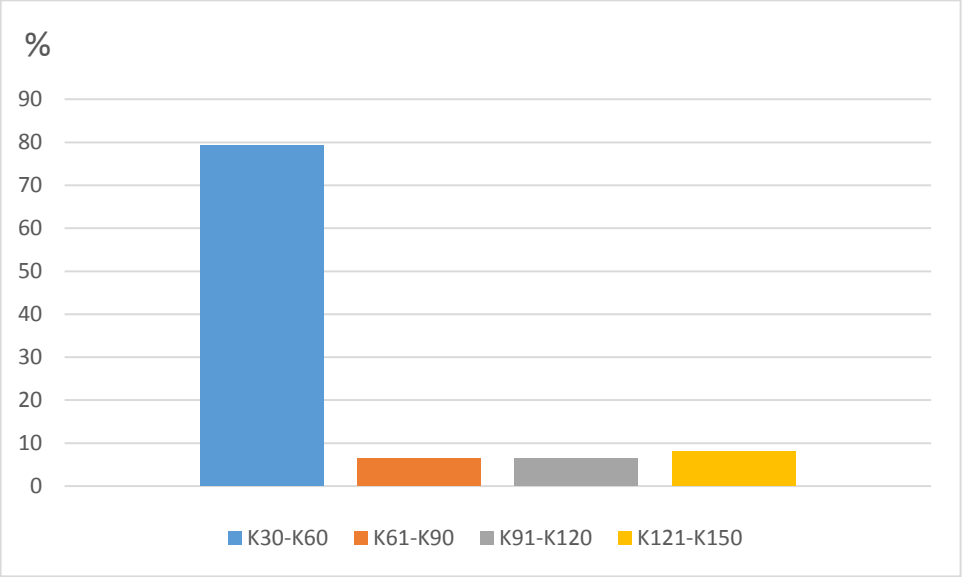


Well over 50% of the respondents indicated that local content can drive broadband adoption in Chongwe. Broadband brings about access to different information from different parts of the world where people exhibit different aspirations and beliefs. They may belong to different religions, educational backgrounds and culture. Hence their inclinations in terms of what they would like to access online becomes critical to the adoption of broadband. It was noted from the people interviewed that much of the content accessed online is usually in a foreign language and the information portrayed may be of no value and lacks significance to those in Zambia's rural areas.

4.4 High Pricing of Broadband Services

From the research, it was established that there is a general need for more affordable broadband services in rural Zambia. 79% of the respondents expressed willingness to monthly subscribe for broadband for as low as K30 to K60 per month as shown in figure 14 below. The Affordability Report (2015) also observed that once the net incomes are so low amongst prospective users, it results in a real high cost to connect to broadband services and hence the low adoption levels. Furthermore, the rural population do not view broadband as a very important service in terms of the hierarchy of needs but would have it packaged with other services. Those talked to stated that they would not subscribe to broadband as a standalone service since it would be very expensive considering the rates that are currently obtaining from the service providers.

Figure 13: Preferred monthly expenditure on Broadband



The high cost broadband services in Zambia was attributed to the lack of good telecommunications infrastructure, high cost of internet bandwidth from external providers and also technological limitations. Zambia is a landlocked country and therefore needs to interconnect with other countries in order to access the Ocean Pacific Cable and reach other regions and continents (Kasolo, 2004). These connections have cost implications which in turn the ISP passes onto the final consumer in the form of high broadband pricing. Other customers also spoken to, bemoaned that the cost of doing any business in Zambia is generally high because of the cost of electrical and chemical energy. Hydro electricity and diesel prices have continued to be serious threat to business and telecommunication is without exception. Equipment that provides broadband services is normally powered by commercial electrical energy falls back onto solar or diesel engine in the event of commercial power outage. It follows therefore that the higher the cost of electrical energy the higher the cost of broadband services. From the analysis, it was observed that the overall

cost of maintaining a BTS in a rural set up is relatively higher than urban areas. This is also partly because non-availability or limited availability of an affordable source energy. It was observed that the sites access node that are not connected to commercial power would have to run on Diesel engine or solar which adds up to the running and maintenance costs for such infrastructure.

The operators also revealed that the other cost emanates from the additional transmission capacity that is needed to link up the rural broadband access nodes to the Mobile Switching Centre (MSC) or the ISP Core. Furthermore, the regulator also imposes license costs on the operator whenever additional Spectrum is required. High Rentals for the land occupied by their infrastructure and the process of acquiring a permit from the Local Authorities were a concern to the operators. Sometimes it took unnecessarily long to process the permit and thereby causing unacceptable delays in deployment.

Maseko (2007) stated that the other factors that have also led to the internet not being accessible to most Zambians includes the economic capacity which has proven that most Zambians cannot afford to get access to the internet, because of the high cost of broadband internet, computers and their associated accessories. For this reason, it is not surprising that the majority of the respondents in the study would prefer keeping their internet expenditure to a very minimal level. According to Affordability Report (2015), the most pernicious barrier to broadband market development is the high cost that the user incurs for the connection. This is even more pronounced in developing countries such as Zambia in that broadband may not be regarded as a priority since the majority of the potential clients still live in poverty and cannot afford the service. In 2011, the UN Broadband Commission set a target for entry-level mobile or fixed broadband to cost not more than 5% of the average

monthly incomes (Gross National Income (GNI) per capita), by 2015. However, it should also be mentioned here that there some customers may not have been educated on the relevance of broadband and what they would achieve with the service. This is so because if it were considered in the opposite but positive sense, access to broadband communications technologies in both citizens and countries would benefit through increased educational opportunities, business productivity, job growth, and economic prosperity. For instance, one other aspect that can foster broadband adoption is the inclusion of content that is able to address the local needs of users such as health and education as revealed by the study.

4.5 Digital Illiteracy

Amongst those spoken to, some argued to say that todays' smart phones and computers require an appreciable level of digital literacy and basic computer skills for someone to successfully operate them. This implies that it would be quite a challenge to foster broadband market development in rural Zambia without first of all addressing literacy issues. It was observed that Chongwe town does not have any training center from which residents can obtain skills that would enable them use computers and other related devices. The absence of such a training facility disadvantages residents in that they will lack the basic skills to search, locate, assess and also critically evaluate the information that is delivered from the internet through broadband. In an interview with representatives from the or the ministry of works, supply and communications, it was revealed that digitally illiterate people are often the ones who fall prey to phishing and email frauds which may actually result in them losing money or have their identities stolen.

The rural population needs to be educated on the purpose of broadband and the benefits which can directly or indirectly be derived from its application. It was further observed that

ISPs need to take a leading role in not only providing broadband services but also providing the necessary education that would promote the awareness and adoption of broadband in rural markets. Despite much of the information sitting on servers all over the world, high digital illiteracy levels as exhibited in the rural areas pause a barrier in the market development of broadband in rural Zambia. Other issues, such as lack of relevant content, and limited digital and language literacy, combine to entrench the digital divide even wider.

4.6 Chapter Summary

A total of 136 questionnaires were received out of a 150 that were distributed. From the received 136 copies, 74 were male while 62 were female respondents which represented 54.4% and 45.5% respectively. It was noted from the study that non-availability of broadband access infrastructure, high cost of end user equipment, lack of local content, expensive broadband services and digital illiteracy were some of the major barriers to broadband market development in Chongwe.

CHAPTER 5

5.0 Conclusion and Recommendations

5.1.1 Conclusion

In conclusion, broadband is an important tool for development in rural areas and has continued to be a service that requires tact and proper management from all stakeholders involved in its implementation so that it can appropriately unleash its benefits to the rural communities. The broadband evolution has continued to positively impact our society and has greatly changed the way we live, learn and conduct our everyday business. It has been identified as a valuable resource that would foster economic and social development in a nation. From the literature that has been reviewed, it has been established that broadband adoption can provide employment for the local people in the form of Graphic Designers, Web Developers, Network Administrators, PC Hardware and Software technicians and retailers etc. It would further more benefit individual households through practical trends that are in the form of e-commerce, e-medicine as well as tele-working. It would also result in significant investment opportunities such as Internet Cafes

However, despite the importance of broadband being well known to policy makers, its accessibility has been hampered by a lot of barriers that need the intervention of all stake holders for them to be overcome. The country needs to deliberately come up with measures that can bring about and promote broadband penetration that would result in the social and economic benefits of our rural areas. In this information age, broadband is able to enhance the transmission, storage and sharing of information among people from different walks of life enabling them to engage in business with anyone around the globe.

In order to conclude on the general research objective of establishing major hindrances to market development of Broadband in rural Zambia and therefore recommend the possible solutions to overcome the challenges.

5.1.2 Lack of Local Content as a Barrier to Broadband Market Development

It can be stated that the low broadband adoption levels that have currently been witnessed is partly attributed to lack of local content that is able to address the local needs of the people. Much of the digital content that is accessed online does not particularly meet most of the needs in the rural setups such as education, health and agriculture. There has not been any evidence of e-learning or notable implementation of telemedicine to encourage or foster the adoption of broadband in rural Zambia. Broadband has not yet been fully explored as a tool that can deliver these services to our rural population as it has been the case in developed countries.

5.1.3 Lack of Broadband Echo System as a Barrier to Broadband Market Development

The broadband echo system has not been adequately developed in rural areas to carter for the growing needs of the settlers. The main determinant of broadband access infrastructure deployment has been noted to be associated with the potential profits that may be derived from a particular market. As indicated by the providers, lucrative markets are those from which investors tend to yield huge profits. It has been concluded that building network infrastructure that span over long distances is not profitable because of the low economies of scale and a low population density. This results in low network effects and have negatively affected the expected market growth in rural areas and hence the need for policy makers to

define courses of actions that would be able to address the escalating costs of broadband provisions outside urban areas.

Galloway (2005) also argued that the diffusion of broadband technologies throughout rural settlements in many countries has been a matter of policy response to broadband access infrastructural issues. Therefore, the absence of broadband infrastructure in rural areas remains a notable barrier that requires utmost attention.

5.1.4 Digital Illiteracy as a Barrier to Broadband Market Development

The current digital illiteracy in our rural areas has also contributed to low adoption levels in that most people are not yet able to successfully operate electronic gadgets such as computers and smart phones. It was also observed that Chongwe does not have any ICT training center from which such skills can readily be obtained. The unfamiliarity and discomfort that in most cases may be exhibited by digitally illiterate people in the use of digital technologies to access and apply information, can be attributed to the dominance of foreign languages that has the end user devices and the internet in general. This illiteracy is also fueled by the poor implementation of ICT skills acquisition that is expected to be sourced through our education system.

5.1.5 Low Income as a Barrier to Broadband Market Development

Low Income has also been identified as a barrier to broadband market development in rural Zambia because it makes the majority of the rural population not to afford the high prices of broadband internet services. The poor economic circumstances which is reflected amongst the majority of offline people often demands the need for income generating opportunities in these rural settlements. The lack of secondary industries and the high unemployment levels have negatively contributed to broadband market development. This barrier is often

exacerbated by the high costs of broadband provision incurred by ISP's in the extension of network coverage especially if fixed network is preferred. This increased cost faced by network operators can also be attributed to the lack of equally important facilities such as roads and affordable electric power solutions.

As also observed by Xavier (2002) the delivery of broadband services to undeserved, rural and remote areas is very much likely to continue being a very serious Challenge. It is usually characteristic of these locations such as a low population and revenue base. These are a significant disadvantage for an Internet Service Provider based on economies of scale. For this reason, the cost per customer of providing terrestrial broadband services in these areas have continued to be significantly higher than in more densely populated areas. And also the idea of surprisingly securing market share in these densely populated metropolitan and regional centers will be of higher commercial priority to most operators.

5.2 Recommendations

5.2.1 Infrastructural Deployment

Since the infrastructural development for broadband access in rural areas requires a large sum of capital investment and also that rural areas have remained unattractive markets to BSP, it is recommended that the deployment of access infrastructure be a government driven initiative that employs a public utility model to capitalize broadband access infrastructural deployment in rural areas. The expectation of BSP's to eventually expand their network into rural areas may not suffice in that their search for return on investment may take too long or never be realized at all. The growth of the broadband market will also depend upon the deployment of broadband access infrastructure in rural and undeserved areas. This involves the installation of MSAGs, MSANs, 3G BTSs and Point of Presence (POP) Routers in rural

areas and fiber as well as Digital Microwave backbone links that would be able to thoroughly support service delivery.

The universal access project is a welcome initiative since it lowers the operators initial cost of deploying a BTS but also there is need for the regulator to ensure complete coverage of the entire country. Such actions are very necessary especially at political level in order to optimize the economic benefits that broadband unleashes. The aim of Universal Service Access is to ensure that equitable levels of service is made available equitably to people living both in the rural and urban areas, to ensure that the services provided are affordable to all members of the society regardless of income level and geographical location and lastly that the services are easily accessible by people with disabilities (Msimang, 2003). For those who are able to afford the Internet, they must have a compelling reason to go online, based on content that is in their language and locally relevant.

5.2.2 Low Cost End User Devices

It is recommended that companies and entrepreneurs that manufacture end user equipment such as desktop, laptop computers and smart phones should improve the affordability of these digital products so as to allow ownership even among Chongwe settlers. Low cost computers and smart phones are very critical in driving the adoption of broadband services in rural areas. Payment plans for end user devices must also be encouraged to enable those who cannot afford cash to pay over a specified period of time. The government can also put in place measures that facilitate the provision of low-cost broadband services that target low-income families in rural areas. This can be achieved by further reducing tax on both telecommunication provider's and end user equipment, and also offer incentives to those investors that take the risk of providing broadband services even in rural areas.

5.2.3 Local Content Development

It is recommended that the regulator needs to encourage and support the creation local content to make broadband more relevant to the majority of those in rural settlements. There is need to make broadband relevant to its users based on language and content in order to foster adoption across a much wider sector in rural areas. A more developed local Internet markets tend to report lower international prices for bandwidth and vice versa: markets with more intense international Internet traffic tend to report lower local prices for Internet access (Bruegge et. al 2011:5). Content needs to be typically in the peoples own local language and should be relevant to the communities within which they live and conduct their daily business. However, it is very possible for an individual to belong to more than one community and hence such requirements have to be catered for. Kozma (2012) also pointed out that information important to rural communities must be generated in digital form and in local languages. For instance, information on improved crop inputs, weeding, and harvesting; animal breeding, feeding, and treatment of diseases; as well as information on water irrigation, energy efficiency, health, and nutrition need to be made available in a local language. This will bring about change since change will come in Africa when information is communicated in a usable form to the people that need it, at a time and in a form that is needed, and when people have the knowledge to apply this information. Government should also improve the delivery of its services to the people through the application of ICT.

5.2.4 Trade Barriers and Incentives

The researcher recommends that government should also ensure that it removes all trade barriers that relate to the importation of ICT equipment such as computers, software, audio and video recorders, smart phones, cameras, because they are some of the necessary tools

used by those who create digital content. These trade barriers would be in the form of duty that is imposed by the Zambia Revenue Authority (ZRA) which tends to further raise the cost of acquisition.

Government should consider offering incentives to encourage operators who embark on broadband rural connectivity. This gesture could be in terms of tax holidays or other forms that would be deemed appropriate for such a purpose. This appreciation would clearly show government's commitment to ensuring sufficient network coverage from the operators.

5.2.5 Digital Literacy Skills

The schools should create and maintain an innovative environment for the production of local content. Bruegge (2011) also revealed that the key steps to the production of local content include improvement of basic literacy (for instance drafting, language, etc.), critical thinking ability, and also media, information and digital literacy skills. These steps to improve ICT, digital, media and information literacy should include both the formal educational system and lifelong learning. Programs that are specifically developed to target youth groups and adult populations are also able to transfer the needed skills to other members in a community who can also assist others to create, record and distribute local content.

5.2.6 Broadband Awareness Campaigns

Broadband awareness campaigns need to be thoroughly carried out and communal internet access centers also need to be set up. Companies, individuals and organizations operating in rural areas need to be made aware of internet technologies to enable them become more prolific in their social and business through the use of broadband technologies. This would give an opportunity for the local people to be educated about broadband and allow them to

appreciate the technologies. Government can also consider setting up an ICT centers that can impart basic computer skills to the rural population in order to eliminate digital illiteracy. The introduction and updating of ICT curriculum for all primary and secondary schools will allow students to keep up with the rapidly changing technological developments and improve digital literacy in the country. This implies the need to have computers in order to increase awareness on the vast benefits that can be obtained from broadband and also drive increased broadband penetration, it is recommended that courses of actions be formulated to foster broadband adoption across all sectors (Carrega, 2009).

Alongside other broadband technologies currently being used in rural Zambia, it is also recommended that BPL be considered for deployment. The service can easily ride on the current Rural Electrification Project provided broadband access nodes are installed in strategic places. It also has a lower last mile maintenance cost because it not as prone to vandalism as compared to its copper counterpart. Logistically, it would actually be more affordable if the two projects that is, The Universal Access and The Rural Electrification were planned and executed in collaboration so that the delivery of electricity must also result in the delivery of broadband service. This is because Universal Access Project would greatly reduce on their investment in alternative power facilities in the event that they worked in collaboration with Rural Electrification Project.

5.2.7 e-Government, e-Education, and e-Health as Drivers for Broadband Demand

There is need for government to use the already running e-government project to further improve broadband demand through the provision of its social services using the Government Wide Area Network (GWAN). Government can also have a direct impact on the rate of deployment and use of broadband through the design of its own programs and

services (McCalla et al, 2009). The GWAN has already covered Lusaka and has linked up most ministries under phase 1 of the project. Ministries should entirely or partly begin offering some of their services online to the general public and become key drivers for broadband demand. The educational sector must deliberately bring on board programs that would assist the rural communities to access education just like their urban counterparts through broadband technologies. There is need to also train content developers in the creation, preservation and dissemination of locally produced digital material that pertains to education and health. It will greatly help the country to continuously harness the talent of creating digital content and also developing it into a form that is that can be disseminated for usage by other interested persons. This in turn would improve on ICT adoption and usage in rural areas and would furthermore narrow the digital divide.

5.2.8 Proposed Business Model

Alongside the business models that are being used currently, the researcher suggests that a more non-profit municipal approach be considered in order to address some of the barriers to broadband market development in rural Zambia. As noted in the research, the low income levels and unfavorable payback periods on investment have greatly hindered broadband supply from most of the BSP's in Zambia. Hence, the Local Authorities need invest in the metro infrastructure.

In this approach, the researcher considers the possibility of having Local Authorities as Broadband Service Providers within their designated locations and making sure that the general citizenship has access to broadband as one of the social services to be rendered to the community. The operators are currently bent on making profits and may never extend their network to rural and underserved areas. The network can be designed, deployed and

maintained by the local authorities and the service can be provided at least at less the current market price so as to enable most of the people to afford it.

We have depicted the business using a canvas model proposed by Alexander Osterwalder in his book entitled business ontology. It shows that the key partners or suppliers include Donors, Central Government, ZICTA and Power Utility Companies (PUC) and the different roles that each one of them need to play in order to overcome the barriers to broadband market development in rural Zambia.

It identifies the key activities that the Municipal ISP would engage in as required by the services

Table 7: Proposed business model for Rural Broadband Market Development[10]

[10] http://www.sswm.info/es/category/step-rrr-business-development/module-4-business-development-part-i-entrepreneurial-adapta-4

<table>
<tr>
<td rowspan="2">Key Partners

- Donors
- Central Government
- ZICTA
- Power Utility Companies (PUC)
The donors have to provide the financial resources to complete the project.
Central Government should formulate ICT policies that will foster broadband demand and adoption in rural areas. It should extend some of its services to rural areas using broadband technologies.
Removal all barriers relating to the importation of ICT equipment.
ZICTA needs to use part of the UAF to facilitate for low cost CPE.
PUC to provide affordable power solutions</td>
<td>Key Activities

Identification of undeserved areas that need broadband internet.
Broadband Campaigns to sensitize and educate potential broadband users.
The installation of network infrastructure.
Network monitoring, management and optimization.
Broadband Sales Customer Support</td>
<td rowspan="2">Value Proposition

Delivered services to the customer include e-education, e-health, e-banking, e-commerce, e-government, browsing, and video streaming etc.
Resolution of barriers to information access in rural Zambia at an affordable price.
Customer needs to be satisfied include education, health, agriculture and commerce.
The minimum viable internet package is 2Mbps which would allow a client to browse, stream, download and upload files etc.</td>
<td>Customer Relationship
Long and short term contracts with government ministries and department for internet provision.
End user loyalty program such as promotions.</td>
<td rowspan="2">Customer Segments
Value is being created for customers in rural and undeserved areas.
Customers such schools, government departments and hospitals will be priority.
Customer architects include low income individuals located in the remotest parts of Zambia.</td>
</tr>
<tr>
<td>Key Resources
- Routers
- Switches
- Firewalls
- Wireless System
- Air condition
- OFC
- MSAGs
- CPEs
- Power
- Human Resource
- Upstream ISP
- Real Estate
- Fire Detection System</td>
<td>Channels
Customers would be reached using Optic Fibre Cable and Radio Access. OFC can be laid to the nearest node.
Wireless is most cost effective.</td>
</tr>
<tr>
<td colspan="3">Cost Structure
- Acquisition and installation of Broadband equipment. Spectrum license.
- Brand Promotion.
- Salaries/Commissions</td>
<td colspan="2">Revenue Streams
The price for internet must be at least lower than the general market price.
Broadband Subscriptions</td>
</tr>
</table>

that need to be delivered. In this regard, a selection criteria of communities that need broadband and the installation of associated infrastructure are some the key activities that constitute service provision in rural areas. A tailor made marketing program needs to be executed to sensitize and educate potential broadband users within the identified rural communities. As noted in table 5, the Municipal ISP should clearly identify the targeted customers and the channels through which their reach would be efficient and cost effective. The Municipal ISP needs to build relationships with customers so as to maintain loyalty and growth whilst ensuring customer satisfaction in the broadband service being offered. It should clearly be stated and evidenced as to why a client would opt for Municipal ISP as opposed to other competitors.

Key resources would be required in order to deliver value to the customers. Equipment such as routers, switches, firewalls and wireless hotspots etc. would have to be purchased and installed in readiness for broadband access by the customers. It would be noticed from table 5 that much of the cost in the setting up of Municipal ISP would be attributed to the purchase and deployment of broadband infrastructure, Spectrum license fees to ZICTA

Local Authorities would be more ideal for broadband supply in rural areas in that their main focus is not necessarily to make profit but to simply offer a much needed service to the community. Their offer would be more affordable to drive broadband demand to the rural population because of their services are targeted at low income earning communities. However, funding for the central and access infrastructure may partly be obtained from ZICTA as well as donors to finance the project. Central government can also assist local government by coming up with a broadband funding program to support broadband community projects. Applying a Municipal based infrastructure development and finance

model would greatly address the challenges associated rural broadband market development in Zambia.

However, caution must be taken so as not to impede private sector investment in broadband infrastructure as a result of the unfair competition that might eventually arise. As a matter of policy, local authorities need to include broadband delivery into their traditional utility services such as housing, water and electricity etc.

5.3 Areas of Further Research

This research was not exhaustive and hence the areas of further research include the following:

a) Similar research needs to be carried out in other rural districts so as to get a more representative picture on barriers that cut across all rural areas of Zambia.

b) There is need to also carry out a study on whether the quality of broadband being supplied to rural areas is good enough to run today's applications.

c) A more detailed investigation on how the Universal Access Fund is managed and what projects are being funded with a specific result on the social and economic impact it has had on its beneficiaries.

d) A detailed investigation on how the rural age distribution affect broadband adoption and the development of specific business models which can maximize the market share within such age groupings.

5.4 Chapter Summary

Broadband market development in Lusaka rural has been hindered by lack of infrastructure, lack of local content, digital illiteracy and low income levels for the rural population. There is very scanty broadband access infrastructure in Chongwe which operators stated that it was due to low return on investment. The low population density and low income levels pause a serious risk to broadband investment in rural areas.

There is need for government to further lower the entry cost for rural broadband markets so as to encourage and give incentives to operators who venture into rural markets. Low cost end user devices with favorable payment plans over a period of time are also desirable for low income earners. It is also recommended that the production of local content that pertains to health, agriculture, education etc would improve the adoption of broadband in rural areas.

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Appendices 1: Questionnaire

THE UNIVERSITY OF ZAMBIA

DEPARTMENT OF ELECTRICAL AND ELECTRONIC ENGINEERING

STUNDENT NAME: Ristone Mwanankuwa

COMPUTER NUMBER: 513809946

Questionnaire

Dear respondent

I am a student at the University of Zambia in the School of Engineering. I am carrying out a research on Barriers to Broadband Market Development in Rural Zambia: A Case Study of Lusaka Rural Broadband Market. You have been randomly selected and it is my sincere request that you answer the following questions honestly. Kindly note that the information collected from you will be treated with the utmost confidentiality and will only be used for the purpose of this research. Your participation will be highly appreciated.

INSTRUCTIONS

- Do not write your name on the questionnaire.
- Where options are provided, simply tick within the given space. For instance,

  Do you trade in Chongwe? Yes [√] No [ ]

	SECTION A **PERSONAL DETAILS**	**For Official Use Only**
1	Gender Male [ ] Female [ ]	[ ]
2	Marital Status Married [ ] Separated [ ] Widows [ ] Single [ ] Divorced [ ] Age……..	[ ]
3	Do you have a family? Yes [ ] No [ ]	[ ]
4	If answer to question 4 is yes, kindly state the family size. 2 people [ ] 3 people [ ] 4 people [ ] Above 4 people [ ]	[ ]
5	Which of the following describes the house you are living in? Own house [ ] Rented [ ] Provided by Employer [ ] Others [ ]	[ ]

	ACADEMIC DETAILS	
		[ ]
6	What is the highest level of education that you have attained? No formal education [ ] Primary [ ] Secondary [ ] College Diploma/Certificate [ ] University Degree [ ]	
	SOCIAL ECONOMIC STATUS	
		[ ]
7	Are you currently in any formal employment? Yes [ ] No [ ]	
		[ ]
8	If yes, In which category is the employer? Agriculture [ ] Service Industry [ ] Government [ ] Parastatal Company [ ] Others [ ] State…….	
		[ ]
9	If answer to question 8 is yes, kindly state your net monthly income range. Below K600.00 [ ]	

	K600.00 to K1 200.00 [ ] K1 201.00 to K4 000. [ ] Above K4 000.00 [ ]	[ ]
10	If answer to question 8 is yes, kindly state your job status from the following. Director [ ] Manager [ ] Supervisor [ ] Worker [ ] Other [ ] State……	[ ]
11	If your answer to question 8 is No, which of the following is the source of your income? Self-employment [ ] Government grant [ ] Casual worker [ ] Other [ ] State …….	[ ]
12	If your answer to question 8 is No, what is your monthly wage? Below K600.00 [ ] From K600.00 to K1 200.00 [ ] From K1 201.00 to K4 000.00 [ ] Above K4 000.00 [ ]	

		[ ]
13	Which of the following devices do you own? Desktop Computer [ ] Smart phone [ ] Tablet [ ] Laptop [ ] Computers [ ] Smart TV [ ] Others [ ] State……..	
	SECTION B **ICT Policy Related Questions**	
		[ ]
14	Does Zambia as a country have an ICT Policy? Yes [ ] No [ ]	
		[ ]
15	Does the Zambian ICT Policy address the expansion of broadband services to rural parts of the country? Yes [ ] No [ ]	
		[ ]
16	If the ICT policy does not include the expansion of broadband services to the rural community, are there plans to address this issue? Yes [ ] No [ ]	
		[ ]
17	Which of the following is a major challenge in implementing International Telecommunications Union (ITU) vision of connecting the whole world? a) Lack of physical Access b) Funding	

	c) Policy d) Low Literacy level of the rural community e) Others (State) ……	[ ]
18	How relevant to development do you think the broadband policy is a) Not relevant b) Fairly Relevant c) Relevant d) Very relevant	[ ]
19	How effective would the existence of a broadband policy be in persuading Government to provide funding for the access infrastructure a) Not effective b) Fairly effective c) effective d) Very effective	[ ]
20	What areas do you think the existence of the broadband policy impact the rural community? .... **<u>Impact of Broadband on Investment</u>**	[ ]
21	Would the existence Broadband connection result in the local people engaging a lot of business activities? a) Greatly Disagree b) Fairly Agree c) Agree d) Strongly agree	[ ]

22	Would the existence of internet connectivity result in attracting investors to your community? a) Disagree b) Fairly Agree c) Agree d) Strongly agree	[ ]
23	Would the existence of broadband connectivity result in Job creation? a) Disagree b) Fairly Agree c) Agree d) Strongly agree	[ ]
24	What jobs do you think would be created by the existence of internet connectivity? …… …… **<u>Impact of local content on the adoption of broadband services</u>**	[ ]
25	I Would be very keen in seeking access to internet connectivity if the content was in my local language. a) Disagree b) Fairly Agree c) Agree d) Strongly agree	[ ]

26	I would quickly adopt internet access if it addressed my local educational needs. a) Disagree b) Fairly Agree c) Agree d) Strongly agree	[ ]
27	I would quickly adopt internet access if it addressed my local healthy needs a) Disagree b) Fairly Agree c) Agree d) Strongly agree	[ ]
28	I would quickly adopt internet access if it addressed my local Social needs educational needs a) Disagree b) Fairly Agree c) Agree d) Strongly agree	[ ]
29	I would quickly adopt internet access if it addressed my local business a) Disagree b) Fairly Agree c) Agree d) Strongly agree	[ ]

30	I would quickly adopt internet access if it addressed my local agriculture needs a) Disagree b) Fairly Agree c) Agree d) Strongly agree **<u>Cost of end user device and Market Growth</u>**	[ ]
31	The cost of end user equipment (e.g. smartphone) is a hindrance to broadband market growth a) Disagree b) Fairly Agree c) Agree d) Strongly agree	[ ]
32	Would you prefer a payment plan for good end user equipment for accessing internet? a) Disagree b) Fairly Agree c) Agree d) Strongly agree **<u>Broadband Pricing and affordability</u>**	[ ]
33	What tariff plan would you prefer for internet accessibility a) Prepaid Data bundles b) Postpaid	

	c) Fixed monthly charge d) Other (State) ……	
34	How much would be willing to spend on internet connectivity in a month? a) K30.00-K60.00 b) K61.00-K90.00 c) K91.00-K120.00 d) K121-K150.00 e) Above K150.00	[ ]
35	Would you subscribe to free broadband service internet? a) Disagree b) Fairly Agree c) Agree d) Strongly agree	[ ]
	----------THANK YOU----------	

Appendix 2: Sample Interview Questions with ISPs

1. Is it profitable for ISP's to provide broadband services to rural areas as compared to urban?

   Yes [ ] No [ ]

2. Why is broadband access infrastructure concentrated in urban areas?

   ……
   ……
   ……
   ……
   ……
   ……
   ……
   ……
   ……
   ……

3. What are the major barriers to broadband market development in rural Zambia?

   Lack of broadband access infrastructure [ ]
   Low profits [ ]
   Sparsely populated residents [ ]
   High cost of end user equipment [ ]
   High cost of broadband services [ ]
   Low literacy levels [ ]
   Lack of marketing strategy from ISPs [ ]

4. Kindly highlight any other form of challenges that you feel pose a barrier to broadband market development in rural Zambia.

   ……
   ……
   ……

……

……

5. Kindly state ways in which your company has helped in developing the broadband market in rural Zambia

……

……

……

……

…….....

6. How would government help address these barriers?

……

……

……

……

…….

7. What measures has your company taken in driving broadband adoption?

……

……

……

……

…….

Appendix 3: Sample Interview Questions with the Regulator (ZICTA)

1. What is ZICTA's view on the current state of deployment of broadband access infrastructure in rural Zambia?

   ……
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2. What are the major barriers to broadband market development in rural Zambia?

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3. Would the inclusion of local content foster the adoption of broadband services in rural areas? *Explain*

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4. How is ZICTA addressing some of the challenges broadband market development in Rural Zambia?

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5. How has the current deployment of broadband access infrastructure in rural areas influenced policy and regulation towards making the service more available and affordable?
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7. In which way is ZICTA helping in driving the adoption of broadband in rural?
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Appendix 4: Sample Interview Question: Ministry of Works, Transport and Communication

1. Are you currently using broadband services in government?

   Yes [ ] No [ ]

2. If your answer to Question 1 is no, kindly explain why?

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3. Are there any incentives offered to ISP's who provide broadband in rural Zambia?

   Yes [ ] No [ ]

4. If yes to question 3, kindly elaborate

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5. What programs has government put in place to lower the digital illiteracy in rural areas?

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6. Has government considered putting up broadband access infrastructure in rural districts such as Chongwe for it e-government project?

Yes [ ] No [ ]

7. Does government view broadband availability and accessibility as a valuable resource?

Yes [ ] No [ ]

8. Does government through the e-government offer any online services to the general public?

Yes [ ] No [ ]

9. If yes to question 8, kindly state the services,

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10. Would government encourage the idea of putting content in local languages? *Why*……
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11. How would government help in making the end user equipment more affordable?

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12. Is there any coordination by government with other stake-holders in the deployment of broadband?