UNIVERSITY OF THE WITWATERSRAND
WITS GRADUATE SCHOOL OF PUBLIC AND DEVELOPMENT MANAGEMENT

RESEARCH REPORT

BARRIERS TO BROADBAND MARKET DEVELOPMENT IN RURAL AREAS IN SOUTH AFRICA

Caroline Wangari Macharia
Student No: 519050

Supervisor: Ms Lucienne Abrahams

A research report submitted to the Faculty of Management, University of the Witwatersrand, in partial fulfillment of the requirements for the degree of Master of Management in ICT Policy and Regulation.

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DECLARATION

I hereby declare that this research report titled "**Barriers to Broadband Market Development in Rural Areas in South Africa**" is my own unaided work. It is submitted in partial fulfillment of the requirements of the degree of Master of Management in ICT Policy and Regulation in the University of the Witwatersrand, Johannesburg. It has not been submitted before for any degree or examination in any other university.

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Caroline Wangari Macharia

ABSTRACT

This research study investigates challenges affecting the supply and demand side factors of the broadband ecosystem that hinder the market development of broadband in rural areas in South Africa and how policy and regulation has affected the evolution of the broadband ecosystem in rural areas.

Although the elements of the broadband ecosystem are strong and well placed in urban areas, not all elements of the broadband ecosystem in rural areas are in place and equally strong. The relative strengths and weaknesses of the different elements of the broadband ecosystem in rural areas are unknown and demand and supply side factors are not understood. Hence the broadband policy may not be based on a full understanding of the complex ecosystem.

The study points to a classic case of market failure that exists in rural areas in relation to the broadband market development. The study identifies that a governance framework, investment management framework, universal access funding model, sufficient frequency spectrum resources, policies and regulation that specifically address the development of the broadband market in rural areas are lacking.

Although the barriers and gaps identified in this study are known to the industry this research study goes further to corroborate from an academic research perspective the existence of these barriers that are affecting the broadband market development of rural areas.

DEDICATION

This work is dedicated to my parents Grace Wanjiku Macharia and Anderson Muriuki Macharia and my children Gilmore Ouma Oyugi and Grace Wanjiku Oyugi.

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- My children who had to sacrifice their weekend outings for a year so that mummy could do her studies.
- To God for granting me the passion, will and strength to finish this journey

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LIST OF ABBREVIATIONS

ADSL	Asymmetric Digital Subscriber Line
ANC	Africa National Congress
DBSA	Development Bank of Southern Africa
CSIR	Council of Scientific and Industrial Research’s
DoC	Department of Communications
DSL	Digital Subscriber Line
ECA	Electronic Communications Act
ECNS	Electronic Communications Network Services
ECS	Electronic Communications Services
E-Commerce	Electronic Commerce
E-Government	Electronic government
E-Health	Electronic health
E-Services	Electronic services
E-Strategy	Electronic strategy
FTTB	Fibre to the business
FTTC	Fibre to the curb
FTTH	Fibre to the home
FTTX	Fibre to the X
GCRO	Gauteng City-Region Observatory
HSDPA	High-speed Downlink Packet Access

HSUPA	High-Speed Uplink Packet Access
IAP	Internet Access Provider
ICASA	Independent Communications Authority of South Africa
ICT	Information and Communication Technologies
IP	Internet Protocol
ISAD	Information Society and Development Plan
ISDN	Integrated Services Digital Network
ISPs	Internet Service Providers
ISRDS	Integrated Sustainable Rural Development Strategy
ITU	International Telecommunication Union
IXP	Internet Exchange Point
MSAN	Multi-service access network
OECD	Organisation for Economic Co-operation and Development
PC	Personal Computer
PNC	Presidential National Commission
PSTN	Public switched telephone networks
SAIX	South African Internet Exchange
SNO	Second national operator
SME	Small Medium Enterprise
UMTS	Universal Mobile Telecommunications System
USAASA	Universal Service and Access Agency of South Africa

USALs	Universal Service Access Licenses
USAO	Universal Service and Access Obligations
VDSL	Very high bit rate Digital Subscriber Line
VoIP	Voice over Internet Protocol
WLAN	Wireless Local Area Network
WMN	Wireless Mesh Network

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CHAPTER ONE: BARRIERS TO BROADBAND MARKET DEVELOPMENT IN RURAL AREAS IN SOUTH AFRICA

1. Introduction

Coming from the era of apartheid where communities were settled in rural areas with infrastructure that was near non-existent, public policy has been focused on rural development, especially through addressing the availability of services such as telecommunication in these areas, aimed at enabling the digital inclusion of the rural areas (Department of Communications, 2011). The ICT Rural Strategic Framework is focused on "capital investment for broadband infrastructure in rural and semi-rural areas, ensuring access to ICT services, the development of digital hubs as ICT centres" (DoC, 2011, p. 4). This is a clear acknowledgement of the problem in rural areas around the availability of broadband access. This raises the need to increase broadband adoption and usage in rural areas with the aim of achieving digital inclusion. However an underdeveloped rural broadband ecosystem remains a challenge that needs to be addressed by policy makers and regulators in order to achieve the goals of the digital inclusion of rural areas.

"Globally there are more than 1 billion broadband subscriptions" (Kim, Kelly, & Raja, 2010, p. 1), 465 million subscriptions being wireline broadband subscriptions and 575 million being wireless high speed data subscriptions (Kim, Kelly, & Raja, 2010). 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 three percent of the subscriptions (Kim, Kelly, & Raja, 2010, p. 2). The digital divide manifests itself between countries and also exists within countries creating a divide between the ones that have access to broadband and the ones that don't have access. According to Bridges.org (2001), Domestic divides tends to manifest itself in ICT across "education, income, race, gender, age, language, and disability" (Bridges.org, 2001, p. 25). These divides are often an indicator of the existing inequalities within the country which is mainly attributed to the gap between the urban and rural citizens. People with low incomes, low literacy, and people living in rural areas, the unemployed, the disabled and the elderly have all been identified as people who are slow to adopt ICT. The low broadband penetration is also attributed to the limited availability of broadband networks, unaffordable broadband services and devices and the limited broadband access in rural areas. This has resulted in the lack of universal access to broadband and has had an impact on the economic growth and social benefits in rural areas.

Traditionally broadband definition is focused on speed and bandwidth where the minimum data transfer speeds are 256kbp/s however for the purpose of this research broadband is viewed from a broadband policy perspective as an ecosystem consisting "of internet and data services from both a demand and supply side perspective" (Coyle & Williams, 2011, p. 3).

1.1 Putting a perspective to the rural areas in South Africa

The Integrated Sustainable Rural Development Strategy (ISRDS) report (Burger, 2000) defines rural areas as being characterized by spatially dispersed populations and agriculture remains the dominant or exclusive economic sector. The DoC (2011) defines rural areas as "the low ratio of inhabitants to open spaces; - sparse population – and where the manufacturing base is mostly weak due to poor development or the absolute unavailability of the required infrastructure" (DoC, 2011, p. 4). On the other hand the Gauteng Provincial

Government (2010) defines rural areas as spaces where only small areas are occupied by people and infrastructure and these areas tend to be characterised by forests, water and mountains. For the purpose of this research rural is defined as a sparsely populated area characterized by a low number of inhabitants and the unavailability of basic infrastructure such as roads, water, electricity and telecommunications. Rural areas are sustained through agricultural activities, commercial and subsistence farming, nature reserves, small towns and villages with poor or no manufacturing base.

The DoC (2010) estimates that "19 million or 42% of the population in" South Africa's is based in the rural areas (DoC, 2010). World development indicators estimates the percentage of the population in South Africa living in urban areas as 61.7% while the rest of the population of 38.3% resided in the rural areas (World Bank, 2010). 70% of poor people live in Rural South Africa while about 70% of the rural residents are classified as poor according to the ISRDS report (Burger, 2000).

According to Patel (2010) metropolitan cities, secondary cities and regional service centres in South Africa make up the urban areas as they are characterized by a dense population and diversified economies while small towns and settlements are classified as rural as they are located in the vast rural regions. There is a high interdependence on the urban areas and cities and according to Patel (2010), the huge under investment in the rural infrastructure in South Africa has been the cause of its spatial inequality. The rural areas in South Africa have been characterized by extremely low access to basic services in comparison to the urban areas such as sanitation, social services, transport, water, electricity, waste removal and communication infrastructure, which has resulted in a higher cost of living than normal. Poverty in rural South Africa has "been accompanied by low and even declining levels of economic output" (Patel, 2010, p. 5). The rural income is limited due to the lack of a vibrant rural economy, attractive jobs and entrepreneurial opportunities. Rural housing in South Africa has been a reflection of the past homeland policy and is characterized by dislocated settlements, isolated ghettos and substandard housing with many of its inhabitants being migrant workers in urban areas (Patel, 2010).

Individuals in rural areas are faced with a number of major challenges that impact development which the ISRDS report identifies as the increased "cost and difficulty of providing goods and services" to rural areas effectively due to its spatially dispersed population (Burger, 2000). The economic conditions result in less opportunities and the limited tax base impacts the ability of the rural areas "to mobilize sufficient resources to finance their own development programmes, leaving them dependent on transfers from the centre" (Burger, 2000, p. 2). Rural areas according to the ISRDS report (Burger, 2000) often operate inefficiently and are politically marginalized depriving the rural areas from having the power to influence government policies.

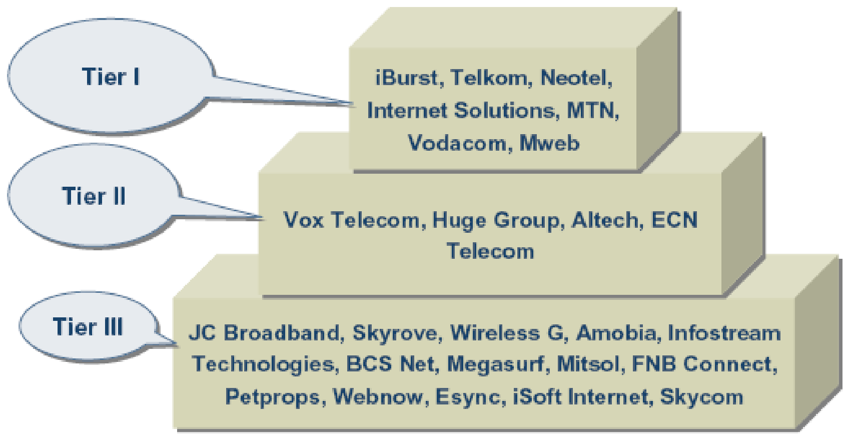
For the purpose of this study the rural community of Metsweding will inform the basis of this research. Although Metsweding is situated close to Johannesburg and Pretoria which are considered as urban areas, Metsweding is considered a rural area with an underdeveloped agricultural base.

1.2 A review of the South African broadband market structure

The South African broadband market is classified into fixed broadband and wireless mobile broadband with operators and ISP's specialising in the provision of either fixed and wireless mobile broadband services or both. This section provides insight into the major players in the South African broadband market that specialise in the provision of broadband services and the various broadband access technologies that currently exist. Figure 1 below provides an outline of the broadband and internet service providers in South Africa. Tier 1 operators are classified as "those having extensive infrastructure at a national level and provide all levels of broadband services – access, backbone, platform and sales" (Frost &

Sullivan, 2010, p. 78). Tier II providers purchase capacity at a wholesale price from the Tier I providers which is then re-packaged and the service resold to the market.

Figure 1: Major companies in broadband market in South Africa



Source: *Frost & Sullivan, 2010, P. 78*

Telkom was initially the only fixed line operator in South Africa providing fixed line services such as fixed broadband internet, satellite communications and fixed voice services until 2002 when the second fixed line operator Neotel was licensed as the second national operator (SNO). Telkom has maintained a near monopolistic presence in the market with Neotel not having achieved a significant market share in the time it has been operating in the market (Frost & Sullivan, 2010). Telkom's fixed line revenues and penetration has been on the decline which is mainly attributed to the increased mobile substitution and the increased mobile penetration of mobile services (Esselaar, Gillwald, Moyo & Naidoo, 2010). Some of the services that Telkom offers that provide broadband connectivity include Integrated Services Digital Networks (ISDN), Asymmetrical Digital Subscriber Line (ADSL) access and satellite services which enable connectivity where no physical infrastructure exists like in remote and rural areas. Telkom also offers Wimax service as a complementary or replacement service to ADSL in areas with high theft and breakage incidences of copper. Telkom is also a co-owner of the East African submarine system which consists of about 10, 000km of submarine cable that spans the east coast of Africa and provides connectivity to global points (Telkom, 2011). Telkom has deployed about 143, 000km of Fibre to the X (FTTX) across the country with majority of the deployments being Fibre to the curb (FTTC) and Fibre to the business (FTTB) in metropolitan areas (IT-Online, 2012). Telkom has plans in place to extend the fibre network to provide Fibre to the home (FTTH) which became a reality with the recent launch of its Multi-service access network (MSAN) that will offer subscribers with connection speeds of between 20 megabits per second and one gigabits per second. "Customers using the MSANs will be able to access both voice and data in a variety of broadband formats, including ADSL, ADSL2 and VDSL2" (IT-Online, 2012). Telkom is also set to start trialling its Space Stream product which is a satellite service aimed at enabling internet and voice services to areas with "unreliable or no terrestrial infrastructure" (Muller, 2012). The service is aimed at enabling affordable communication services to rural communities in South Africa (Muller, 2012).

Vodacom was established in 1993 and has over the years invested over 30 billion rands in building its network which provides 2G network coverage to 98% of the population and 3G coverage to 54% of the population and 70% of the land surface (BuddeComm, 2010; Vodacom Group, 2010). As of 2010 Vodacom's South Africa network boasted a total of 7817 base stations however Vodacom indicated that it faces a challenge in extending its 3G network to rural areas (Vodacom Group, 2010). Vodacom's 2G coverage in urban areas covers a total land surface of 99.9% while in rural areas covered a total land surface of 81.8%. Vodacom's 3G coverage in urban areas was sitting at 63.8% while coverage in rural areas was at 7.3% (Vodacom Group, 2010). In 2006 Vodacom Ventures purchased a 10% in WirelessG a company that specialised in the provision of

Wi-Fi. The move was seen as an enabler for Vodacom to provide Wi-Fi as an alternative complementary service to Vodacom's 3G broadband services. Vodacom also launched HSDPA broadband services in 2006 in Johannesburg, Durban, Cape Town and Port Elizabeth. Vodacom later bought a stake in Wireless Broadband Company (WBS) which had an existing network based on Iburst technology but also had Wimax spectrum, Vodacom however did later sell the stake in WBS. Vodacom commenced LTE trials in June 2010 consisting of between 100 – 150 towers operating in the 1800MHz and 2100MHz spectrum bands (Vermeulen, 2011).

MTN South Africa launched in mid-1994 as the second mobile operator providing voice and data services and over time managed to build a total of 8912 base stations that provides 2G coverage to 96% of the population and 73% of the land surface (BuddeComm, 2010). MTN's 3G network covers 49% of the population mainly centred in urban areas and are focused on delivering data services (MTN Group Limited, 2010). MTN 3G coverage does not extend to rural areas and intends to re-farm part of its 900Mhz spectrum which is currently used for voice services, for 3G use specifically for extending broadband services into rural areas (MTN, 2010). By 2010 "MTN had 120 live HSPA+ sites and more than 2000 3G/HSDPA sites" (BuddeComm, 2010, p. 21).

CellC launched in 2001 as the third mobile operator providing voice and data services to the market and had a signed roaming agreement with Vodacom for 15 years (BuddeComm, 2010). By 2005 CellC's 3G network had grown to include 2000 base stations that provided coverage to 63% of the population and 8.7% of the land surface (BuddeComm, 2010). CellC had upgraded 1300 of its base stations to HSPA+ in 2010 and started rolling out broadband services in metropolitan centres in Port Elizabeth, East London, Bloemfontein, Durban, Cape Town, Polokwane and Pietermaritzburg (BuddeComm, 2010). CellC has been trailing LTE using its existing 900MHz and 850MHz spectrum, (Vermeulen, 2010). CellC's network has mainly been concentrated in providing coverage in urban areas.

Telkom Mobile (8ta) launched its 3G network in October 2010 making it the fourth mobile operator providing both voice and data services to the South Africa market. As at the end of May 2011 Telkom Mobile had 1012 base station which was mainly located in the metropolitan areas with no coverage in the rural areas (Telkom Group, 2011). Telkom Mobile also has a roaming agreement with MTN for the provision of coverage in areas where it has no coverage but this coverage is mainly used to support its voice services.

Sentech was in 2002 awarded a carrier of carrier licence and a multimedia services license which authorised Sentech to provide voice, internet and data services to South African and overseas operators through its satellite and fibre optic network (Lange, 2010). As part of its multimedia services license condition Sentech was required to provide internet connectivity to 8500 computers in 500 rural schools over a span of 5 years (Lange, 2010). Sentech also launched satellite based internet services which was aimed at providing broadband connectivity to rural based telecentres. Sentech and Telkom were the only operators provided with a fixed wireless licence in the 3.5GHz band which Sentech used to provide wireless broadband services to business and residential subscribers (Lange, 2006). Sentech launched wireless broadband service, MyWireless in 2004 in major cities in Johannesburg, Durban, Pretoria and Cape Town, however the service was later discontinued in 2008 (Lange, 2006; Mashinini & Neilson, 2012).

Neotel on the other hand officially launched as the second fixed line operator in 2006 providing voice and data services through its fixed wireless access via CDMA and Wimax to the South African market (Lange, 2006). The terms of granting the launch of a second fixed line operator included the requirement that Telkom would provide Neotel with access to its infrastructure for two years which was aimed at facilitating access based competition until such a time that Neotel had launched its own infrastructure. However the non-unbundling of the local loop or Telkom's last mile continues to remain a barrier to creating competition within the provision of fixed broadband internet services to the home or business and Telkom continues to enjoy a monopoly.

Broadband InfraCo a fully owned state corporation was officially launched in 2010 with the objective of lowering the cost of broadband through its involvement in the submarine cable in the West coast of Africa. Broadband Infraco was awarded a full service network (FSN) that was acquired from Eskom and Transnet (Neilson, Falconer & Mashinini, 2012). As a holder of an I-ECNS licence Broadband Infraco is only mandated to provide network services and is prohibited from providing retail services such as internet, value added and capacity services due to the lack of an ECS licence (Neilson, Falconer & Mashinini, 2012). Involvement in the submarine cable enables opportunities for international connectivity to be provided to the South African wholesale market at competitive rates specifically with the aim of servicing rural areas. Broadband InfraCo has already launched 13, 612km of fibre optic network connecting South Africa's commercial centres and its neighbouring countries (Broadband Infraco, 2011). Broadband InfraCo has expanded the availability of broadband connectivity access through the establishment of five independent broadband point of presence (POPs) (Broadband Infraco, 2011).

Telkom Internet started its operations in 2000 as an Internet Service Provider (ISP) providing internet services consisting of dial-up Internet with ISDN or analogue connections. "Telkom SAIX (South African Internet Exchange) is the country's Internet Exchange Point (IXP) and largest Internet Access Provider (IAP), owning the largest IP backbone infrastructure connecting South Africa to the world (Lange, 2006, p. 148) and providing wholesale Tier I Internet access to ISP's and Corporate's.

Atlantic Internet Services was founded in 1996 as one of the largest ISP's in South Africa providing ADSL, Dial-up Internet, ISDN, Diginet services, 3G and iBurst Internet services to both consumers and businesses (Lange, 2006; Mashinini & Neilson, 2012). Atlantics main business focus is the retail ISP business operating over 190 franchises throughout South Africa. Atlantic is also positioned as the largest reseller of iBurst and Vodacom 3G in South Africa (Mashinini & Neilson, 2012).

Internet Solutions started its operations in 1993 and the company has focused on providing services such as Internet access via leased line, hosting, mobile, voice, unified messaging and satellite solutions to businesses (Lange, 2006, Mashinini & Neilson, 2012). In 2009 Internet Solutions was awarded a ECNS license which enabled them to provide their own telecommunication infrastructure (Mashinini & Neilson, 2012).

MWEB which is part of the Naspers Group currently owns the largest market share of dial-up service and offers "dial-up Internet access, analogue and ISDN and ADSL connectivity to customers in the home and business market" (Mashinini & Neilson, p. 75, 2012). In addition to this MWEB also offers DSTV on demand, e-commerce solutions and resells 3G broadband solutions from Vodacom and MTN (Mashinini & Neilson, 2012).

The wireless Mesh Network (WMN) project by the Council of Scientific and Industrial Research's (CSIR's) was launched in September 2010 with the aim of enabling broadband connectivity in rural areas through its wireless network(Rasool, 2012). To date it has been able to provide broadband connectivity to over 200 facilities of which "175 are schools and the rest are school circuit manager offices and a community radio station" (Rasool, 2012). "WMN uses unconventional methods to communicate information, instead of the traditional point-to-multipoint communication; it is based on peer-to-peer communication between network nodes" (Rasool, 2012).

It is quite evident that the provision of broadband access to rural areas by the fixed operators has mainly been through satellite technology due to the lack of a physical telecommunication infrastructure. While the mobile operators have only started exploring the possibilities of extending 3G coverage to rural areas specifically for the provision of broadband services, wireless broadband infrastructure currently provided by the mobile operators is concentrated within urban areas. The major ISP's businesses focus mainly seems to be targeted at providing internet services to businesses and corporate's with no strategy focus on the provision of services to rural areas.

1.3 Trends in Broadband Adoption

The overall SA telecommunication sector performance experienced a steady decrease in the number of fixed line subscribers and fixed line growth "was less than 10%" from 2001 to 2007 (DoC, 2008, p. 13).

On the other hand the mobile sector experienced a significant increase in subscriber numbers which "was over 80% in 2007" (DoC, 2008, p. 13).

Mail & Guardian online (2009) report that South Africa's broadband penetration rate was at 2% which translates to 1 million broadband subscribers in 2009. This number fell way below the global average in 2009 of 22.5% broadband penetration rates Mail & Guardian online (2009).

Figure 2: Internet and broadband statistics South Africa - 2010

INTERNET USER STATISTICS	
Internet users (e)	6.2 million
Internet penetration	12.50%
Broadband subscribers (e)	2.4 million

Source: *Lange, 2010, p. 229*

Figure two above highlights that South Africa had an internet penetration of 12.5% or 6.2 million Internet users in 2010 out of a population of 49.8 million people while the number of broadband subscribers stood at 2.4 million which indicates a broadband penetration of 5 % in 2010 (Lange, 2010). South Africa had 12.3 internet users per 100 people in 2010 in comparison to the global average of 30.5 internet users; this was according to the World Development Indicators (The World Bank, 2010). The latest report from ITU and UNESCO highlights that South Africa's Internet access stands at 9.8 per every 100 households in 2011 with 21 individuals using internet in South Africa per every 100 individuals in 2011 which highlights an increase from 2010. South Africa however continues to significantly lag behind with the countries ranking being placed at number 109 out of 177 countries as shown in figure three below (Mybroadband Staff Writer, 2012).

Figure 3: Percentage of individuals using internet

Percentage of Individuals using the Internet

RANK	ECONOMY	PERCENTAGE OF INDIVIDUALS USING THE INTERNET 2011
1	Iceland	**95.0**
2	Norway	**94.0**
3	Netherlands	**92.3**
4	Sweden	**91.0**
5	Luxembourg	**90.9**
6	Denmark	**90.0**
7	Finland	**89.4**
8	Qatar	**86.2**
9	New Zealand	**86.0**
10	Switzerland	**85.2**
109	South Africa	***21.0***
110	Bhutan	**21.0**
111	Iran (I.R.)	***21.0***
112	S. Tomé & Principe	***20.2***
113	Mongolia	***20.0***

Source: *Mybroadband Staff Writer, 2012*

South Africa had a better country performance in 2011 on mobile broadband and the latest ITU and UNESCO report highlights that South Africa had active mobile broadband subscriptions of 19.8 per 100 inhabitants as highlighted in figure four below (Mybroadband Staff Writer, 2012). South Africa however still continues to lag behind significantly with its ranking being placed at number 47 out of 177 countries (Mybroadband Staff Writer, 2012).

Figure 4: Mobile Broadband Penetration Worldwide, 2011

Mobile Broadband Penetration, Worldwide, 2011

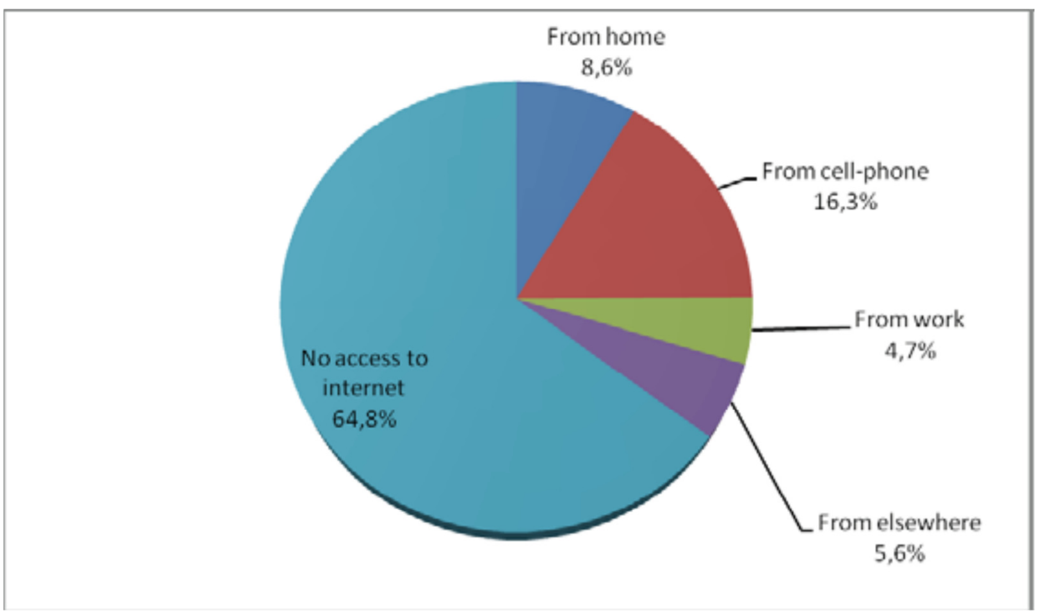
RANK	ECONOMY	ACTIVE MOBILE-BROADBAND SUBSCRIPTIONS PER 100 INHABITANTS 2011
1	Singapore	**110.9**
2	Korea (Rep.)	**105.1**
3	Japan	***93.7***
4	Sweden	**91.5**
5	Finland	**87.1**
6	Denmark	**80.2**
7	Luxembourg	**66.7**
8	United States	***65.5***
9	United Kingdom	**62.3**
10	Qatar	**61.0**
47	South Africa	***19.8***
48	Antigua & Barbuda	**19.7**
49	Belgium	**19.4**
50	Belarus	**18.9**

Source: *Mybroadband Staff Writer, 2012*

By the "end of 2011 the number of internet users in South Africa had grown to 8.5 million" users which represented a growth of 27% from 2010 which stood at 6.2 million number of internet users (Lange, 2010; Goldstuck, 2012). "This growth brings Internet penetration in South Africa to approximately 17 percent.

Despite rapid growth, however, it lags significantly behind the biggest Internet user bases of Africa. Nigeria, with 45-million users, has 29 percent penetration, while Egypt's 21.6-million users gives it 26 percent penetration and Morocco's 15.6-million users represents 49 percent penetration" (Goldstuck, 2012, p.1). The penetration of Internet access in households was at 7.3% in 2007 with no data to compare from the 2001 census however this figure remains significantly low (Statistics South Africa, 2007). Figure five below highlights census 2011 statistics which report that internet access in households stood at 16.3% in 2011 a growth of 55% from 2007. While a higher portion of households that did not have internet access stood at 64.8% in South Africa (Statistics South Africa, p.58, 2012). Households that had access to the internet mainly accessed the internet through cellphones (Statistics South Africa, p.58, 2012).

Figure 5: Percentage of households who have access to internet, Census 2011



Source: *Statistics South Africa, 2012, p.58*

In terms of fixed broadband internet South Africa had 1.5 Fixed Broadband Internet subscribers per 100 people in 2010 in comparison to the global average of 7.8 Fixed Broadband Internet subscribers; this was according to the World Development Indicators (The World Bank, 2010), these statistics indicate South Africa was lagging behind the global average. Muller (2009) reported that "South Africa only had 1.3 million fixed broadband subscribers in 2008" and an "internet penetration of 6.59%" (Muller, 2009). Although the statistics above indicate that between 2008 and 2010 the Internet penetration had grown by about 53% in South Africa the country still lagged behind the global average by about 40% which is a significant gap.

Figure 6: Fixed Broadband Penetration Worldwide, 2011

Fixed Broadband Penetration, Worldwide, 2011

RANK	ECONOMY	FIXED (WIRED)-BROADBAND SUBSCRIPTIONS PER 100 INHABITANTS 2011
1	Liechtenstein	71.6
2	Monaco	44.2
3	Switzerland	39.2
4	Netherlands	38.7
5	Denmark	38.2
6	Korea (Rep.)	36.9
7	Norway	*36.5*
8	France	36.1
9	Iceland	33.9
10	Belgium	33.0
100	Egypt	2.2
101	Philippines	*1.9*
102	Oman	1.8
103	Morocco	1.8
104	South Africa	*1.8*
105	Nicaragua	1.8

Source: *Mybroadband Staff Writer, 2012*

The latest report from ITU and UNESCO highlights that South Africa's fixed broadband subscriptions per 100 inhabitants currently stands at 1.8 as shown in figure six above which puts South Africa behind other countries such as Mauritius, Tunisia and Egypt as indicated in figure six above (Mybroadband Staff Writer, 2012). South Africa clearly lags behind with its ranking placed at 104 out of a total number of 172 countries in fixed broadband penetration (Mybroadband Staff Writer, 2012). As at the end of 2011 ADSL grew by 13% in South Africa to 820, 000 fixed broadband users (Vermeulen, 2012). This growth was much lower compared to the internet growth in 2011 (Vermeulen, 2012).

Figure 7: Mobile Statistics South Africa, 2010

MOBILE STATISTICS	
Mobile subscribers (e)	56 million
Annual growth	6%
Mobile penetration	113%
Major mobile operators	Vodacom
	MTN
	CellC

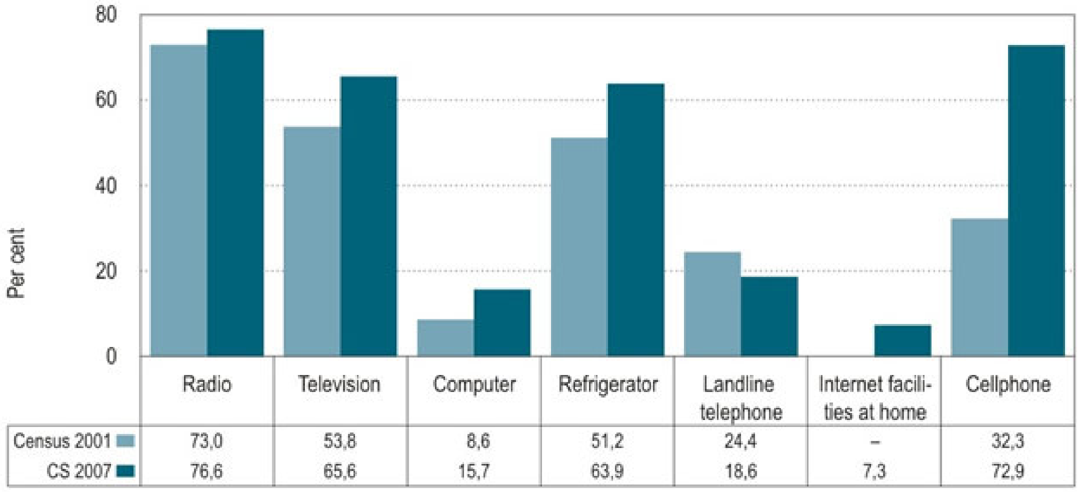
Source: *Lange, 2010, p. 229*

Figure seven above highlights that although the mobile penetration in 2010 stood at 113% and number of mobile subscribers stood at 56 million in South Africa, the statistics on the number of broadband subscribers (2.4 million) and the broadband penetration rates (5%), highlights how behind South Africa has lagged in broadband access and also significantly fallen below the global average. This highlights that a significant disparity or gap exists between mobile access and broadband access in South Africa.

Figure eight below highlights that the ownership of services by households such as cellphone, computer, Television, radio and refrigerators increased significantly between the 2001 census results and the 2007 community survey (Statistics South

Africa, 2007). The 2007 community Survey also highlights that the penetration of landlines declined between 2001 and 2007 which could be attributed to the increased ownership of cellphones (Statistics South Africa, 2007).

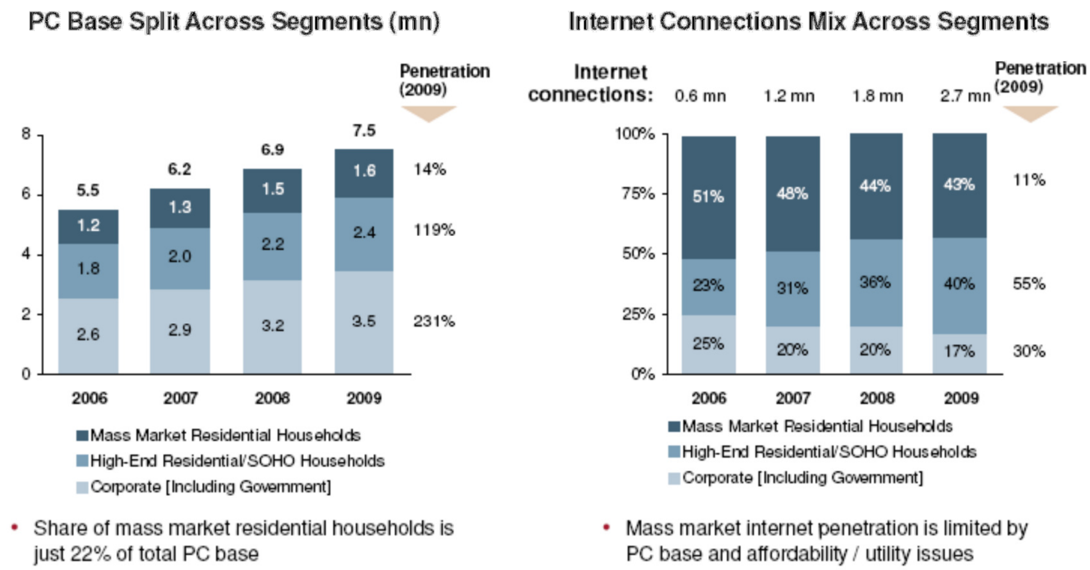
Figure 8: Percentage of Households with Household goods in working order



Source: *Statistics South Africa, 2007*

Figure nine below highlights that internet penetration growth in South Africa is limited by the Personal Computer (PC) penetration rate, the lower the PC penetration the lower the Internet penetration as is the case with the Mass market residential household figures represented below. This is an indicator that devices that enable broadband or internet connectivity play a critical role in driving broadband adoption. A study finalised by World Wide Worx highlights that 6 million subscribers accessed the internet through computers, notebooks and tablets while 2.48 million subscribers lacked computer access in 2011 (Vermeulen, 2012).

Figure 9: PC Base Split across Segments versus Internet Connections Mix across Segments



Source: *Analysys Mason, 2010*

Table one below further highlights the proportion of households with access to a mobile phone and access to internet across all the provinces in South Africa and in comparison to mobile phone access the table highlights the low penetration rates that exist across all provinces in relation to internet access, signifying again the disparity or gap that exists on Internet penetration. The growth experienced between 2007 and 2010 on Internet access was very small compared to the growth experienced in the number of households with mobile access.

Table 1: Proportion of households with a mobile phone and household internet access by province, 2007 and 2010

Provinces (population)	2007					2010	
	Households mobile phone	Households Internet access	Total households	Percentage households mobile phone	Percentage households Internet access	Percentage households mobile phone	Percentage households Internet access
Eastern Cape (6.5m)	**971 310**	**50 422**	**1 586 735**	**61.2**	**3.2**	**79.9**	**3.8**
Ikhwezi Local	1 144	83	2 567	44.6	3.2		
Free State (2.7m)	**548 090**	**32 975**	**802 872**	**68.3**	**4.1**	**85.1**	**6.9**
Mohokare Local	5 530	121	10 216	54.1	1.2		
Gauteng (10.4m)	**2 549 681**	**373 007**	**3 179 579**	**80.3**	**11.7**	**92.8**	**17.1**
Westonaria Local	34 766	1 444	50 675	68.6	2.8		
KwaZulu-Natal (10.2m)	**1 606 906**	**123 921**	**2 234 129**	**71.9**	**5.5**	**88.5**	**8.0**
Ndwedwe Local	12 656	202	26 408	47.9	0.8		
Limpopo (5.2m)	**856 869**	**21 345**	**1 215 935**	**70.5**	**1.8**	**90.2**	**3.1**
Fetakgomo Local	13 322	237	21 851	61.0	1.1		
Mpumalanga (3.6m)	**728 132**	**35 148**	**940 403**	**77.4**	**3.7**	**92.3**	**6.3**
Seme Local	13 820	968	21 605	64.0	4.5		
Northern Cape (1.0m)	**163 558**	**14 315**	**264 653**	**61.8**	**5.4**	**75.6**	**6.0**
Karoo Hoogland Local	1 105	216	2 982	37.1	7.2		
North West (3,2m)	**646 156**	**26 479**	**911 120**	**70.9**	**2.9**	**86.4**	**6.0**
Maquassi Hills Local	11 325	421	20 330	55.7	2.1		
Western Cape (4.5m)	**1 0191 530**	**223 001**	**1 369 180**	**74.5**	**16.3**	**85.4**	**18.7**
Laingsburg Local	819	144	1 966	41.7	7.3		

Source: *Abrahams and Goldstuck, 2010, p. 17*

Table two and Table three below compares the South African household ICT and broadcasting penetration rates by service types in various district municipalities and majority of the district municipalities are classified as rural areas. The survey findings in Table two and Table three below indicate a huge disparity exists as households in district municipalities with access to radio, cellphones, television and telephones indicate a high penetration rate whilst households with computers and Internet access indicate having the lowest penetration levels. The tables indicate that 65% of the district municipalities have "an average penetration below that of the national average" of 42% (DoC, 2008, p. 21). Table two below highlights the access gaps that exist in South Africa indicating a national average of 7% in internet penetration and 16% in computer penetration across the district municipalities which is extremely low in comparison to the national average across all the 6 services of 42.7%.

Table 2: SA Household ICT and Broadcasting penetration by service type, by district municipality

	Number of Households	Cellphone	Computer	Internet access	Television	Telephone	Radio	Average of 6 service types
DC15: O.R. Tambo	356085	60%	2%	1%	32%	2%	58%	25.7%
DC44:Alfred Nzo	102011	58%	2%	0%	32%	1%	68%	26.9%
DC14: Ukhahlamba	90310	59%	5%	1%	37%	5%	67%	29.1%
DC43: Sisonke	105660	61%	4%	2%	36%	4%	68%	29.1%
DC24: Umzinyathi	104534	65%	4%	2%	32%	6%	69%	29.5%
DC13: Chris Hani	203041	59%	3%	1%	46%	6%	65%	29.9%
DC27: Umkhanyakude	114974	72%	2%	1%	36%	2%	74%	31.1%
DC47: Greater Sekhukhune	217171	69%	5%	1%	48%	3%	69%	32.5%
DC26: Zululand	155884	73%	3%	2%	42%	4%	74%	33.0%
DC33: Mopani	265290	68%	6%	2%	52%	4%	69%	33.3%
DC29: iLembe	124526	64%	5%	3%	48%	11%	68%	33.3%
DC12: Amatole	458581	63%	7%	3%	54%	9%	69%	34.1%
DC39: Bophirima	100073	66%	6%	2%	57%	7%	69%	34.3%
DC28:Uthungulu	184507	68%	8%	4%	49%	8%	74%	35.1%
DC34: Vhembe	287190	71%	7%	1%	58%	3%	75%	35.9%
DC23: Uthukela	139640	73%	6%	2%	53%	9%	74%	36.1%

Source: *DoC, 2008, P. 20*

Table 3: SA Household ICT and Broadcasting penetration by service type, by district municipality

	Number of Households	**Cellphone**	**Computer**	**Internet access**	**Television**	**Telephone**	**Radio**	**Average of 6 service types**
DC21: Ugu	151622	65%	7%	5%	55%	13%	73%	36.2%
DC45: Kgalagadi	42151	70%	8%	3%	58%	10%	70%	36.7%
DC16: Xhariep	37245	57%	9%	3%	59%	17%	78%	36.9%
DC35: Capricorn	285566	72%	7%	2%	60%	5%	76%	37.1%
DC38: Central	183401	67%	7%	3%	65%	6%	75%	37.1%
DC37: Bojanala	357199	74%	9%	2%	62%	6%	71%	37.4%
DC32;Ehlanzeni	387318	76%	9%	3%	61%	6%	73%	37.8%
DC8: Siyanda	59894	58%	13%	4%	63%	20%	69%	38.0%
DC36: Waterberg	160720	73%	10%	4%	59%	10%	73%	38.2%
DC18: Lejweleputswa	202391	66%	8%	3%	64%	11%	77%	38.3%
DC40: Southern	270444	71%	12%	5%	59%	13%	72%	38.6%
DC19:Thabo Mofutsanyane	187116	67%	9%	3%	64%	11%	83%	39.6%
DC7: Pixley ka Seme	43285	56%	11%	5%	69%	22%	76%	39.7%
DC20: Fezile Dabi	149094	69%	11%	5%	63%	15%	74%	41.2%
DC25: Amajuba	101052	75%	9%	3%	66%	14%	80%	41.5%
DC10: Cacadu	99832	56%	14%	8%	72%	22%	78%	41.6%
DC30: Gert Sibande	247517	75%	12%	5%	65%	11%	80%	42.5%

DC6: Namakwa	36439	57%	14%	5%	72%	31%	76%	42.8%
DC31: Nkangala	305569	81%	12%	4%	67%	11%	82%	43.2%
DC48: West Rand	186850	74%	17%	7%	66%	21%	74%	43.4%
DC22: Umgungundlovu	217877	69%	16%	7%	67%	23%	78%	43.9%
DC17: Motheo	227026	72%	16%	6%	70%	15%	84%	44.7%
DC5: Central Karoo	15708	55%	13%	7%	78%	33%	82%	44.7%
DC46: Metsweding	46503	82%	20%	7%	68%	15%	78%	44.8%
DC42: Sedibeng	241223	73%	16%	5%	78%	16%	82%	45.2%
DC9: Frances Baard	82889	66%	17%	8%	77%	26%	78%	45.3%
NMA: Nelson Mandela Bay Metro	276881	65%	20%	8%	80%	29%	79%	46.8%
EKU: Ekurhuleni	849350	80%	22%	10%	72%	22%	78%	47.4%
ETH: eThekwini	833859	78%	19%	9%	74%	32%	80%	48.8%
DC2: Cape Winelands	173345	69%	22%	10%	81%	31%	82%	49.2%
DC4: Eden	141578	71%	23%	13%	78%	31%	81%	49.4%
TSH: City of Tshwane	686639	83%	29%	13%	74%	25%	81%	50.7%
DC1: West Coast	76215	72%	22%	10%	83%	35%	84%	51.1%
DC3: Overberg	60057	69%	23%	13%	82%	37%	83%	51.2%
JHB: City of Johannesburg	1165014	82%	26%	14%	78%	29%	82%	51.7%
CPT: City of Cape Town	902278	77%	34%	19%	86%	47%	84%	57.9%
Total	**12500624**	**73%**	**16%**	**7%**	**66%**	**19%**	**77%**	**42.7%**

Source: *DoC, 2008, p. 21*

It is quite evident from the statistics above that broadband and Internet adoption remains significantly low in South Africa which is further supported by the results of the community Survey of 2007 (Statistics South Africa, 2007). Majority of the rural areas such as OR Tambo, Sedibeng and Metsweding District municipalities sit with an Internet penetration rate that is well below the average of some of the District municipalities that are classified as urban areas such as City of Cape Town, City of Johannesburg and City of Tshwane as highlighted in table two and table three above signifying the internet access gap that currently exists between the rural and urban areas.

1.4 A global review of rural broadband market development

Although broadband is identified as a driver for socio-economic growth globally the digital divide between the rural and urban areas remains a common challenge with similarities across countries on the nature of challenges being faced. Preston, Cawley & Metykova (2007) identifies some of these contributing challenges facing the rural communities in the European Union as the rural / urban migration which tends to see the young able individuals moving from rural to urban areas leaving an ageing population behind in the rural areas, this trend has been a noticeable especially in “the former East Germany region and Midlands in Ireland” (Preston et al, 2007, p.394). This has contributed significantly to the rural communities in the European Union being much slower adopters of broadband services in comparison to their urban counter parts and a lack of support in the form of training and IT skills has further exuberated the problem. A lower degree of broadband infrastructure investment and the presence of significant market failure have been visible in the rural regions of the European Union while government interventions to address these challenges have in most cases not been successful (Preston et al, 2007, p.394). According to Preston et al (2007), in the rural communities with broadband access there has been “a lack of competition in broadband infrastructure and service provision, resulting in inadequate supply and even prohibitively high prices” (Preston et al, 2007, p.394). Lower incomes and lower purchasing power for the total cost of broadband access is a common challenge facing rural households in the European Union in comparison to the urban households and urban centres which "act as sites of job and wealth creation" (Preston et al, 2007, p.394). Some of the national and local policy initiatives that have been implemented by several European Union countries include the subsidisation of network construction by national governments and in the case of Ireland national government took the initiative to build its own Metropolitan Area Network infrastructure (Preston et al, 2007, p.394). "European Union member states have sought to encourage broadband rollout within a liberalised and competitive market framework, however with urban areas drawing most attention and money, the predominantly "market driven" approach often fails to provide adequate rural broadband services (e.g. Spain, Austria, Ireland)" (Preston et al, 2007, p.394). A large emphasis on the supply side and little focus on the demand side has been a common feature of the national broadband strategies with "a lack of coordination between policies on infrastructure rollout and policies on the development of applications, content and services" (Preston et al, 2007, p.395). In Hungary many rural communities remain without access to broadband services while the urban centres remain connected. A similar scenario presents itself in Poland and Slovakia where broadband infrastructure is unevenly distributed with the rural areas remain without access to broadband (Preston et al, 2007, p.396). Some of the measures that have been implemented to tackle the rural urban divide in the European Union countries include joint Public and private initiatives to build broadband infrastructure. Government subsidized initiatives have been introduced to address the provision of broadband access to regions with underdeveloped infrastructure through the European Union's structural fund (Preston et al, 2007, p.396). The Slovak and Hungarian governments in particular have initiated programmes that offer "one-off financial support for those who purchased a PC or a broadband connection" (Preston et al, 2007, p.396). Other measures implemented include the introduction of policies that address "the lack of IT skills or content" and information disseminating programmes by the Slovak government that are aimed at educating targeted groups on ICT and "the spread of digital content" (Preston et al, 2007, p.397).

1.5 Challenges facing rural areas in South Africa around Broadband market development

Some of the challenges that South Africa faces include the unavailability of ICT infrastructure, lack of commitment from the "provincial and local government" in the coordination of "ICT programmes and policies for national benefit and homogeneity" (DoC, 2010, p. 5). With an increasing trend in private and public services being provided online, the inability to access broadband by majority of the population becomes a public policy problem. The DoC (2010) also identifies that "the funding of broadband services in South Africa is both fragmented and uncoordinated" (DoC, 2010, p. 5). Broadband infrastructure availability in South Africa tends to be confined to urban areas and tends to be limiting in terms of being too costly and inaccessible by all. One of the disadvantages highlighted by the DoC (2010) that is as a result of the inaccessibility of affordable broadband services is a widening digital divide which negatively impacts the rural areas and remote communities. The provision of broadband into rural areas remains a major economic and technical challenge as costs remain high in low population density areas and technical constraints are encountered when providing broadband over longer distances. The broadband market structure has created challenges in the development of services and this has mainly been attributed to the existence of monopolistic structures in the provision of broadband infrastructure. High barriers to entry also characterize the South African market and the monopolisation of infrastructure by incumbent operators prevents new entrants from providing their own infrastructure and competing in the market hampering the development of effective competition in the market.

Network providers in South Africa are discouraged from rolling out network infrastructure into rural areas due to the low return of investment as a result of a small subscriber base (DoC, 2011). Building a national backbone requires a huge amount of capital which makes it commercially unviable for operators to offer broadband services in rural areas. Broadband infrastructure based on "wireless broadband technologies: has been rolled out by mobile operators however majority of the network rollout has been concentrated in "urban and semi-urban areas, with little in-roads into rural areas" (DoC, 2011, p. 13). This has resulted in low broadband penetration in rural South Africa of between 2% to 5% (DoC, 2011).

The level of ICT infrastructure deployed in rural areas according to the DoC (2011) is limited and in areas where access to ICT is available the people lack the technical knowledge required to utilize the technology. In addition rural areas fall short or lack the necessary human resource skills critical for the support of ICT technology which is a result of skilled ICT resources migrating from rural to urban areas in search of better opportunities. Majority of the rural people cannot afford any form of ICT due to the high cost of communication and poverty. In addition the lack of relevant local content in rural communities decreases their chances of "equitable access to ICTs" (DoC, 2011, p. 15). Low literacy levels and language barrier is another challenge that rural areas face and this becomes a problem when considering increasing the internet penetration in these areas since majority of the rural people can only read and communicate in their local language while majority of the internet content is presented in the English language. Majority of the SME's in rural areas are also not exposed to latest trends in "current thinking" which results in a "lack of entrepreneurial acumen and culture" (DoC, 2011, p. 15).

Motivating operators to build infrastructure in areas where the return on investment remains low due to minimal usage and low population density remains a challenge. In comparison the population density in urban areas remains high making the returns on investments more attractive a challenge that ICASA is cognisant of. Infrastructure sharing by operators is one of the solutions being touted which aims at reducing the costs of building infrastructure into rural areas (Wilson, 2012). In line with the spectrum allocation plans announced recently, "ICASA has stipulated fairly stringent coverage targets for companies that get access to coveted spectrum in the

800MHz (suited for rural areas) and 2.6GHz frequency bands in 2012" (Wilson, 2012). However the release of the 800MHz band by broadcasters remains a long wait despite the looming deadline, the broadcasters are only able to migrate from the 800MHz band by 2015 which leaves the rural areas with a longer wait for broadband access (Wilson, 2012). Communication increases the attractiveness of rural areas as "investment destinations" and the investment in broadband networks in rural areas will go further in alleviating the lack of attractiveness of rural areas and the need for people in rural areas to migrate to urban areas (DoC, 2010, p.11). Limited information exists that provides detailed insight into the challenges faced by rural areas in South Africa in the provision of broadband access hence the main source of information has mainly been drawn from the DoC.

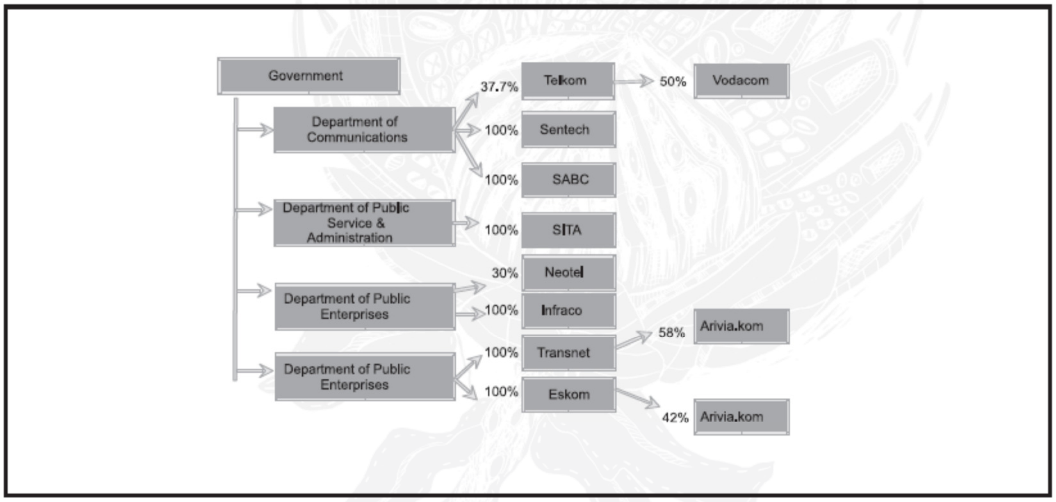
1.6 Broadband Policy and Regulation Analysis: Review of the South African Market

Gillwald (2005) argues that the adoption of "International reform models" has been the main barrier to access being affordable and the market being innovative. The current Market structure is identified by Gillwald (2005) as the root cause of the monopolies that exist and the existence of an ineffective regulator. In order to address the disparities and inequalities that exist in developing countries a different approach needs to be adopted that involves strategic regulation that focuses on the achievement of "national developmental objectives" and a new policy approach that involves the market being restructured with the goal of eliminating anti competitiveness (Gillwald, 2005). These measures are critical in ensuring that innovative services are provided to underserviced areas and barriers to entry are lowered to cater for new market entrants that are critical in the development of the "information infrastructure" (Gillwald, 2005).

Gillwald (2007) further highlights the challenges facing South Africa as the relatively low adoption of broadband while the affordability of broadband services such as ADSL and mobile broadband remain relatively high. Gillwald (2007) pegs these problems to being as a result of "limited competition and ineffective regulation" (Gillwald, 2007, p. 53). South Africa adopted two contradicting broadband policy approaches which have been a barrier to the sector progressing "despite Governments acknowledgement of its centrality to a modern economy and information society" (Gillwald, 2007, p. 53).

One of the policy approaches involved "a local adaptation of the international telecommunications reform model" through a "managed liberalisation" process (Gillwald, 2007, p. 53). This resulted in the market being, structured "around a number of vertically integrated operators, fixed and mobile, whose services have evolved to offer broadband" (Gillwald, 2007, p. 53). The most recent update of this model involved reforming "the regulatory and licensing framework" with the aim of addressing challenges relating to convergence (Gillwald, 2007). These reforms were detailed in the last update of the Electronic Communications Act (ECA) in 2006 but despite the reforms the cost of broadband services remains high while the adoption of broadband services has remained very low. The Government resulted to adopting a second strategy as part of its current reform process which involved the introduction of a broadband operator, Broadband Infraco that was 100% state owned. The second strategy was aimed at enabling the provision of low cost international bandwidth via undersea cable and breaking Telkom's monopoly in the provision of International bandwidth which had resulted in high costs of international bandwidth (Gillwald, 2007). The second policy strategy highlighted the increasing involvement of government in ICT investment and state ownership as highlighted in figure 10 below which contradicts the first global policy approach adopted of an international telecommunications reform model.

Figure 10: Government Ownership



Source: *Gillwald, 2007, p. 60*

Gillwald (2007) highlights that adopting an international reform model "seeks to transfer investment risk from the public sector to the private sector through the privatisation of state telecommunications assets and the liberalisation of traditionally monopoly markets" (Gillwald, 2007, p. 56). The model requires that an independent regulator manages the processes to the benefit of the public and requires that powers and activities are separated "between policy formulation, policy implementation and telecommunications operations" (Gillwald, 2007, p. 56). The model proposes that policy formulation should be government's responsibility while ownership of telecommunication networks must be left to the private sector and must be separated from the state. However the "managed liberalisation" policy approach has failed due "to the uneven implementation of the reform model, particularly liberalisation and autonomous regulation" (Gillwald, 2007, p. 56).

Between 1994 and 2001 the policy focus was centred on addressing the access gap that existed in South Africa however due to financial constraints this prevented Government from investing directly in the provision of access. This resulted in Telkom being granted exclusivity as a fixed line operator in return for achieving certain access roll out targets set out by Government. However the policy outcomes of this policy approach resulted in Telkom failing to meet its access roll out targets for fixed line services while on the other hand mobile penetration grew at a rapid rate due to a competitive mobile market (Hodge et al, .2008).

Between 2002 and 2005 the policy focus shifted to mobile access technology as a result of its success in achieving increased penetration and adoption. This resulted in Vodacom and MTN being slapped with access roll out targets for mobile phones and SIM cards. Subsequently government introduced Universal Service Access Licenses (USALs) as a vehicle of addressing the outstanding infrastructure gaps and a means of not burdening new entrants with high access targets. This policy approach however failed in meeting its goals which was as a result of a failed USALs framework that “had little impact on access” and roll out targets for mobile phones and SIM cards which were not achieved (Hodge et al, 2008).

Between 2006 to the current period the policy focus shifted to cost and competition while on the access side “the focus shifted to broadband infrastructure and the internet as an education tool and as a critical business tool” (Hodge et al, 2008, p. 6). The policy framework focused on Governments investments shifting to state owned corporations such as Sentech and Broadband Infraco which were used as vehicles “to achieve the cost and access goals” (Hodge et al, 2008). This policy approach resulted in Sentech’s failure to make any progress in the provision of “wireless broadband infrastructure” to the rural areas. This highlighted the critical need for the regulator “to have enabling legislation in place before entry rather than having the process of putting regulation in place after the entrant has been licensed” (Hodge et al, 2008, p. 70).

The cost of Broadband remains significantly high in South Africa in comparison to global destinations, which makes the task of increasing broadband penetration in South Africa a Universal Access and Services challenge (Hodge, Lipschitz, Sheik, & Aproskie, 2008). “Cost-competitiveness and universal access emerged as the primary, overarching objectives for telecommunications policy in South Africa" (Hodge et al, 2008, p. 4) and form the criteria for judging the success or failure of the policy.

The draft broadband policy document issued in 2009 with the aim of addressing increased access and broadband affordability in South Africa failed to address key issues affecting sector development such as market structure, institutional structures and existing constraints (Esselaar et al, 2010). Esselaar et al (2010) highlight the areas that the broadband policy document failed to address as the lack of mention of a regulatory framework, the lack of reference to Broadband Infraco and the need for the coordination of state owned corporations in the rollout of broadband. The lack of reference to an open access model that is key in "driving the rapid development of the broadband market, creating local champions, enabling rapid deployment in poorer areas and creating opportunities for innovation and small and medium enterprises" were further gaps highlighted in the document (Esselaar et al, 2010, p. 16). Esselaar et al (2010) further highlights that the policy document does not address spectrum usage and rights of way which are critical in enabling the rollout of broadband infrastructure. The policy document "is not integrated into national economic growth and development strategies" and the lack of "a demand stimulus strategy" and Government coordination across sectors raises concerns around the effectiveness of the policy document (Esselaar et al, 2010, p. 16).

Adopted in July 2010 the focus for the broadband policy has been on having "an all inclusive information society that can enjoy the economic benefits associated with broadband in both urban and rural areas" (DoC, 2010, p. 4). The broadband policy document outlines the key policy areas as:

a) Access which focuses on enabling universal access to broadband services through the provision of infrastructure, enabling universal access to broadband networks by addressing "access to international networks, national backbone networks and local networks" (DoC, 2010, p. 13), the provision of broadband services to needy persons through subsidy provision and the provision of broadband services to legal persons by enabling broadband access in both private and public institutions aimed at stimulating broadband adoption by government departments. The policy is also cognisant "that the radio frequency spectrum is a scarce national resource and that the allocation shall be guided by the developmental objectives in the public interest" (DoC, 2010, p. 13).

b) Affordability whose goal is to increase competition aimed at enabling the low cost of broadband services to the benefit of consumers, businesses and the government. The policy is aimed at enabling increased competition "in both electronic communications network services (ECNS) infrastructure and electronic communications services (ECS)" (DoC, 2010, p. 14).

c) Usage whose main focus is the increased "uptake and usage of broadband" (DoC, 2010, p. 14) services in both rural and urban areas, the creation of increased public awareness of the benefits of broadband in both rural and urban areas and increased security aimed at creating confidence in the use of broadband services by broadband users.

The DoC (2011) issued draft spectrum policy directions on the 800MHz and 2.6GHz spectrum bands also referred to as the high demand spectrum or digital dividend aimed at bridging the digital divide and the rural and urban divide (DoC, 2011). The 800MHz frequency band enables wider broadband coverage requiring less base stations and indoor and in building coverage while the 2.6GHz frequency is suitable for the provision of high capacity which is key in carrying traffic in areas that are densely populated. The policy directions are aimed at ensuring "that the award of licences in high demand parts of the radio spectrum is directed towards the attainment of the goals of universal service and access for all" (DoC, 2011, p. 6) and enabling broadband services to the market at much lower costs. The policy directions focus on 3 key areas which are:

a) To enable the entry of new national and rural providers of broadband and electronic services (DoC, 2011).
b) To enable the participation of broad based black economic empowerment licensees (DoC, 2011).
c) To drive the "uptake and usage of electronic communications in rural and urban poor settlements" through the imposition of "universal access and service obligations" (DoC, 2011, p. 6).

No progress has been made to date on the implementation of these two policies yet which is partly to be blamed on the department's constant change of ministers (Tullett, 2012) and the constantly changing policy directions. "The department has been through numerous cycles of discussion, hampered by the procession of ministers through its doors, each taking time to get up to speed and evaluate their options, engage in consultation and make tentative steps towards strategic goals before being replaced and restarting the process" (Tullett, 2012). Barely after issuing policy documents that address the broadband and spectrum direction the minister of communication Dina Pule recently at the ICT colloquium held in Midrand called for the overhaul of South Africa's ICT policies which involved consolidating "all policy on broadcasting services in the digital environment; broadband and internet access; spectrum licensing framework for the country's development; new regulatory areas" (Voster, 2012) into an national integrated ICT policy that's to be implemented by 2013. The minister pins this shift in focus "from an evolutionary policy design to more integrated and comprehensive ICT policies" as being aimed at supporting the DoC goal of "achieving 100% broadband coverage and increased access for rural areas" (Odendaal, 2012). The shift in focus is also pinned on the draft broadband policy document which failed to deal with a couple of challenges which are outlined as the "market structure and the regulatory environment" (Odendaal, 2012).

The constant shift in policy directions raises key questions on the capabilities of the DoC to implement policies and poses major challenges to South Africa achieving its goals of enabling universal broadband access to all especially to rural communities.

1.7 Universalisation of broadband in South Africa

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 society regardless of income level and geographical location and lastly that the services are easily accessible by people with disabilities (Msimang, 2003). Some of governments objective in promoting Universal Access and Services policies include “the promotion of political and social cohesion through the integration of isolated communities into mainstream society and the elimination of economic and social disparities between the information rich and information poor” (Msimang, 2003, p. 30). These policies remain critical in accelerating “social and economic development” through telecommunications (Msimang, 2003, p. 30). South Africa currently sits with a mobile penetration rate of 113% (Lange, 2010), and voice revenues have been on a decline while data traffic on the networks has faced an increased growth (Wilson, 2011). South Africa has an internet penetration of 12.5% or 6.2 million Internet users out of a population of 49.8 million people while the number of broadband subscribers stood at 2.4 million which indicates a broadband penetration of 5 % in 2010 (Lange, 2010). In terms of fixed broadband Internet South Africa had 1.5 Fixed Broadband Internet subscribers per 100 people in 2010 in comparison to the global average of 7.8 Fixed Broadband Internet subscribers; this was according to the World Development Indicators (The World Bank, 2010), these statistics indicate South Africa was lagging behind the global average. These statistics highlight that a significant disparity or gap exists between mobile access and broadband access in South Africa. ANC (2012) highlight that South Africa’s performance especially on universal access to Internet has fallen behind which is amongst one of the many other key global ICT indicators where its performance lags behind. The ANC (2012) goes further to state that South Africa has failed to fully utilize the opportunities presented by the technological advances and partly blames this failure on a “fragmented and uncoordinated policy and institutional arrangements” (ANC, 2012, p. 6). Although the DoC (2010) has set targets for data electronic communications services which are highlighted as the availability of the service to 90% of households which includes broadband access and affordability of the service to 60% of households whose cost should not be more that 5% of the household's total expenditure (DoC, 2010, p. 4). These targets remain far from being achievable as the cost of broadband services continues to hamper growth and development due to its affordability for the majority of the South African population being out of reach. Universal service is defined as every household having access to a fixed line telephone services in the country while universal access is defined as everyone in the community having access to a public telephone service which could be for example a public payphone (Msimang, 2003). Universal Access and Services policies are aimed at extending availability and affordability of ICT services to underserved areas which includes "those in high cost areas, such as rural and remote regions, as well as lower income groups" (Intven & McCarthy, 2000, p. 61). Although the initial scope of South Africa's universal service and access policies only catered for the provision of fixed line telephone services and access to public payphones, mobile voice penetration sits at over 100% indicating that South Africa has infact achieved universality of mobile voice services. Broadband's growing importance due to its economic impact and its increased use however raises questions on whether broadband should form part of the scope of Universal Access Services with the ultimate aim of enabling the reach to all members of society and especially communities in the rural and underserved areas. USAASA (2009), acknowledges that convergence and new services such as broadband, VOIP and email have proven challenging to "traditional universal service policies and the means by which universal service objectives are currently met" (USAASA, 2009, p. 16). USAASA (2009) also acknowledges that these new services which includes broadband affordability and availability and the transport networks for these services needs to be included in the scope of Universal Access Service. The DoC (2010) acknowledges the importance of broadband in achieving digital inclusion and enabling universal access to affordable ICT and in the broadband policy document describes its vision as "to ensure universal access to broadband by 2019 by ensuring

South Africans are able to access broadband either individually, or as a household, subscribe to a broadband service, or are able to access a broadband service directly or indirectly at a private or public access point" (DoC, 2010, p. 7). This policy stance signifies public policies seriousness in ensuring that broadband is made accessible to all and particularly to underserved communities such as rural areas with the aim of achieving digital inclusion for all. However broadband is currently not included in the scope of universal access and services policy despite the declining voice revenues and the growing importance of broadband and this presents a problem if the target is to achieve broadband access to all.

1.8 Metsweding District Municipality

Metsweding District Municipality which remains the focus of this research forms part of north-eastern Gauteng and is situated next to Tshwane and Ekurhuleni Municipalities and comprises of Kungwini and Nokeng Tsa Taemane local municipalities. Metsweding covers 4169 km^2 of land of which 2202km^2 is in Kungwini and 1967km^2 is in Nokeng Tsa Taemane (Metsweding District Municipality, 2011). Metsweding District Municipality is largely rural with Urban and Peri-Urban localities. Peri-Urban areas are defined by Plessis (2008) as "formerly rural localities that are now, due to the rapid expansion of South Africa's metros and major towns, directly in the path of urbanization" (Plessis, 2008, p. 2). Cullinan, Bronkhorstspruit and Rayton are classified as urban towns and "are identified as nodes in the Metsweding District Area" (Metsweding District Municipality, 2011, p. 31), while the Hammanskraal areas form part of the end of the provincial urban edge and the peri-urban lies on the western boarders of Tshwane. The rural settlements which are classified as small holdings with rural characteristics are situated outside the urban edge while the intensive rural areas form part of the Northern area of Nokeng Tsa Taemane with agriculture being the main form of activity in this area (Metsweding District Municipality, 2011).

Figure 11: Metsweding District Municipality Population Figures

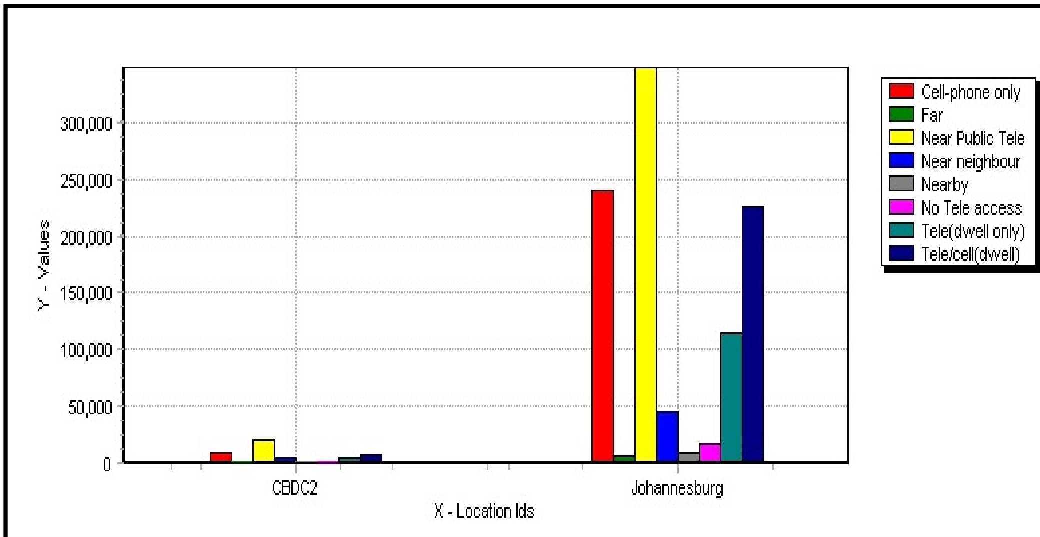
Municipality	Population 2001	Population 2010	District Population as %	Growth rate
Nokeng Tsa Taemane	53,201	59, 172	30%	1%
Kungwini	107,063	135,970	70%	3%
Metsweding	160,273	195, 142	100%	2%

Source: *Metsweding District Municipality, 2011, p. 11*

According to the Metsweding District Municipality (2011) there were an average of 51, 000 households in 2009 in Metsweding District Municipality with the population "estimated at 160, 273 in 2001, and was expected to increase to 195,142 in 2010" (Metsweding District Municipality, 2011, p. 10) as highlighted in Figure 11 above. The Population in Kungwini local municipality was estimated at 107, 063 in 2001 and expected to grow to 135, 970 in 2010, while the population in Nokeng Tsa Taemane local municipality was estimated at 53, 201 in 2001 and expected to grow to 59, 172 in 2010 as highlighted in Figure 11 above.

Metsweding which has always been viewed as a rural area on an urban edge has a significant agricultural base that is underdeveloped. Diamond mining which is based in Cullinan forms one of the main economic activities of Metsweding and has also contributed to the tourism growth in the area. Tourism which is a growth area for Metsweding offers visitors activities ranging from recreational activities in Roodeplaat Dam, mining and heritage tours in Cullinan and eco-tourism (Metsweding District Municipality, 2011).

Figure 12: Comparison of Metsweding to City of Johannesburg Access to Telecommunication Services



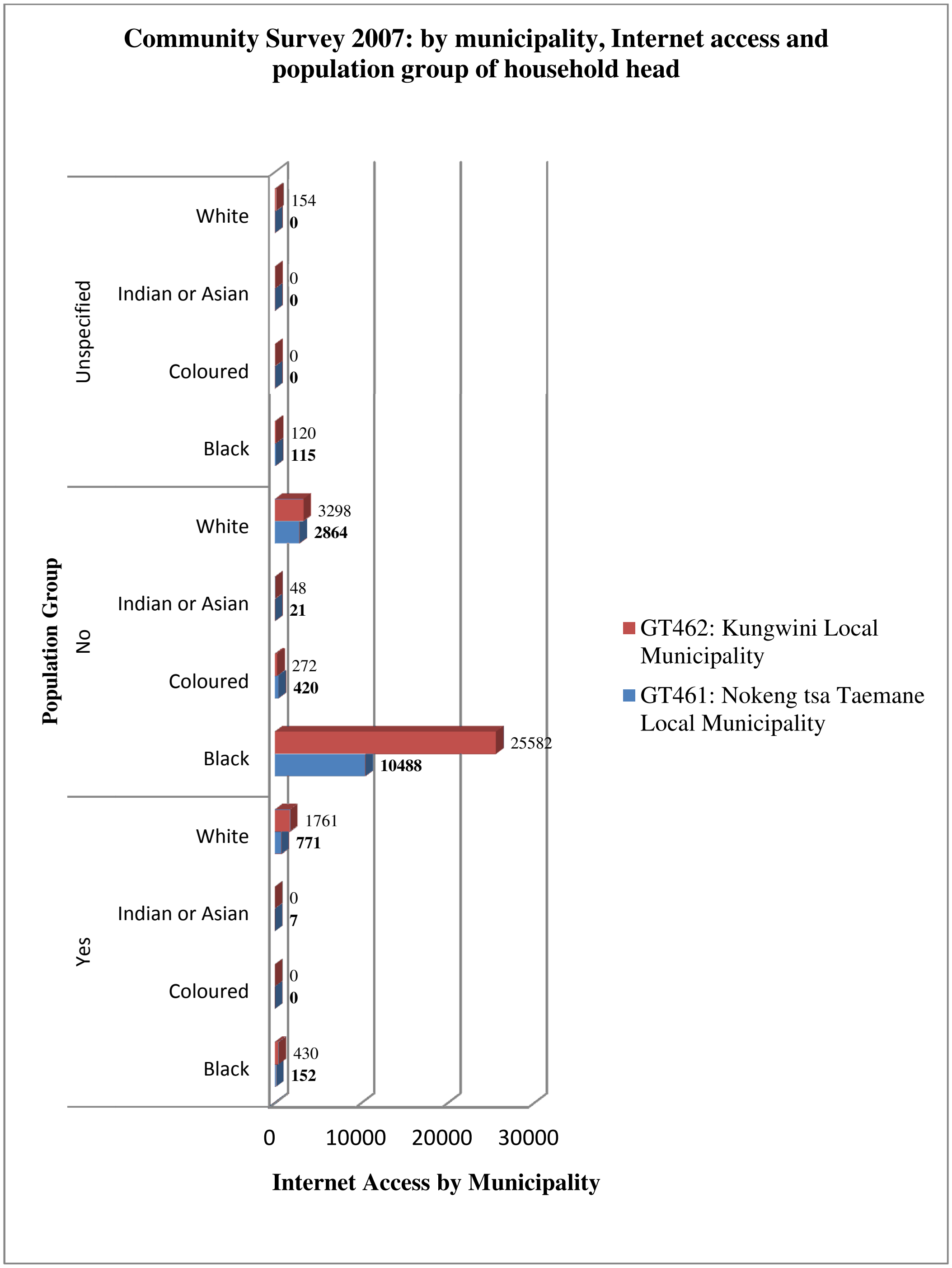
ID	LOCATION	Cell-phone only	Far	Near Public Tele	Near neighbour	Nearby	No Tele access	Tele (dwell only)	Tele/cell (dwell)
CBDC2	Metsweding District Municipality	8998	816	19154	3348	1126	1177	3215	6554
Johannesburg	City of Johannesburg Metropolitan Municipality	239625	5624	349634	45494	8914	17038	113972	226537

***Source:** Statistics South Africa Census, 2001*

In comparison to the City of Johannesburg the access levels to basic telecommunications services significantly lags behind in Metsweding District Municipality as illustrated in Figure 12 above which indicates a huge disparity that exists between the municipalities. Table 3 above also indicates that the level of household penetration in Metsweding District Municipality of Computers sits at 20% and Internet access sits at 7% which is significantly low in comparison to the City of Cape Town and Johannesburg. Metsweding District Municipality sits with a computer penetration in households of 20% as indicated in Table 3 above which is not far off from the City of Johannesburg which sits with a computer penetration of 26%. The Internet penetration in households however lags behind at 7% penetration in Metsweding District Municipality in comparison to 14% penetration in the City of

Johannesburg signifying an internet gap. Although the 2001 national statistics did not measure Internet penetration, the 2007 community survey did measure Internet penetration which indicates that there are households with Internet access in Metsweding as indicated in Figure 13 below.

Figure 13: Community Survey 2007 by municipality, Internet access and population group



Source: *Statistics South Africa Community Survey, 2007*

1.9 Summary of the problem

Broadband adoption and usage in rural areas remains relatively low and this has been attributed to the underdeveloped broadband ecosystem that currently exists. Rural areas are characterised by extremely low access to basic services such as communication infrastructure in comparison to urban areas. Satellite technology seems to be the main form of technology provided to rural areas by fixed operators due to the lack of physical telecommunication infrastructure while wireless broadband infrastructure provided by mobile operators is concentrated in urban areas. Major ISP's are focused on providing services to the business segment with no focus on rural areas. Spectrum allocation plans are currently in process in relation to the digital dividend spectrum that aims to address the digital divide and provision of access to rural areas. However broadcasters will only be able to migrate from the 800MHz band by 2015 as opposed to the initial target date of 2012 which leaves rural areas with a longer wait for broadband access (Wilson, 2012). Affordability of broadband services remains relatively high which is attributed to the limited competition that exists and ineffective regulation (Gillwald, 2007). The existing market structure is to be blamed for the existence of monopolies and ineffective regulation (Gillwald, 2005). Adopting International reform models as opposed to a national strategy is to blame for the high cost of broadband access and lack of the market being innovative (Gillwald, 2005). Overall South Africa has lagged behind significantly in the provision of broadband access in comparison to the global average. And broadband is currently not included in the scope of universal access and services policy despite the declining voice revenues and the growing importance of broadband. The constant shift in policy direction that addresses broadband poses a major challenge to South Africa achieving its goals of extending broadband reach to rural areas.

Factors that could be contributing to the problem include limited availability of telecommunication infrastructure, the low levels of access, the lack of affordable broadband services and the high levels of poverty in rural areas. Taking these factors into consideration this research study aims to establish an understanding of the barriers that currently exist in rural areas that prevent broadband market development and also seeks to establish whether existing policies and regulation have addressed these gaps sufficiently.

CHAPTER TWO: THE BROADBAND ECOSYSTEM

2. Introduction

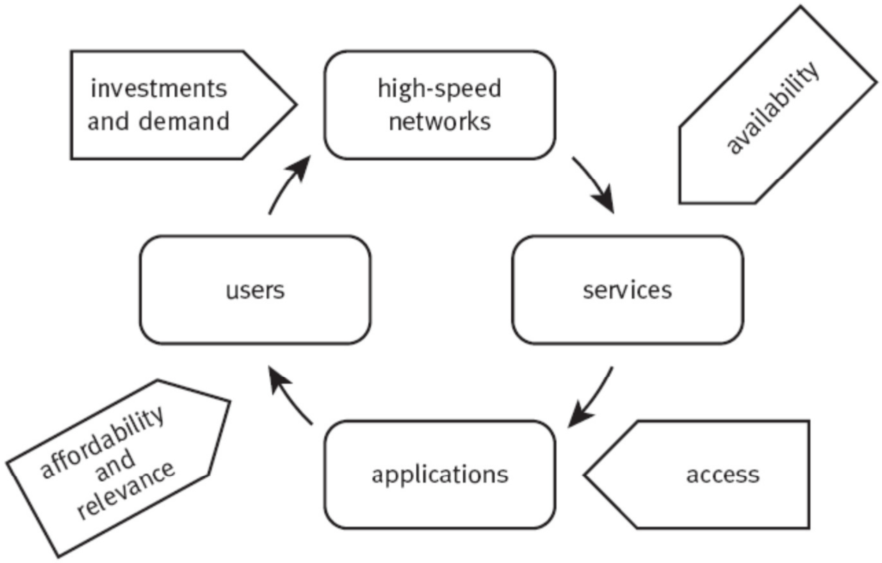
This chapter provides a detailed view of the global thinking on the conceptual and theoretical frameworks outlined in this research study. The sections have been structured in a logical format that outlines the interdependencies that exist between the broadband ecosystem, policy and regulation. The chapter starts by outlining why a broadband ecosystem framework approach was used as opposed to a policy approach in developing the broadband market. This is followed by an overview of each broadband ecosystem components and the key elements within these components that need to be factored when developing a conceptual framework for broadband development. This is followed by a review of the economic value of broadband and global examples of how broadband has made an impact on various sectors of the economy. The next section highlights the interdependencies that exist between supply and demand side factors and the absorptive capacity and the effect that these elements ultimately have on the economy. This is followed by points for consideration when analysing and designing policies for broadband development. This section will also examines the important role that regulation and universalisation plays in broadband development by reviewing theoretical frameworks that include the economic theory of regulation and the public interest theory. The next section provides an overview of the global thinking on the importance of universal access in bridging the digital divide and its importance in broadband market development. The last section provides an analysis of the essential facilities doctrine and competition policy which plays an important role in enabling broadband market development. The chapter will then close with the conclusion.

2.1 The Broadband Ecosystem approach

Melody (1996) highlights the importance of policy makers utilising an "analytical framework" as a base for formulating "information society policies that reflect the particular circumstances, needs and priorities of different countries" (Melody, 1996, p. 244). The literature reviewed in this section echoes Melody's thinking and proposes a broadband ecosystem framework approach for policy makers when formulating broadband policies that promote broadband market development as opposed to a broadband policy approach. Without a full understanding of the complex broadband ecosystem and the strengths and weaknesses that exist within the different elements of the broadband ecosystem, policy makers cannot formulate effective policies that "guide information society developments" (Melody, 1996, p. 244).

The Broadband Ecosystem policy framework by Kim et al, (2010) as illustrated in figure 14 below proposes a holistic approach to broadband development which policy makers and regulators can adopt as a guide when developing a framework that supports the development and universalisation of broadband in their countries. The broadband ecosystem framework proposes that governments develop policies and programmes that focus on the different elements of the ecosystem (Kim et al, 2010). To achieve expansion and use interdependencies, a holistic approach is required in order to produce better results and avoid an incomplete policy or strategy (Kim et al, 2010).

Figure 14: The Broadband Ecosystem



Source: *Kim et al, 2010, p. xxii*

Melody (1996) reinforces this thinking in figure 15 below whereby he highlights the key elements to the "successful development and application of the information infrastructure" as the supply and demand sides. Melody (1996) highlights the importance of technology on the supply side as being able to support the technical capacity required for the provision of an array of required services. Melody (1996) further reaffirms the importance of networks and innovative services in the supply of infrastructure based services. On the demand side Melody (1996) highlights the two main categories as "end users in households" and "applications in organisations" which he indicates are interdependent on each other. Melody (1996) proposes that it is key for a country to establish a plan for "information infrastructure development" with the aim of providing "continuing benefits throughout the evolution to its particular information society" (Melody, 1996, p. 255), an assessment of its circumstances and priorities using the information infrastructure framework. The process according to Melody (1996) involves identify sectors of the economy that require prioritisation in ICT development and application and also involves identifying sectors of the economy where the application of ICT services can overcome the barriers to "economic and social development". This process is in part is also dependant on "domestic priorities for economic and social development" (Melody, 1996, p. 255).

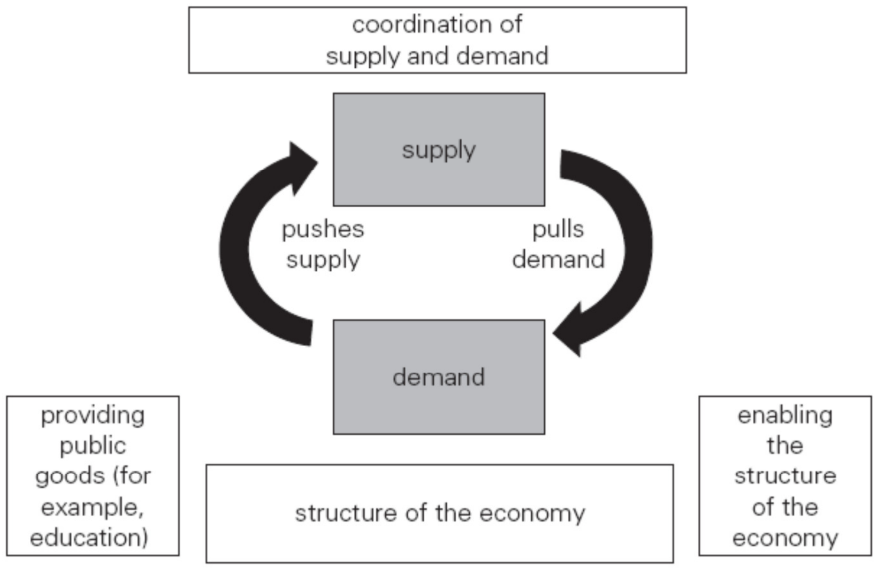
Figure 15: The Information Infrastructure: Ingredients for success

SUPPLY	DEMAND	
(Technical Capacity)	**Application in Organisations (Niche Markets)**	**Household End-Users**
Equipment Supply	Designer Services / Network Development	Demand/Need
Telecom Infrastructure Digital	Skill Development	Skill
- Narrowband	Organizational Reform	Income
- Broadband	Sectoral Reform	Benefits
Special Services / Networks	Reallocation of Resources	Habit Change
Terminals		Reallocation of resources
Skills		
Content		

Source: *Melody, 1996, p. 253*

When analysing approaches to driving broadband development policy makers and regulators need "to recognise the full scope of the challenges that must be addressed" (Kelly & Rossotto, 2011, p. 39). This involves evaluating the challenges that exists within the supply side and demand side components of broadband, thereafter the next step for policy makers would be the development of "specific policies and strategies to address those challenges" (Kelly & Rossotto, 2011, p. 44). Countries with a high broadband penetration according to Kelly & Rossotto (2011) have demonstrated that addressing both the demand and supply factors as highlighted in figure 16 below is critical in driving the successful diffusion of broadband. It is critical for the supply and demand side factor to interact if the goal is to achieve the highest broadband penetration and adoption as highlighted in figure 10 below.

Figure 16: Framework for Government Intervention to Facilitate Broadband



Source: *Kelly and Rossotto, 2011, p. 51*

A broadband ecosystem framework approach ultimately helps identify the roles and the different players including government that are required to play "to cash in on the inter-dependencies among the components of the broadband ecosystem" (Kathuria & Kedia-Jaju, 2011, p. 9).

2.2 Components of the Broadband Ecosystem

Kim et al (2010) proposes three building blocks "defining visionary but flexible strategies, using competition to promote market growth, and facilitating demand" (Kim et al, 2010, p. x), that will support growth of the broadband ecosystem. These building blocks are illustrated as stages of broadband development as shown below in figure 13.

Figure 17: Stages of Broadband Development

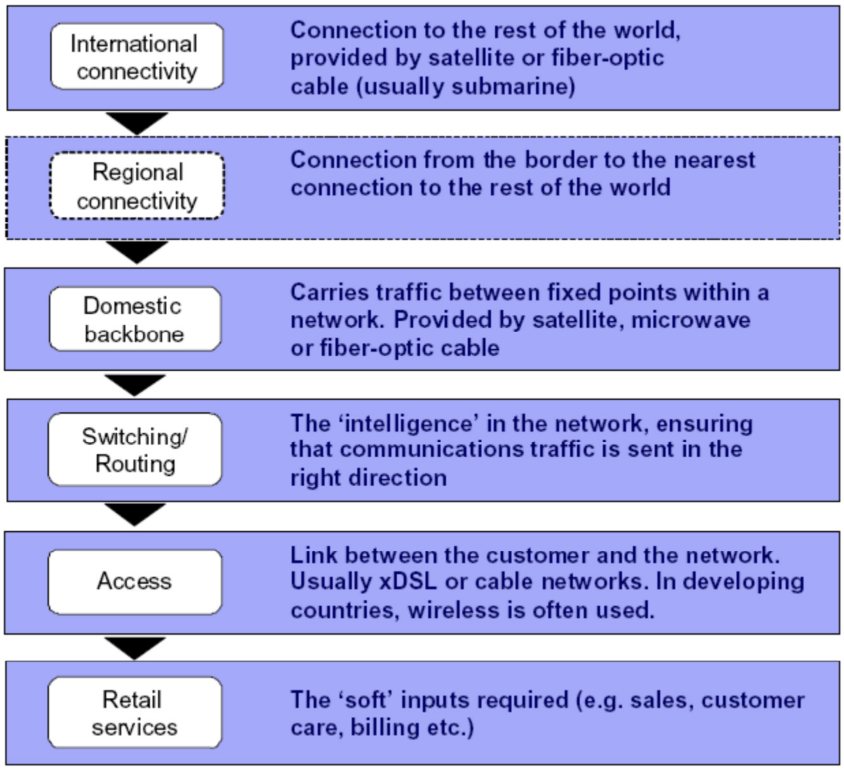
Component	Early stage: Promote	Mass market: Oversee	Universal service: Universalize
Goal	■ Focus on promotional policies as a pump-primer to spread broadband networks.	■ Facilitate competition through consistent, enabling regulation.	■ Universalize broadband service as the market grows.
Networks	■ Develop an enabling environment through policies and regulations that promote investment and market entry. ■ Reduce administrative burdens and provide incentives and subsidies for research and development, pilots, and network rollout. ■ Create certification systems for cyber buildings. ■ Allocate and assign spectrum for wireless broadband services.	■ Consider infrastructure sharing, including unbundling the local loop. ■ Reallocate spectrum to increase bandwidth.	■ Undertake, using public-private partnerships as appropriate, deployment of open access broadband networks in high-cost or remote areas. ■ Coordinate access to rights of way.
Services	■ Provide broadband networks to schools, government agencies, and the like (using the government as an anchor tenant). ■ Standardize and monitor service quality.	■ Create an enabling environment for intra- and intermodal competition. ■ Ensure nondiscriminatory access for service, application, and content providers.	■ Consider expanding universal service obligations to include broadband.
Applications	Undertake government-led demand aggregation, with government agencies as early adopters and innovators. ■ Provide e-government and education applications. ■ Promote creation of digital content. ■ Develop local content and hardware sectors.	■ Support secure, private, and reliable e-commerce transactions. ■ Implement intellectual property protection.	■ Develop advanced e-government programs. ■ Offer grants to community champions and broadband demand aggregators.
Users	■ Provide low-cost computers and other user devices (for instance, in education). ■ Deliver digital literacy programs for citizens.	■ Establish ethical guidelines for information use.	■ Expand universal service programs to underserved communities. ■ Construct community access centers. ■ Subsidize user devices for poor households.

Source: *Kim et al, 2010, p. xxiv – p. xxv*

2.2.1 Broadband Ecosystem Component 1: Networks

The conceptual framework proposed by Kim et al (2010) highlights networks as one of the components of the ecosystem. When defining broadband networks the focus has mainly been on networks that support high speed data connectivity normally above a set minimum threshold. The current minimum threshold defined by the ITU stands at 256Kbps however these threshold standards will differ from country. Williams (2009) describes the network component as a supply chain of elements that consist of networks, processes and business services which is illustrated in figure 18 below.

Figure 18: Broadband Communications Supply Chain



Source: *Williams, 2009, p. 7*

The network supply chain illustrated in Figure 18 above consists of International connectivity which links a country to other countries globally, domestically and the regional backbone networks that carries traffic from the landing station to the point where International connectivity lands and distributes the traffic inland. The next level is the intelligent network which is responsible for the switching and routing of traffic followed by the access network which acts as a link between the core network and the customer. The network component consists of both wireless and wire line technologies that support data communication. Williams (2009) highlights the importance of backbone networks and the role they play in the delivery of ICT services. The backbone network cost becomes more significant if the operator provides broadband access however the cost of the network will vary depending on the subscriber location. This has significant implications on the cost of broadband being delivered to subscribers in rural areas which becomes significantly higher as opposed to subscribers in urban areas where broadband costs become lower due to populations being significantly larger. Williams (2009) suggests that the cost of the backbone networks ultimately determines the commercial viability of supplying broadband services. Fibre optics networks in developing countries is bringing broadband access closer to the users reach and in developing countries wireless networks is growing fast and is more prevalent than wire line broadband (Kim et al, 2010). Policy makers need to adopt a technology neutral approach as the choice of technology networks is dependent “on local conditions such as geographic location, economic prosperity, rural or urban environments and local terrain” (Budde, 2010, p. 29). Compliance to global standards and interoperability is critical in realizing the benefits of broadband and also due to “increased interaction and interdependence between different devices and networks” (Budde, 2010, p. 29). Kim et al (2010) on the other hand proposes that countries need to review their policies and strategic goals together with the envisioned services and applications which will enable them to define network capabilities that match their vision. Network connectivity speeds also need to match the services they envision will be supported on these networks. Kim et al (2010) suggest that setting a minimum standard of connectivity would be counterproductive and insufficient to the countries future envisioned applications and recommend that “connectivity standards should balance ambition with a realistic assessment of supply and demand factors” (Kim et al, 2010, p. 21).

2.2.1 Broadband Ecosystem Component 2: Services

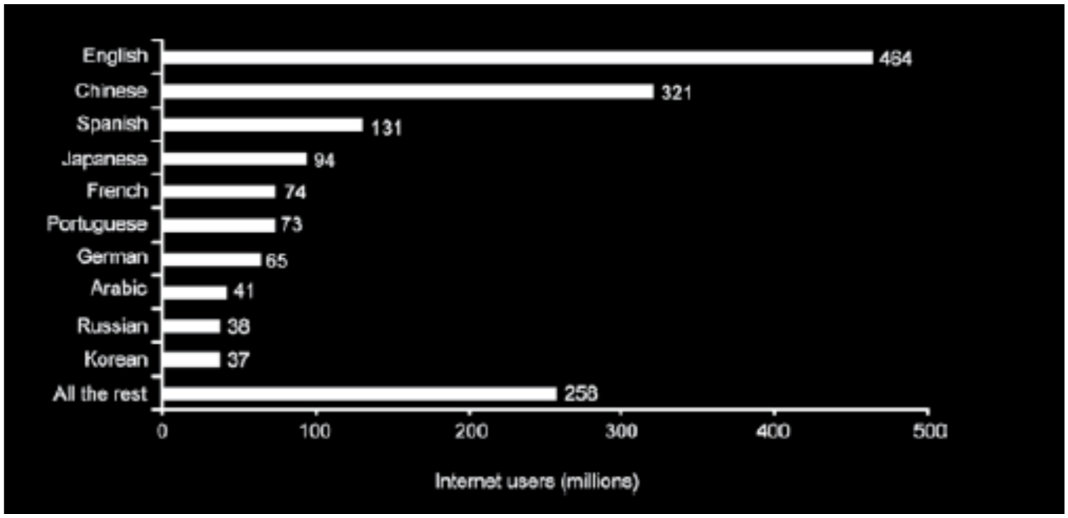
The second component of the broadband ecosystem is services which operators are able to offer to the market once the networks have been established (Kim et al, 2010). The scope of services that are provided over the networks includes videos, voice, data etc. Technology changes such as convergence are changing the mode of service delivery such as video streaming through Internet and television which subscribers can now watch over the Internet known as IPTV (Kim et al, 2010).

However Kim et al (2010) suggest that a number of considerations need to be factored when delivering services one of them being the connectivity speed which will either enhance or provide a bad user experience and suggests that the higher the connectivity speed the better the user experience and performance of the service. Latency is another consideration that needs to be factored when delivering services which Kim et al (2010) define as “the time taken for data to move from source to destination” and is a critical requirement when delivering applications that require real time streaming such as video streaming and online gaming. Another consideration that Kim et al (2010) highlight is the growing demand for bandwidth as a result of an increase in bandwidth intensive applications on the network. Kim et al (2010) indicate that a growing supply of International bandwidth through a rise in submarine cables has resulted in its demand which grew by “54 percent” from 2002 to 2008. Meaningful broadband services should be offered to subscribers at “the highest bandwidth possible at the lowest price… and should also be of high quality, (Kim et al, 2010, p. 22).

2.2.2 Broadband Ecosystem Component 3: Content and Applications

Applications which are the third component of the ecosystem forms a core feature of the ecosystem and are defined as “function-specific software that uses the data stream to deliver content to users” (Kim et al, 2010, p. 24). Providing broadband connectivity without supplying content will in most cases render the technology of no value or relevance (Budde, 2010). The development of online content and applications in addition to the network remains a critical element of the ecosystem (Budde, 2010). Providing online content that’s available in local languages and accessible to individuals with limited literacy remains a major challenge that is also contributes to the growing digital divide. Language diversity on the internet is growing which is evident in the number of non-English speaking people that are visiting the internet as illustrated in figure 13 below. This signifies the growing importance of having content that is available in local languages.

Figure 19: Top 10 Languages (by Internet Users) on the Internet



Source: *Budde, 2010, p. 34*

"Free and open source software is now available that is enabling the creation of localized applications" (Budde, 2010, p. 32). "cloud computing" is enabling the storage and sharing of applications over the internet and users are able to make use of broadband connectivity to access these applications from any location and using multiple devices for connectivity (Kim et al, 2010). The rise in social networking sites is also changing the behaviour of users and businesses as a whole. Businesses are turning to social networking sites such as Facebook and tweeter as a vehicle for advertising which is a move that is "challenging older business models" (Kim et al, 2010, p. 25). Applications is being used as a vehicle to deliver media and content to subscribers with e-government being an example that has enabled government to interact with the public and is driving users to become more digitally literate (Kim et al, 2010). However having affordable technologies remains a critical ingredient in enabling accessibility to application developers that will drive and support the growing number of application developers and applications being developed (Budde, 2010).

2.2.3 Broadband Ecosystem Component 4: Users

The fourth component of the ecosystem is users who are creating and driving demand for new content and media. A growth in user devices that support multimedia content is fuelling the adoption of broadband. Kim et al (2010) highlights user trends that are driving broadband adoption as the drop in the cost of computers, growth in the use of Smartphone devices which "allow users to connect to applications over wireless networks" and thirdly the rise of netbooks due to affordability which are attracting users in the low income brackets. However for broadband adoption to be successful having the knowledge and skills to utilise broadband is critical "which should be considered part of normal cognitive skills development, whether through normal education or lifelong learning" (Budde, 2010, p. 35).

2.3 Economic Value of Broadband

Broadband has changed the way the world operates ushering in an advent of new innovations which have changed the methods of delivering services, how people communicate, transact and do business. Examples 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 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, p. 6). Healthcare is one of the areas where broadband can most make a difference with an estimated 10% and 20% in costs that could be saved in providing Healthcare through the use of telemedicine delivered through broadband. Budde (2011) on the other hand cites examples of Uruguay where every child was provided with access to a laptop and the internet at school that resulted in the project costing the country less than 5% of the education budget but reaping significant educational rewards. The implications for broadband are enormous with an international estimate of 1.3% additional growth experienced in the national “gross domestic product (GDP) for every 10% increase in broadband penetration” (Budde, 2010).

El- Darwiche, Friedrich, Sabbagh & Singh (2011) highlights the critical role that broadband plays in the provision of e-health services at reduced costs and outlines forecasts that suggest that the “U.S. patient monitoring market including home tele-health and hospital wireless telemetry monitoring segments will reach nearly $ 4 billion by 2017” (El- Darwiche et al, 2011, p. 11). In developing countries broadband is being used to deliver mobile health services such as the collection of patient data and delivery of information relating to health to people in rural and remote areas (El-Darwiche et al, 2011). El- Darwiche et al (2011) also suggests that farmers in the agricultural communities can benefit from broadband which can be used as a medium to disseminate information relating to weather forecast and up to date market prices for crops. This creates the benefits of removing the middleman from the equation and creating “market information asymmetry” (El- Darwiche et al, 2011). El- 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)” (El- Darwiche et al, 2011, 2011, p. 13).

Qiang, Rossotto and Kimura (2009), highlight the benefits that broadband has brought to firms as increased productivity, efficiency and cost saving benefits. For these benefits to be realised Qiang et al (2009) indicates that the ability of a firm to combine 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” (Qiang et al, 2009, p. 37). Qiang et al (2009) suggests that firms that integrate broadband with their business process will normally achieve the highest levels of increases in their productivity.

Roller & Waverman (2001) establish that the presence of telecommunication infrastructure has a positive impact on the economic growth of a country through the spill overs and network externalities it creates. The study indicates that this positive impact is mainly achieved where "a critical mass of telecommunications infrastructure is present" (Roller & Wavermann, 2001, p. 909). Roller & Waverman (2001) study further concludes that the critical mass level is only achievable where the telecommunication infrastructure reaches near universal service levels implying that the impact on the economic growth experienced by countries with a less developed telecommunication infrastructure is of a lesser degree. Developing countries that want to experience the significant economic growth impact experienced by developed countries would have to improve their telecommunications infrastructure significantly; however Roller & Waverman (2001) suggest that a framework that also considers investments in both supply and demand side is key in enabling this success.

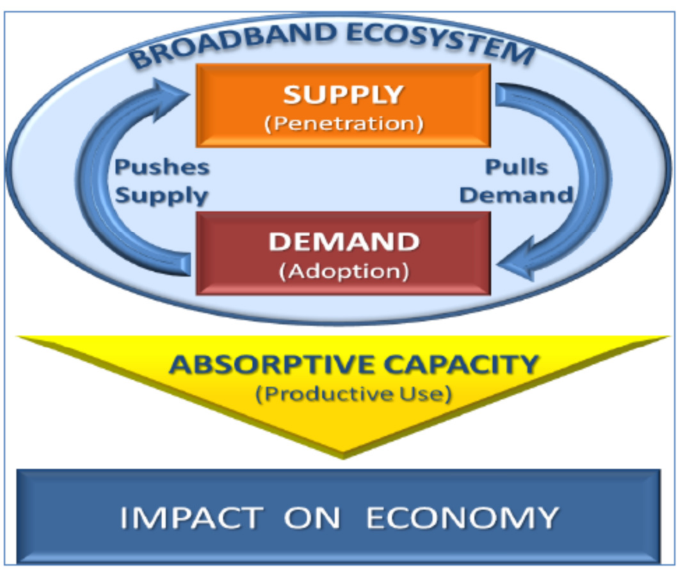
Entrepreneurs and businesses according to Muller (2012) are changing the platforms used to market or advertise their businesses and are turning to Internet applications such as YouTube to increase their company revenue's. One of the local South African companies quoted in the article by Muller (2012) that has benefited from using YouTube is the Six Pack Factory channel whose owner cites' that the channel generate an excess of 100, 000 views per day which has had a positive impact on the company website. The owner is quoted as stating that the company revenues have grown by 100% as a result of using YouTube and is generating monthly revenues of R 50, 000 (Muller, 2012). "Some large international YouTube channels are generating well over R1 million per year" (Muller, 2012). "According to analytics and advertising company TubeMogul many channels are making over $100,000 per year" (Muller, 2012).

Countries everywhere according to Budde (2011) need to take advantage of the broadband growth or risk missing out on “the opportunity to reap the economic and social benefits that broadband brings” (Budde, 2011, p. 1). The role that ICT plays in economic development has been widely acknowledged and its “positive impact on innovation, productivity, trade, employment, foreign investment, economic growth and, consequently, a country’s competitiveness, has been widely proved and documented not only in the case of developed countries, but also in developing countries and economies in transition” (Budde, 2011, p. 31).

2.4 The Impact of the Broadband Ecosystem on the Economy

“Broader regulatory intervention” is required in developing countries that address “the supply and demand incentives” (Horton, 2011, p. 3). Broadband has to be seen “as an ecosystem of mutually dependent and reinforcing components: demand and supply” as shown in figure 20 below (Kelly & Rossotto, 2011, p. 17). According to Kelly & Rossotto (2011) the supply of broadband infrastructure is the first critical requirement however the demand of broadband carries an equal weighting of importance that is necessary in substantiating the worth of the network investment.

Figure 20: Broadband Ecosystem and its impact on the Economy



Source: *Kelly & Rossotto, 2011, p. 18*

2.4.1 Supply Side Considerations

The infrastructure components of supply in the broadband ecosystem comprises of "1) international connectivity; 2) domestic backbones; 3) metropolitan connectivity and 4) local connectivity" (Kelly & Rossotto, 2011). In developing plans and strategies for broadband networks, policy makers need to recognize that for the network to function effectively and efficiently all the components in the broadband supply chain must work together. It is important that the broadband networks at all levels are synchronized, as local networks that support high speeds can only materialize if the network capacity and speeds of both the national and international networks can support them. Kelly & Rossotto (2011) further state that the level of a countries infrastructure dictates the technology that will be deployed. Qiang, (2010), argues that broadband network investments must be a key part of a developing countries overall development strategy. Government in cooperation with the private sector plays a critical role in the deployment of broadband networks and must also play a critical role in network investments (Kelly & Rossotto, 2011). Government remains the main decision maker on spectrum allocation, open access, infrastructure sharing and rights of way and use of broadband services. Hernandez, Leza & Lena (2010) highlight that policymakers focus on "supply of competitive networks" needs to be on-going as networks forms "the critical pipeline" that links all the elements within the ecosystem (Hernandez, Leza & Lena, 2010). Public intervention becomes priority where broadband infrastructure is concerned when aimed at "achieving distributional policy objectives of reducing digital divide and facilitating regional development through increased competitiveness" (Qiang, 2010, p. 7). In light of the recent draft invitations to apply for spectrum in the 800Mhz and 2.6Ghz bands released by ICASA, spectrum scarcity remains a major barrier to broadband development and especially spectrum that would enable coverage on a wider scale and at a much lesser cost to address the current coverage gap in rural areas. Spectrum allocation of frequency bands that promote rapid broadband expansion is key in enabling broadband access to rural areas in South Africa. Table 4 below highlights the major spectrum holdings in South Africa by the operators and it is evident that the 2.6GHz spectrum which is considered valuable spectrum is currently owned by Sentech and WBS which are both public owned corporations. The 900MHz spectrum which falls in the sub 1GHz zone is also considered as valuable spectrum and is currently owned by CellC, MTN and Vodacom however the spectrum is currently utilised for voice services.

Table 4: Major spectrum holdings in South Africa

		Spectrum Bands						
		800 MHz	**900 MHz**	**1800 MHz**	**2100 MHz**	**2.6 GHz**	**3.5 GHz**	**Total**
Major Spectrum Holdings	**Neotel (fixed network operator)**	~2 x 5 MHz		2 x 12 MHz			2 x 28 MHz	90 MHz
	Telkom (fixed network operator)			2 x 12 MHz	2 x 10 MHz		2 x 28 MHz	100 MHz
	Vodacom (mobile operator)		2 x 11 MHz	2 x 12 MHz	2 x 15 MHz			81 MHz
					1 x 5 MHz			
	MTN (mobile operator)		2 x 11 MHz	2 x 12 MHz	2 x 15 MHz			81 MHz
					1 x 5 MHz			

	Cell C (mobile operator)		2 x 11 MHz	2 x 12 MHz	2 x 15 MHz			76 MHz
	Sentech (broadcast signal distribution and satellite infrastructure provider)					1 x 50 MHz	2 x 15 MHz	80 MHz
	WBS (wireless network service provider)			2 x 12 MHz		1 x 15 MHz		64 MHz
				1 x 10 MHz				
	USALs (universal service licensees)						2 x 14 MHz	14 MHz

Source: *Zimri, No Date*

2.4.2 Demand Side Considerations

Demand side components drive the adoption of broadband access and services and broadband use through creating awareness on its benefits, enabling affordability of the service and making it more attractive to users and are often referred to as "demand facilitation or stimulation" (Kelly & Rossotto, 2011). Content, applications and services which are the components of demand must remain relevant and innovative as these factors are critical in driving demand for broadband and also aid in creating a "vibrant broadband ecosystem" (Kelly & Rossotto, 2011, p. 18). Hernandez et al, (2010) highlight that policy makers require new tools to address the demand component that seeks to understand the causes for the non-adoption of broadband. Understanding the barriers to the non-adoption of broadband goes a long way in assisting policymakers to design policies that drive broadband development. The three approaches that are used to drive broadband demand include 1) awareness which is critical in driving broadband demand as it focuses on driving awareness on how to use broadband and educates the market on the benefits of broadband through digital literacy training programmes in schools and training of businesses on the benefits of broadband, 2) affordability which is identified as a main inhibitor to broadband adoption is key in driving demand for broadband. Device cost or total cost of ownership of a device remains a barrier to broadband adoption in developing countries (Kelly & Rossotto, 2011). Solutions that can be implemented to drive affordability include the introduction of low cost devices, subsidizing the cost of devices through government financing, the scrapping of tax on devices and developing community centres that provide community access to broadband services, 3) attractiveness requires the market to enable a wide range of services, content and applications that appeals to all types of consumers. Relevance and attractiveness of the services, content and applications is key in driving demand for broadband.

2.4.3 Absorptive Capacity

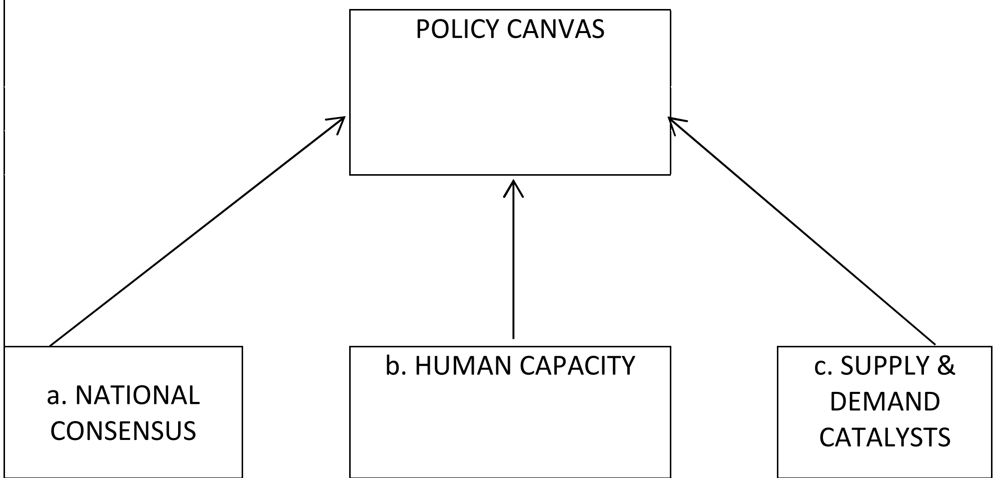
Addressing supply and demand to promote broadband networks and services alone is not enough to drive broadband to its full potential in the economy and to realize that "broadband users (e.g. citizens, businesses and government) must also have the capacity to understand, learn and apply the lessons learned about broadband benefits and capabilities across the economy and society" (Kelly & Rossotto, 2011, p. 18). To realize the full benefits of broadband "the various sectors of the economy and society must have the capacity to acquire, assimilate, transform and exploit the capabilities enabled by this platform" (Kelly & Rossotto, 2011, p. 26). Broadband's benefits are directed into the economy and allow broadband to realize "its potential as a general purpose technology" (Kelly & Rossotto, 2011, p. 50). For broadband's full potential to be realized there needs to be 1) applications and services that drive efficiency and productivity and 2) there also needs to be the knowhow on how to utilize applications and services efficiently and productively by governments, businesses and citizens. These two requirements are key in achieving the full economic impacts of broadband (Kelly & Rossotto, 2011). To complement broadband rollout and facilitate understanding policy makers are able to incorporate broadband benefits into policy development and policy implementation. Broadband can significantly impact the economic and social growth of a country and drive change however for this potential to be realized governments, businesses and citizens must use broadband to the point where the economies productivity is increased. The four components that are identifiers of a countries absorptive capacity and determine the extent to which a country can translate broadband "into economic and social development are 1) the macroeconomic environment, 2) business environment, 3) quality of human capital and 4) governance structure" (Kelly & Rossotto, 2011, p. 27). "The degree of absorptive capacity in a given economy will determine the amount of broadband-enabled economic development" (Kelly & Rossotto, 2011, p. 20).

2.5 Policy Analysis and Considerations for Broadband Development

Analysing policy effectively requires one to understand Governments overall policy objectives and how the evaluation of the objectives changes at each stage of the policy setting process. Understanding factors such as the changing market dynamics, evolving technologies and lessons learnt plays an important role in shaping the policy context. By understanding the policy framework adopted by Government using various policy tools can one only then be able to analyse the impact of the policy and the lessons learnt (Hodge et al, 2008).

Having infrastructure that functions is important “to economic development and social needs” (Horton, 2011, p. 3). The benefits of having good infrastructural structures are especially critical in ensuring that the benefits are disseminated to remotely dispersed populations or geographical areas that are far removed from having access to markets. Broadband rollout tends to be capital intensive making it a complex issue to deal with when policy is involved. Policy makers according to Horton (2011) are required to first gain a wide understanding of the issues that exist around broadband development before embarking on formulating national visions when developing broadband plans. Horton (2011) indicates that the first step in broadband planning involves the identification of a proper definition of broadband and its planned objectives. This is normally followed by identifying and elaborating policy considerations which are outlined in figure 21 below.

Figure 21: Broad Policy Considerations



a. Building a national consensus and evaluating the implications and opportunities for broadband across many sectors and society. A cross-sectoral view is highly important.

b. Developing the human capacity to ensure a successful deployment and uptake of the use of the infrastructure

c. Creating the supply and demand catalysts for government, big and small enterprise, and individual citizen.

Source: *Horton, 2011, p. 4*

The policy framework used for broadband roll out "must take into account the magnitude and extent of the tasks involved and a broad cost-benefit analysis of the measures needed" (Horton, 2011, p. 4). Setting targets such as coverage and access speeds remains one of the more popular approaches. A top down approach is another alternative method for prioritising budget for broadband rollout according to the implementation priority. Government intervention is critical where underserved or rural areas are involved, which "could benefit enormously from training and capacity development, which in turn could then exploit broadband" (Horton, 2011, p. 5).

Ultimately the national vision or policy statement needs to provide a picture of the position that the country aims to hold in the information society going forward and "should successfully address the digital divide and show the way forward by demonstrating how the government will navigate the economic and social future" (Horton, 2011, p. 5).

2.5.1 The Economic Theory of Regulation

Stigler, (1971), explains that the main role of the theory of economic regulation is to highlight those that "receive the benefits or burdens of regulation, what form regulation will take, and the effects of regulation upon the allocation of resources" (Stigler, 1997, p. 3). According to Stigler (1971) the industry can either actively seek regulation or have regulation imposed upon it. Stigler (1971) highlights two main views of regulation that are common 1) the primary aim of regulation is to protect and benefit the public or a subclass of the public, 2) politics is an ever changing and moving mix of forces. Wernick, & Picot, (2007) on the other hand highlight that "economic theory is based on the fact that politics plays a passive role, only reacting to external effects" (Wernick, & Picot, 2007). Rasmusen & Zupen (1990) on the other hand observe that "as the economic regulation developed, researchers typically focused on specific cases of policymaking and identified the interest groups that shaped the observed regulatory outcome" (Rasmusen & Zupen, 1990, p. 187). This implies that these regulatory outcomes were normally as a result of influences from specific interest groups with political links that were mostly used as a regulatory response to raise the barrier to market entry with the aim of protecting its market interests. These barriers to market entry were normally "in the form of tariffs, quotas, exchange controls, administrative barriers or government preferences in purchasing" (Rasmusen & Zupen, 1990, p. 188). Regulation therefore plays a key role in ensuring that policies and regulation are implemented that either address or react to anti-competitive behaviour or market failures that would hamper broadband development and access.

2.5.2 The Public Interest Theory

According to Domas (2003), there are two concepts to the public interest theory 1) that regulation aims to protect and benefit the public, 2) proposes that economic regulation should be imposed when market failure occurs with the aim of maximizing social benefit. Wernick & Picot (2007) on the other hand highlight governments that act as the public's representative as playing a crucial role in influencing the markets for the benefit of the public. Wernick, & Picot, (2007) highlight the main two characteristics of public goods as firstly being that "any member of a group consuming a public good cannot be denied consumption by other members of the group" and secondly that "public goods are characterised by non-rivalry in consumption" (Wernick & Picot, 2007, p. 663). In relation to broadband development the public interest theory plays a key role as it recognizes the role of government as an enabler in driving or influencing market forces for the benefit of the public. An example would be including broadband as a component of the universal access and service policy framework with the aim of stimulating broadband availability and uptake in rural areas. Broadband's importance has led to increased calls for broadband to be viewed as a public good with the aim of ensuring that its benefits are widely felt through the various economic sectors and also ensure the universal access of broadband at affordable prices (Kelly & Rossotto, 2011). This requires governments to have direct interventions that enables the promotion and universalisation of the broadband markets an initiative that has led some countries to take "more direct action to promote broadband development, establishing initiatives and strategies" (Kelly & Rossotto, 2011, p. 39).

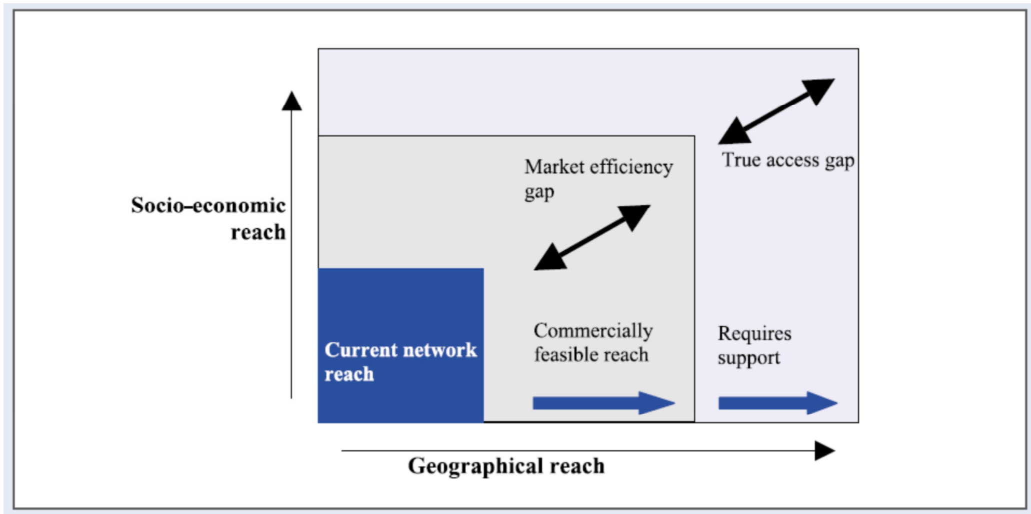
2.6 Universalisation of Broadband

To ensure universal access to ICT services by all members of the society, universal service enables social inclusion by all and access to ICT services at affordable prices (Carrega, 2009). Universal service plays a key role in ensuring that there is availability to basic telephony services and public telephone networks that support basic voice and data services by all members of the society, people with disabilities and low income earners. The declining demand for fixed telephony services and the increased growth in mobile services is decreasing the importance of "the safety net provided by universal service" (Carrega, 2009, p. 15). This has in turn spurred debates on whether broadband forming part of Universal Access Services scope to revive the relevance of Universal Access Service.

For policy makers to successfully design strategies relating to universal access the capability to distinguish "between the market efficiency gap and the true access gap" is key (Dymond & Oestmann, 2003). "Poverty and isolation are key dimensions to both the market efficiency gap and the true access gap" (Dymond & Oestmann, 2003, p. 59). Extending reach to people living in rural areas remains a challenge due to the high cost that comes with tackling poverty and isolation, and without subsidisation of services, enabling access to rural areas remains a dream (Dymond & Oestmann, 2003).

Figure 22 below highlights limitations that may exist in the market including the market efficiency gap which highlights the difference between the current achievements made under current market conditions versus what the market would potentially achieve if regulatory barriers were removed and incentives were introduced (Dymond & Oestmann, p.58, 2003). The other limitation would be the true access gap which highlights that to reach certain areas of the population or certain population group's i.e. rural or remote areas, certain interventions or investments are required which could be in the form of government subsidies or incentives offered to service providers to encourage them to provide affordable services to these areas (Dymond & Oestmann, 2003). The vertical and horizontal access highlights poverty and geographic isolation as critical dimensions. Dymond & Oestmann (2003) recommends that different strategies are applied to address the market efficiency gaps "through sector reforms and market development" and access gaps are addressed through subsidies that are aimed at enabling access and reach to underserved areas (Dymond & Oestmann, p.58, 2003).

Figure 22: The Market Efficiency Gap and the True Access Gap



Source: *Dymond & Oestmann, 2003, p. 59*

To increase awareness on the benefits of broadband and drive increased broadband penetration Carrega (2009) recommends that demand side policies are formulated to drive increased broadband adoption. The challenges faced deploying broadband services to remote areas lies in the fact that building network infrastructures over long distances is not profitable due to the low economies of scale and a low population density. This ultimately results in expensive broadband services being provided which remains out of reach for the poor in these areas. Supply side policies according to Carrega (2009) need to address these challenges faced in supplying broadband infrastructure to remote areas or populations as part of the Universal Access Service policies.

Budde (2010) believes that universal broadband inclusion for all will imply a significant economic and social change that will address the problems that the millennium development goals aim to achieve and "will be a game-changer in addressing rising healthcare costs, delivering digital education for all, and mitigating the effects of climate change" evident in "the transformational progress which digital inclusion offers to youth, women, the elderly and people with mental and physical disabilities" (Budde, 2010, p. 6).

2.7 The Essential Facilities Doctrine

The essential facilities policy currently focuses on the various forms of sharing infrastructure and "the most important distinction is certainly between passive and active infrastructure sharing" (Renda, 2010, p. 32). Essential Facilities doctrine mandates operators that own an essential facility to provide access to a competitor at a fair price and prevents firms from refusing to deal or provide access. "Backbone networks have a major impact on the commercial viability of ICT services, particularly broadband" (Williams, 2009, p. 52). Backbone networks which form part of a mobile network make up between 10 % to 15% of the overall network costs, (Williams, 2009). The backbone network costs increase significantly when broadband access is enabled over longer distances and especially to rural and remote areas. This ultimately makes the broadband services unaffordable and broadband access commercially unviable as a result of the high fixed backbone network costs (Williams, 2009). The concept of essential facilities becomes critical in markets where a downstream and an upstream market exist and typically the dominant firm controls both the upstream and downstream markets (OECD, 1996). Through the introduction of various forms of measures or controls the essential facilities doctrine enables firms that compete in the downstream market with the dominant firm to access the dominant firm's infrastructure at a competitive price. These controls can be in the form of regulatory measures which play a key role in enabling open access to networks, network interconnection which ensures that operators are able to connect to the backbone network owned by another operator at reasonable costs and having a wholesale market structure that enables competitive broadband services (Williams, 2009). The essential facilities doctrine therefore plays a key role in eliminating the barriers to broadband deployments and fostering broadband penetration especially in rural areas by enabling smaller operators to play in the market and have access to affordable low cost backbone networks eliminating anti-competitive behaviour of operators that own or control infrastructure that is deemed as essential and also eliminating the need for smaller operators to build their own networks. This opens up the market to competition and enables open access which ultimately enables the provision of affordable broadband services to the market.

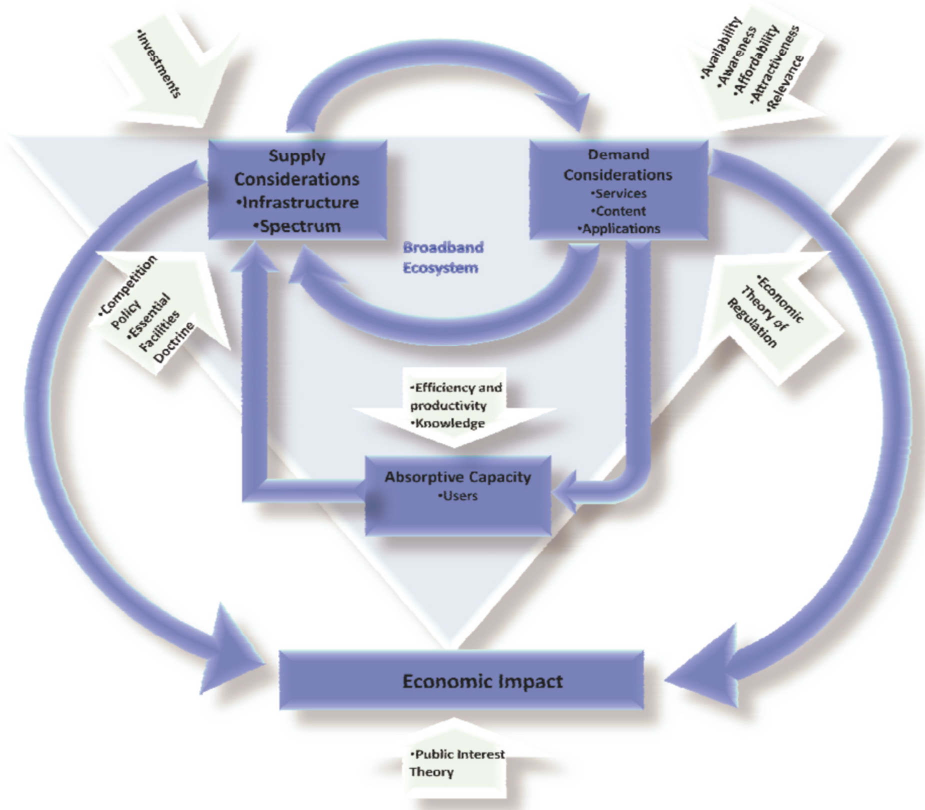
2.8 Competition Policy

According to Monson, Ros, Tardiff, Banerjee, Briceno, Frieden, Kalba, Ehrhardt, Gale, McKinlay, & Sethi (2004) market failures normally occur in the form of externalities and monopolies while competition policy serves as a tool that enables competition and prevents undesirable social outcomes. Wernick & Picot (2007) argue that having a small number of players in the market does not necessarily facilitate monopoly pricing however markets where large sums of capital are sunk into network investments will often experience high barriers to market entry being created and incumbent operators resorting to exerting their market power which in most cases necessitates public interventions. These interventions are normally in the form of competition policy which is normally introduced when the market is unable to correct or rectify the market failures and will normally be in the form of rules that prohibit anti-competitive behaviour and rules that promote a competitive environment such as unbundling policies. Offenders that go against the competition laws will often be penalized and the laws make provisions that prevent anticompetitive behaviour such as colluding, exclusion of competition by dominant operators through their market powers and mergers or acquisitions that reduce competition. Competition policy plays a key role in broadband development by ensuring that barriers to market entry for new players are lowered which ensures that a fair level playing ground is created and is void of anti-competitive behaviour which would in most cases hamper broadband development.

2.9 Conclusion

In conclusion the conceptual and theoretical frameworks highlighted in figure 23 below will act as a framework that will guide the researcher to set the appropriate interview questions for the purpose of data collection. The conceptual and theoretical framework also provides a framework that will be used for the grouping of the data findings and the analysis of the data. The conceptual and theoretical framework will provide a deeper understanding of the interdependencies that exist between the elements of the broadband ecosystem as well as the influences of policy and regulation and the impact that it could have to either inhibit or enable broadband evolution in rural areas.

Figure 23: Conceptual Framework: Broadband Ecosystem and Economic Impact



Source: *Macharia, 2012*

The integrated conceptual framework outlined in Figure 23 above highlights the concepts discussed in the literature review section and reflects the integrated interactions of all the components of the broadband ecosystem required to achieve the desired economic impact. The conceptual framework highlights the dependencies of supply side factors on regulations that promote competition and lower barriers to entry for new entrants which are critical in encouraging investments in infrastructure and stimulating policies that focus on enabling spectrum availability. Demand side factors are also dependent on policies and regulation that drive the utilisation and adoption of broadband and that also address market failures that would otherwise hamper the development of broadband. The conceptual framework also highlights the interdependencies that exist between the supply and demand side factors and the absorptive capacity and the effect that these elements ultimately have on the economy. The elements of the broadband ecosystem can therefore not be viewed independently as the interdependencies are key in achieving the full economic benefits of broadband. The inclusion of broadband into the universal access and service policy is critical in enabling the wider access of broadband to all, drive increased adoption of broadband services and ultimately aims to extend the economic benefits of broadband to all. The conceptual framework ultimately depicts the importance of the different elements of the ecosystem and the important role they play in influencing policies and regulation that enable the broadband evolution and ecosystem development and ultimately impact the market development of broadband with the resultant outcome being an increased growth in the economy.

CHAPTER THREE: RESEARCH METHODOLOGY

3. Introduction

This chapter outlines the research methodology that will be applied in this research study in detail. The qualitative research method has been selected for this study and the motivation for selecting this approach is discussed in detail in this chapter. This chapter also discusses the data collection methods that have been adopted for this study in detail which consists of primary methodology in the form of document analysis of existing policies and regulation and semi-structured in-depth interviews, secondary methodology in the form of qualitative surveys with households, SMME and Government and content analysis in the form of document analysis from various sources which includes the web. Document analysis of policy documents includes analysis of the Electronic Government the Digital Future 2001 (RSA, 2001), Broadband policy 2010 document (DoC, 2010), Radio Frequency Spectrum Policy for South Africa 2010 (DoC, 2010), ITA for a Radio Frequency spectrum Licence for the purpose of providing a mobile broadband wireless access service in the 2.6GHz and 3.5GHz band (DoC, 2010), Draft Spectrum assignment plan for the combined licensing of the 800MHz and 2.6GHz bands (DoC, 2011), Draft ITA for Radio Frequency Spectrum to Provide Mobile Broadband Wireless Access Service for Urban and Rural Areas Using the Complementary Bands 800MHz and 2.6GHz (DoC, 2011), (RSA, 2001). The ICT Policy Colloquium discussion ANC policy discussion document 2012 (ANC, 2012), The ICT Policy Colloquium discussion document 2012 (DoC, 2012) and analysis of existing regulation which include Telecommunications White Paper 1996 (RSA, 1996), Electronic Communications Transaction Act 2002 (RSA, 2002), the Electronic Communication Act 2005 (RSA, 2005), Electronic Communication Act Amendment bill 2012 (DoC, 2012), and analysis of plans which includes the National Information Society and Development Plan (ISAD) 2005 (PNC, 2005) and USAASA Strategic plan 2012 – 2015 (USAASA, 2012),

3.1 Problem Statement

Telecommunications providers in South Africa are discouraged from rolling out network infrastructure in rural areas due to the low return of investment as a result of a small subscriber base that exists in rural areas (DoC, 2010). Building a national backbone is capital intensive and telecommunication operators consider it commercially unviable to offer broadband services in rural areas. Broadband infrastructure based on "wireless broadband technologies: has been rolled out by mobile operators however majority of the network rollout has been concentrated in "urban and semi-urban areas, with little in-roads into rural areas" (DoC, 2011, p. 13). The level of ICT infrastructure deployed in rural areas remains limited and in areas where access to ICT is available the people lack the technical knowledge required to utilize the technology (DoC, 2011). In addition rural areas fall short or lack the necessary human resource skills critical for the support of ICT technology which is a result of skilled ICT resources migrating from rural to urban areas in search of better opportunities. Majority of the rural people cannot afford any form of ICT due to the high cost of communication and poverty. In addition the lack of relevant local content in rural communities decreases their chances of "equitable access to ICTs" (DoC, 2011, p. 15). Low literacy levels and language barrier is another challenge that rural areas face and this becomes a challenge when addressing growth of internet penetration in rural areas. Majority of the rural people can only read and communicate in their local language whilst majority of the internet content is presented in the English language. Majority of the SME's in rural areas are not exposed to latest trends in "current thinking" which results in a "lack of entrepreneurial acumen and culture" (DoC, 2011, p. 15).

Although the elements of the broadband ecosystem are strong and well placed in urban areas, not all elements of the broadband ecosystem in rural areas are in place and equally strong. The relative strengths and weaknesses of the different elements of the broadband ecosystem in rural areas are unknown and supply and demand side factors are not understood. Hence the broadband policy may not be based on a full understanding of the complex ecosystem.

3.2 Purpose Statement

In order to investigate the problem the purpose of this research study is to investigate the barriers faced in developing the broadband market in rural areas in South Africa. The researcher will go about this by examining the conceptual frameworks outlined in the literature review which provides the elements of the research. The study will examine the components of the broadband ecosystem which comprises of 1) Supply side components which consists of International connectivity, domestic backbones, metropolitan connectivity, local connectivity and spectrum, 2) Demand side components which consist of services, applications and content, 3) Absorptive capacity component which consists of the users.

From a theoretical perspective the study will also examine the competition theory, Essential facilities Doctrine, Economic theory of regulation and the public interest theory in relation to broadband market development. The study also proposes to examine the extent to which these frameworks have influenced policy and regulation in driving broadband evolution in rural areas.

The data collected with regards to supply side components will be analysed with the aim of providing insight into the state of investments in broadband networks in a rural municipality in South Africa and in particular explore the existing state of investments in the national backbone and the last mile.

The data collected with regards to demand side components will be analysed with the aim of providing insight into the challenges faced with the availability of broadband access in rural areas and various approaches used to drive broadband adoption in rural areas in South Africa. The approaches that will be explored are awareness, affordability, demand for broadband, ease of access, device types used to access broadband and the availability of local content and applications.

The analysis of primary data in the form of existing policy documents that includes the Electronic Government the Digital Future 2001 (RSA, 2001), Broadband policy 2010 document (DoC, 2010), Radio Frequency Spectrum Policy for South Africa 2010 (DoC, 2010), ITA for a Radio Frequency spectrum Licence for the purpose of providing a mobile broadband wireless access service in the 2.6GHz and 3.5GHz band (DoC, 2010), Draft Spectrum assignment plan for the combined licensing of the 800MHz and 2.6GHz bands (DoC, 2011), Draft ITA for Radio Frequency Spectrum to Provide Mobile Broadband Wireless Access Service for Urban and Rural Areas Using the Complementary Bands 800MHz and 2.6GHz (DoC, 2011), (RSA, 2001). ANC policy discussion document 2012 (ANC, 2012), The ICT Policy Colloquium discussion document 2012 (DoC, 2012) and analysis of existing regulation which include Telecommunications White Paper 1996 (RSA, 1996), Electronic Communications Transaction Act 2002 (RSA, 2002), the Electronic Communication Act 2005 (RSA, 2005), Electronic Communication Act Amendment bill 2012 (DoC, 2012), and the analysis of plans which include the National Information Society and Development Plan (ISAD) 2005 (PNC, 2005) and USAASA Strategic plan 2012 – 2015 (USAASA, 2012) will be conducted to establish whether an appropriate framework exists to address broadband access to rural areas. Semi structured in-depth interviews will also form part of the primary source of data. Secondary source of data which consists of qualitative surveys with households, SMME and government will form part of the secondary source of data that will be analysed and content analysis of documents will also provide a source of data for analysis.

By analysing the demand and supply side components of the broadband ecosystem in a rural municipality in South Africa, this study aims to provide a better understanding of the key elements of the rural broadband ecosystem and the challenges affecting the broadband market development in rural areas. And by analysing the existing policies and regulation, data from the qualitative surveys and data from the document analysis, the study aims to provide insight into the strengths and weaknesses of the policies and regulation and highlight which policy and regulatory measures exist to address the evolution of the broadband ecosystem in rural areas. The study will make recommendations on the policy and regulatory measures that can be put into place to stimulate the broadband market development in rural areas.

3.3 Research Questions

The main research question that forms the basis for this research is “How has policy and regulation affected the evolution of the broadband ecosystem in the rural area of Metsweding Municipality?”

3.3.1 Sub - Questions

The sub-questions that inform this research are as follows:

1. How do the supply side factors affect broadband evolution in rural areas?
2. How do demand side factors influence policy for broadband in rural areas?
3. To what extent does existing policy enable the investment in and absorptive capacity of broadband?
4. To what extent does existing policy and regulation enable broadband evolution and ecosystem development in rural areas?

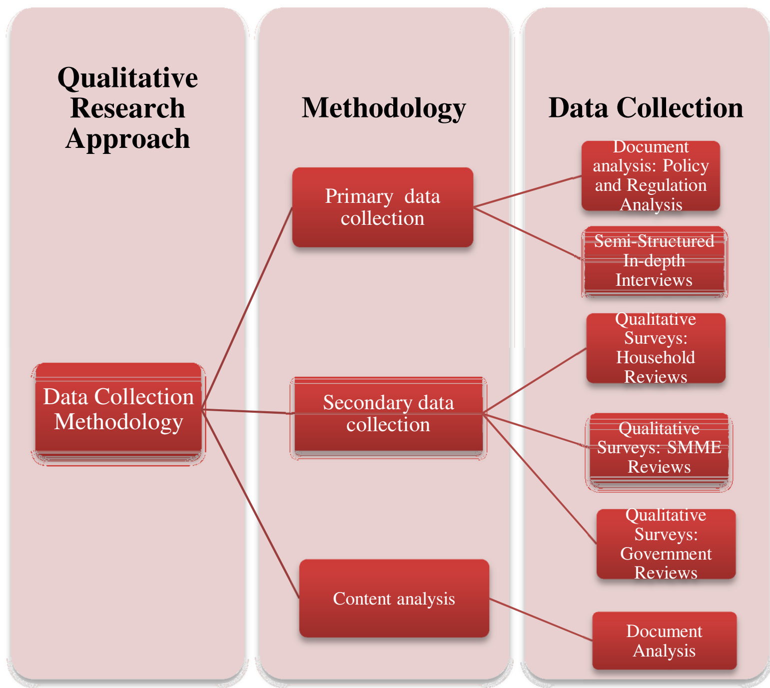
3.4 Research Approach

This research study looks at the evolution of the broadband ecosystem in rural areas in South Africa with a focus on the challenges faced in relation to the supply, demand side factors and absorptive capacity factors that hinder the market development of broadband in rural South Africa. The research questions are key to this study as they provide guidance to the research process. The qualitative research method was selected as this was the most appropriate approach that could answer the research questions. The main aim of qualitative research is normally to gain insight into an individual’s account or perspective of an event happening (Hancock, Windridge & Ockleford, 2009). Qualitative research also aims to provide a deep “understanding of how things came to be the way they are in our social world” (Hancock, Windridge & Ockleford, 2009, p. 4). The qualitative research approach was selected as the research will be conducted in the natural environment of the interviewees and the interviewee's point of view is "emphasized" (Babbie & Mouton, 2001, p. 270). Qualitative research aims "to understand social action in terms of its specific context rather than attempting to generalize to some theoretical population" (Babbie & Mouton, 2001, p. 270). Hancock et al (2009) motivate that qualitative research provides us with an understanding of the social world we live in, the social phenomena and an understanding of "why things are the way they are" (Hancock et al, 2009). "Qualitative research is concerned with the social aspects of our world and seeks to answer questions" (Hancock et al, 2009, p. 7) regarding peoples behaviours, how events affect people, why and how cultural practices have been developed in certain ways and the process of forming attitudes and behaviours. "The essence of qualitative research is to capture life as it is lived…best way to understand a phenomenon is to study it in its context" (Abusabha & Woelfel, 1996, p. 566).

The qualitative research approach "reveal the nature of certain situations, settings, processes, relationships, systems or people" (Leedy & Ormrod, 2005, p. 134). A qualitative approach according to Leedy & Ormrod (2005) enables researchers to gain insights into particular phenomenon's. New concepts and theoretical views are developed around a phenomenon and the qualitative approach also assists in identifying problems or issues within a phenomenon (Leedy & Ormrod, 2005, p. 134). A qualitative approach also enables researchers to test whether "certain assumptions, claims, theories or generalizations" (Leedy & Ormrod, 2005, p. 135), are valid. The qualitative approach enables researchers to ultimately "judge the effectiveness of particular policies, practices or innovations" (Leedy & Ormrod, 2005, p. 135). Qualitative approaches involves searching for themes and for the purpose of this research coding analysis has been identified as the qualitative approach methods that will be applied to identify these themes. For the purpose of this study the qualitative approach will be used for researching the broadband ecosystem with a focus on the broadband ecosystem in rural areas of South Africa.

The research approach architecture consists of primary and secondary methodology and content analysis as illustrated in figure 24 below.

Figure 24: Qualitative research approach



Source: *Macharia, 2012*

Primary data collection methods will consist of document analysis of existing policy and regulation documents and semi-structured in-depth interviews. Document analysis of policy and regulation documents is classified as primary data as it set the scene and basis for the research by providing an indication of whether existing policies and regulation created an enabling environment for the broadband ecosystem market development in rural areas. Primary data is in the form of feedback from the semi-structured in-depth interviews with senior representatives from the Telecommunication industry. This will comprise of fixed and mobile operators, an ISP, the regulator and a telecommunication body. Telkom, MTN, Vodacom, 8ta, CellC, ICASA, FTTH Council and Internet Solutions were selected as the respective senior representatives to participate in the semi-structured in-depth interviews. The in-depth interviews were completed either telephonically, on a face to face basis and an option for self-completion was given to those respondents that were unavailable for either a telephonic or face to face interview. The review of primary data also involves the document analysis of existing policy documents which include the Electronic Government the Digital Future 2001 (RSA, 2001), Broadband policy 2010 document (DoC, 2010), Radio Frequency Spectrum Policy for South Africa 2010 (DoC, 2010), ITA for a Radio Frequency spectrum Licence for the purpose of providing a mobile broadband wireless access service in the 2.6GHz and 3.5GHz band (DoC, 2010), Draft Spectrum assignment plan for the combined licensing of the 800MHz and 2.6GHz bands (DoC, 2011), Draft ITA for Radio Frequency Spectrum to Provide Mobile Broadband Wireless Access Service for Urban and Rural Areas Using the Complementary Bands 800MHz and 2.6GHz (DoC, 2011), (RSA, 2001). ANC policy discussion document 2012 (ANC, 2012), The ICT Policy Colloquium discussion document 2012 (DoC, 2012) and analysis of existing regulation which include Telecommunications White Paper 1996 (RSA, 1996), Electronic Communications Transaction Act 2002 (RSA, 2002), the Electronic Communication Act 2005 (RSA, 2005), Electronic Communication Act Amendment bill 2012 (DoC, 2012), and the analysis of plans which include the National Information Society and Development Plan (ISAD) 2005 (PNC, 2005) and USAASA Strategic plan 2012 – 2015 (USAASA, 2012). The ICT Policy Colloquium discussion

The secondary data reviewed was in the form of findings from the qualitative surveys conducted on Households, SMMEs and a qualitative survey with the local municipality IT department, the local government clinic and the local public school. The qualitative surveys were carried out in four areas within Metsweding municipality which fell within Cullinan and Bronkhorstspruit localities. Content analysis formed a third source of data which consisted of document analysis which included documents sourced from the web and included the review of documents from online sites such as mybroadband, ITweb, IT-Online, Saitnews, themediaonline and africatelecomsonline. The content analysis of documents was aimed at filling in the gaps where there was no or little supporting data that was collected from the primary and secondary methodologies on a particular area.

3.5 Research Design

When I initially embarked on my journey of identifying and defining a research topic for my research study I initially went through three iterations to my research topic. I was focused on a research topic that was centred on broadband and internet but identifying a topic that would enable me to establish data that was relevant to South Africa proved a challenge. I eventually identified my fourth topic which forms the basis of this study however when I embarked on this particular journey I did not comprehend how broad the topic of broadband was and how complex the various elements of the broadband ecosystem were and the interdependencies that existed in their workings.

When developing the conceptual framework for the study I was initially only focused on the supply side elements of the broadband ecosystem and it was only after numerous engagements with my research methods lecturer Dr Abi Jagun that I realised that a focus on all elements of the broadband ecosystem was key in understanding the complexities and interworking's of the broadband ecosystem. This study has opened my eyes to the complexities of broadband and the realisation that for universal broadband access to be a success a framework that addresses all the 3 elements of the broadband ecosystem namely; supply demand and absorptive capacity is key. I have been able to apply the learning's of this study to my current work situation which involves developing broadband services. By extending our broadband services to the market i a also ensuring that we are also addressing the elements that drive the increased adoption and usage of broadband.

Qualitative research design involves the selection of cases that are in small numbers that form the object of study and an in-depth "engagement/encounter with the object of study" (Babbie & Mouton, 2001, p. 279). "A research design is a logical plan for getting from here to there, where here may be defined as the initial set of questions to be answered and there is some set of conclusions (answers) about these questions" (Yin, 2009, p. 26). Using multiple data sources forms another feature of research design and the flexibility enables the researcher to make on-going changes to the research as and when required (Babbie & Mouton, 2001). Because a qualitative approach will be followed, 3 types of research designs will be applied.

3.5.1 Primary data collection

The first primary source of data will be through the document analysis of existing policy documents. Policy analysis "is primarily about making recommendations on preferred or best options. These recommendations will be based on research" (May & Pal, 1999, p. 261). Policy analysis aims to establish which of the government policies is able to deliver on a "set of goals" taking into consideration the relationship that exists between the policy and the goal, (May & Pal, 1999). Policy analysis will form part of the research design methods and will be used to evaluate existing policy documents which include the Electronic Government the Digital Future 2001 (RSA, 2001), Broadband policy 2010 document (DoC, 2010), Radio Frequency Spectrum Policy for South Africa 2010 (DoC, 2010), ITA for a Radio Frequency spectrum Licence for the purpose of providing a mobile broadband wireless access service in the 2.6GHz and 3.5GHz band (DoC, 2010), Draft Spectrum assignment plan for the combined licensing of the 800MHz and 2.6GHz bands (DoC, 2011), Draft ITA for Radio Frequency Spectrum to Provide Mobile Broadband Wireless Access Service for Urban and Rural Areas Using the Complementary Bands 800MHz and 2.6GHz (DoC, 2011), (RSA, 2001). ANC policy discussion document 2012 (ANC, 2012) and The ICT Policy Colloquium discussion document 2012 (DoC, 2012). The ICT Policy Colloquium discussion

Regulatory analysis does not have the effect of either reducing or increasing the number of regulation but rather results in increased effective and efficient regulation (OECD, 1997, p.177). Regulatory analysis is enabled to support trade-offs by ensuring that mechanisms exist that balance conflicts "between economic and other regulatory objectives" to the benefit of society (OECD, 1997, p.177). Regulatory analysis “enable policymakers to understand the consequences of regulation and the optimal allocation of society’s resources” (OECD, 1997, p.177). Regulatory analysis was also chosen as part of the research design methods and also forms part of the primary source of data which will be used to evaluate existing regulation which include Telecommunications White Paper 1996 (RSA, 1996), Electronic Communications Transaction Act 2002 (RSA, 2002), the Electronic Communication Act 2005 (RSA, 2005), Electronic Communication Act Amendment bill 2012 (DoC, 2012), and the analysis of plans which include the National Information Society and Development Plan (ISAD) 2005 (PNC, 2005) and USAASA Strategic plan 2012 – 2015 (USAASA, 2012).

A third source of primary data will consist of a supply side study which will involve face to face semi structured in-depth interviews with the fixed network operator Telkom, mobile network operators MTN, Vodacom, 8ta and CellC, the regulator ICASA, a representative from the FTTH Council and Internet Service Provider Internet Solutions. The supply side study will also examine the spectrum aspect of the ecosystem. The supply study aims to identify the strong and weak points within the supply side of the broadband ecosystem that makes it unbalanced.

3.5.2 Secondary data collection

The secondary source of data will be through a qualitative survey that will target plus minus 11 households, 14 small medium enterprises (SME’s), a local municipality, a local government clinic, a local government primary school and 5 consumers that were picked randomly in the shopping mall and classed under households. The demand side study aims at providing insight into consumer behaviour and the challenges faced within the demand side of the broadband ecosystem.

3.5.3 Content Analysis

Content analysis formed a third source of data which consisted of document analysis which included documents sourced from the web and included the review of documents from online sites such as mybroadband, ITweb, IT-Online, Saitnews, themediaonline and africatelecomsonline. The content analysis of documents was aimed at filling in the gaps where there was no or little supporting data that was collected from the primary and secondary methodologies on a particular area.

3.6 Data Collection Methods

This section reviews the data collection methods applied to this study. Coding analysis will be the most relevant method used for the data collection. Coding of items will assist in identifying items that are similar or different and will help in identifying a link between the elements of the broadband ecosystem. The researcher used the directed approach and as part of the directed approach the initial step involved the researcher first identifying key concepts or variables which would be coded into categories. The process started with the identification of the codes based on the conceptual framework outlined in figure 23 put together by the researcher under the literature review section. The codable units were identified as the elements of the broadband ecosystem in the conceptual framework. Once the concepts were identified the researcher grouped and coded these under the main theme which was identified as the broadband ecosystem and these consisted of the supply side factors, demand side factors and the absorptive capacity of the broadband ecosystem. The main theme was broken down into categories which the researcher coded as the supply side factors, demand side factors and the absorptive capacity. The categories were broken down further into sub categories that were grouped and coded as generic codes and these represented the elements within the supply side factors which were identified as infrastructure and spectrum, the demand side factors which were identified as services, applications and content and the absorptive capacity factors which were identified as investment, quality of human resources, governance structure and efficiency and productivity. The main theme, the category codes and the generic codes were then grouped on an excel spread sheet using a categorisation matrix for the easy grouping of the data findings into the correct code categories.

1. One of the main category under the broadband ecosystem theme was coded as supply side factors and the following generic codes were identified:
    a. Infrastructure
    b. Spectrum
2. One of the main category under the broadband ecosystem theme was coded as demand side factors and the following generic codes were identified:
    a. Services
    b. Content and applications
3. One of the main category under the broadband ecosystem theme was coded as absorptive capacity and the following generic codes were identified:
    a. Investment
    b. Quality of human capital
    c. Efficiency and productivity
    d. Governance structure

The next process involved using the online coding analysis toolkit (CAT) (University of Pittsburgh & University of Massachusetts, 2007 -2010) for the purpose of data collection and coding the data findings into the code categories identified in the theoretical framework. The online Coding analysis toolkit (CAT) (University of Pittsburgh & University of Massachusetts, 2007 -2010) was used in the data collection of primary data from existing policy and regulation documents. The researcher started off by first converting the identified policy and regulation documents into plain text files as was required by the online coding analysis toolkit (CAT). The documents were then uploaded onto the online coding analysis toolkit (CAT) database for the coding process. "CAT relies on predefined spans of text to enable the auto-loading of discrete items or what we call codeable units during the coding process" (University of Pittsburgh & University of Massachusetts, 2007 - 2010). Once the text files are uploaded and the coding process is initiated, "the coding system will present the codeable units one at a time consisting of the text lying in between each pair of blank lines" (University of Pittsburgh & University of

Massachusetts, 2007 -2010). For each dataset selected for coding the researcher had to assign the text file a name and in this process the policy or regulation name was assigned to the data. The researcher was then required to select the file from the CAT dataset that formed the source for the data collection and coded the data findings. The data format style selected for coding was word by word. The researcher analysed the selected policy or regulation document to identify themes or biases and codes were applied to the themes or biases identified that corresponded to the identified generic codes. Once the researcher was done with the data collection and coding of the policy and regulation documents the coded dataset file was converted to excel and the researcher started grouping the codes against the identified generic codes on the categorisation matrix created in line with the deductive analysis approach. The categorisation matrix helped the researcher identify relationships between the variables and codes. Using the Coding Analysis Toolkit (CAT) "adjudication is the process of judging coder choices; it involves looking at codeable units one at a time and assessing the validity of the specific coding choices" (University of Pittsburgh & University of Massachusetts, 2007 -2010). The researcher used the online Coding Analysis Toolkit (CAT) for the validation of the coded data. In this process the researcher choose the dataset that required validation and checked the coded units one at a time and assessed whether the specific code choice was valid. Invalid codes were corrected by the researcher during the validation process. Both primary and secondary sources of data were used as well as content analysis as the main sources of data for this research study.

3.6.1 Policy and regulation analysis

The analysis of policy and regulation documents formed the first primary source of data. The analysis of existing policy documents includes the analysis of the Electronic Government the Digital Future 2001 (RSA, 2001), Broadband policy 2010 document (DoC, 2010), Radio Frequency Spectrum Policy for South Africa 2010 (DoC, 2010), ITA for a Radio Frequency spectrum Licence for the purpose of providing a mobile broadband wireless access service in the 2.6GHz and 3.5GHz band (DoC, 2010), Draft Spectrum assignment plan for the combined licensing of the 800MHz and 2.6GHz bands (DoC, 2011), Draft ITA for Radio Frequency Spectrum to Provide Mobile Broadband Wireless Access Service for Urban and Rural Areas Using the Complementary Bands 800MHz and 2.6GHz (DoC, 2011), (RSA, 2001). ANC policy discussion document 2012 (ANC, 2012), The ICT Policy Colloquium discussion document 2012 (DoC, 2012) and analysis of existing regulation which include Telecommunications White Paper 1996 (RSA, 1996), Electronic Communications Transaction Act 2002 (RSA, 2002), the Electronic Communication Act 2005 (RSA, 2005), Electronic Communication Act Amendment bill 2012 (DoC, 2012), and analysis of plans which includes the National Information Society and Development Plan (ISAD) 2005 (PNC, 2005) and USAASA Strategic plan 2012 – 2015 (USAASA, 2012).

3.6.2 Semi structured in-depth interviews

The second primary source of data was semi structured in-depth interviews with the telecommunication operators. The process started with the collection of primary data in the form of feedback from the semi-structured in-depth interviews with senior representatives from the Telecommunication industry which comprised of fixed and mobile operators, an ISP, the regulator and a telecommunication body. Telkom, MTN, Vodacom, 8ta, CellC, ICASA, FTTH Council and Internet Solutions were selected to participate in the semi-structured in-depth interviews. The in-depth interviews were completed either telephonically, on a face to face basis and an option for self-completion was given to those respondents that were unavailable for either a telephonic or face to face interview.

Individual interviews are one of the popular modes of gathering data in qualitative research and involve an interviewer interacting with a respondent, where a conversation is established and the interviewer steers the conversation in a general direction and "pursues specific topics raised by the respondent" (Babbie & Mouton, 2001, p. 289). Some of the benefits of using interviews for the qualitative approach include data richness and a deeper insight of the phenomena being studied. According to Hancock, Hammersley & East (1998) interviews can either be "structured, semi-structured or unstructured" (Hancock et al, 1998, p. 25). Structured interviews which are normally in the form of questionnaires involve the interviewer posing the same structured questions to the different interviewees in the same way. The disadvantage of this method is that responses elicited could be limited (Hancock et al, 1998). Semi-structured interview involves open-ended questions which are modelled around the topics that the interviewer wants covered. The advantage of this method is that it providers interviewers and interviewees with the opportunity to discuss the topics in detail and also involves the use of prompts or cues by the interviewer should the interviewee have difficulty responding to a question (Hancock et al, 1998). Unstructured interviews on the other hand are hardly structured and provide depth and detail into the phenomenon. There is normally to plan on how the interview is going to be structured and involves the interviewer only discussing a small number of topics (Hancock et al, 1998). The Semi-structured interview method was selected for use in this study as it normally provides the depth and insight required to understand the phenomenon being investigated.

In line with complying with the confidentiality agreement the respondent's real names were not used but were assigned identifiers to identify them. Identifiers will be used when referring to the respondents responses instead of their real names as per below table 5:

Table 5: Identifiers representing the interview respondents

Mobile Operator	**Interview Method**	**Interview Date**	**Identifiers**
8ta	Telephonic, recorded	17th August 2012	MNOR1 - 8ta
Telkom	Telephonic, recorded	17th August 2012	FNOR1 – Telkom
MTN	face-to-face, recorded,	23rd August 2012	MNOR1 - MTN
MTN	Telephonic, not recorded,	28th August	MNOR2 - MTN

	transcribed in full	2012	
CELLC	face-to-face, recorded,	30th August 2012	MNOR1 - CellC
CELLC	face-to-face, recorded,	30th August 2012	MNOR2 - CellC
FTTH Council Africa	face-to-face, recorded,	25th September 2012	FCR1 - FTTH Council Africa
ICASA	Self-Completed	25th September 2012	RR1 - ICASA
Internet Solutions	Self-Completed	23rd August 2012	ISPR1 - Internet Solutions
Vodacom	face-to-face, recorded,	28th August 2012	MNOR1 - Vodacom

Source: *Macharia, 2012*

The identifiers in table 6 below will be used when referring to the Household respondents, SMME respondents and Government respondents:

Table 6: Identifiers Representing Household, SMME and Government Respondents

Household identifiers	**SMME identifiers**	**Government identifiers**
HH1	SMME1	GOVR1-Local Municipality
HH2	SMME2	GOVR2-Public School
HH3	SMME3	GOVR3-Government clinic
HH4	SMME4	
HH5	SMME5	
HH6	SMME6	
HH7	SMME7	
HH8	SMME8	
HH9	SMME9	
HH10	SMME10	
HH11	SMME11	
HH12	SMME12	
HH13	SMME13	
HH14	SMME14	

HH15		
HH16		

***Source:** Macharia, 2012*

3.6.3 Qualitative surveys

The secondary data was in the form of data collected from the qualitative surveys conducted with Households, SMMEs and a qualitative survey with the local municipality IT department, the local government clinic and the local public school. The qualitative surveys were carried out in four areas within Metsweding municipality which fell within Cullinan and Bronkhorstspruit localities.

3.6.3.1. Population and Sample

The research questions will normally guide a researcher on the choice of the sample. The sample chosen has to be a representation of "an entire population or body of objects" (Leedy & Ormrod, 2005, p. 145) from which a researcher wishes to draw a conclusion from. The chosen sample according to Leedy & Ormrod (2005) is normally selected on a random basis or selected based on the sample being representative of the subgroups within a population or objects.

3.6.3.1.1 Population

Metsweding was selected because of its largely rural nature and proximity to Johannesburg. Four Areas in Metsweding were selected two rural and two peri-urban. The selection was informed by the research requirement to target commercially and none commercially viable areas of the rural parts of Metsweding and the fact that majority of the SMME businesses were located in the Peri-urban parts of Metsweding. Maps were produced with the assistance of GCRO for the selected areas to facilitate the selection of the sample target area for the fieldwork. For the purpose of this research the population that will be considered to partake in the interviews will be the local residents and businesses of Metsweding District Municipality and the fixed network operator Telkom one representative and mobile network operators MTN two representatives, Vodacom one representative, 8ta one representative and CellC two representatives, the regulator ICASA one representative, one FTTH Council representative and Internet Service Provider Internet Solutions one representative. Senior representatives from Telkom, MTN, Vodacom, 8ta, CellC, ICASA, FTTH Council and Internet Solutions were selected to participate in the in-depth interviews. The in-depth interviews were completed either telephonically, on a face to face basis and an option for self-completion was given to those respondents that were unavailable for either a telephonic or face to face interview. The DoC, Neotel, FiberCo and a number of ISPs which includes MWEB, Vox Telecoms and iBurst declined to participate in the in-depth interviews. In line with complying with the confidentiality agreement the respondent's real names were not used but assigned identifiers to identify them.

Identifiers will be used when referring to the respondents responses instead of their real names as per below table 7:

Table 7: Identifiers representing the Interview Respondents

Mobile Operator	**Interview Method**	**Interview Date**	**Identifier**
8ta	Telephonic, recorded	17th August 2012	MNOR1 - 8ta
Telkom	Telephonic, recorded	17th August 2012	FNOR1 - Telkom
MTN	face-to-face, recorded,	23rd August 2012	MNOR1 - MTN
MTN	Telephonic, not recorded, transcribed in full	28th August 2012	MNOR2 - MTN
CELLC	face-to-face, recorded,	30th August 2012	MNOR1 - CellC
CELLC	face-to-face, recorded,	30th August 2012	MNOR2 - CellC
FTTH Council Africa	face-to-face, recorded,	25th September 2012	FCR1 - FTTH Council Africa
ICASA	Self-Completed	25th September 2012	RR1 - ICASA
Internet Solutions	Self-Completed	23rd August 2012	ISPR1 - Internet Solutions
Vodacom	face-to-face, recorded,	28th August 2012	MNOR1 - Vodacom

Source: *Macharia, 2012*

The below identifiers listed in table 8 below will be used when referring to the Household respondents, SMME respondents and Government respondents:

Table 8: Identifiers Representing Household, SMME and Government Respondents

Household identifiers	**SMME identifiers**	**Government identifiers**
HH1	SMME1	GOVR1-Local Municipality
HH2	SMME2	GOVR2-Public School
HH3	SMME3	GOVR3-Government clinic
HH4	SMME4	
HH5	SMME5	
HH6	SMME6	
HH7	SMME7	
HH8	SMME8	
HH9	SMME9	
HH10	SMME10	
HH11	SMME11	
HH12	SMME12	
HH13	SMME13	
HH14	SMME14	
HH15		
HH16		

Source: *Macharia, 2012*

Based on the mapping that was done an analysis on the spread of commercial activities in Metsweding was done and it was identified that the majority of the resorts, game reserves and lodges fell within the peri-urban areas while only 2 or 3 lodges fell within the rural areas of Metsweding. It was also identified that a couple of mines and quarry businesses fell within the rural areas of Metsweding. The Household and SMME respondents were identified using snowball sampling. All household interviews were completed in the rural areas, whereas the SMME interviews were conducted in both the rural and the peri-urban areas with the majority being selected from the peri-urban parts of Metsweding due to a minimal number being located in the rural areas of Metsweding.

The Interview sample for the demand side study consisted of 11 rural household interviews with adult members of households, 14 interviews with SMME owners / managers, five interviews with consumers targeted randomly in the shopping centre and classed under households, one interview with the local municipality, one interview with the local government clinic, and one interview with the local public school. An IT manager, head nurse and school principal were interviewed to represent the government departments, which did not have a presence in the select area. The SMME businesses selected consisted of a plant nursery, two small retail shops, manufacturer, two steel companies, two bed and breakfast, steel, petrol and diesel distributor, cars dealership, agricultural produce and distribution centre, a farmer, engineering company and a agriculture equipment hire, parking and accommodation company.

3.6.3.1.2 Sample

The number of households in Metsweding District Municipality is estimated at 51, 000 (Metsweding District Municipality, 2011) and the sampling ratio for the purpose of this research will be 1% to avoid error of margin.

3.6.4 Content analysis

Content analysis formed a third source of data which consisted of document analysis which included documents sourced from the web and included the review of documents from online sites such as mybroadband, ITweb, IT-Online, Saitnews, themediaonline and africatelecomsonline. The content analysis of documents was aimed at filling in the gaps where there was no or little supporting data that was collected from the primary and secondary methodologies on a particular area. Content analysis entails the “systematic examination of the contents of a particular body of material for the purpose of identifying patterns, themes or biases” (Leedy &

Ormrod, 2005, p. 142). Content analysis normally requires the researcher to define a specific research question or problem from the onset which is normally performed on books, transcripts, newspapers etc. The researcher is normally required to identify the body of material for the study and identify the characteristics that will be examined. “Qualitative content analysis is one of numerous research methods used to analyse text data … and is defined as a research method for the subjective interpretation of the content of text data through the systematic classification process of coding and identifying themes or patterns” (Hsieh & Shannon, 2005, p.1278). Document analysis is “useful in trying to understand the philosophy of an organization” (Hancock et al, 2009, p. 19).

3.6.4.1 Deductive Content Analysis

Deductive content analysis is often used for the purpose of retesting existing data by a researcher, (Elo & Kyngas, 2007, p.111**).** Existing research or theory is used to help in providing focus to the research question, ((Hsieh & Shannon, 2005, p.1281). The process involves developing a categorisation matrix and data is then coded according to these categories, (Elo & Kyngas, 2007, p.111). Deductive content analysis “provides predictions about the variables of interest or about relationships among variables, thus helping to determine the initial coding scheme or relationships between codes” (Hsieh & Shannon, 2005, p.1281).

3.6.4.2 Directed Content analysis

“The goal of a directed approach to content analysis is to validate or extend conceptually a theoretical framework or theory” (Hsieh & Shannon, 2005, p.1281). In this process as an initial step the researcher first identifies key concepts or variables which are then used as coding categories. Where data is collected through interviews, open ended questions are structured around the predefined coding categories. Once data is collected, the analysis process will involve the coding of data using the predefined codes, (Hsieh & Shannon, 2005, p.1281). A second strategy used in directed content analysis is where the researcher starts coding immediately using the predetermined codes, (Hsieh & Shannon, 2005, p.1282).

“Data that cannot be coded are identified and analysed later to determine if they represent a new category or a subcategory of an existing code” (Hsieh & Shannon, 2005, p.1282). The advantage of using directed content analysis “is that existing theory can be supported and extended,…as research in an area grows, a directed approach makes explicit the reality that researchers are unlikely to be working from the naïve perspective that it is often viewed as the hallmark of naturalistic designs” (Hsieh & Shannon, 2005, p.1283). The limitations of using theory are that researchers usually form an informed bias on the data, (Hsieh & Shannon, 2005, p.1283).

3.7 Sampling Methods

Sampling in qualitative research “occur at several stages, both while collecting data and while interpreting and reporting on it” (Hancock et al, 2009, p. 21) and is “concerned with seeking information from specific groups and subgroups in the population” (Hancock et al, 1998, p. 2). Sampling in qualitative research involves selecting the people that will be interviewed and selecting the location where these people can be found (Flick, 2007). Sampling “is conceived as a way of setting up a collection of deliberately selected cases, materials or events for constructing a corpus of empirical examples of studying the phenomenon of interest in the most instructive way” (Flick, 2007, p. 27). For the purpose of this study the purposive and snowballing sampling methods will be used.

3.7.1 Snowball Sampling

Snowball sampling is useful when carrying out research in communities that are considered marginalised (Cohen & Arieli (2011). This sampling method is used if a researcher feels that putting together a representative sample of the population might prove challenging (Cohen & Arieli, 2011). This research study will use the snowball sampling technique as it may prove difficult to locate respondents that have access to broadband given the low penetration of broadband services that currently exists in rural areas. In this technique the respondents that a researcher makes contact with, refer people from their social network that could potentially participate in the research. This sampling method "can help researchers to capitalise on informal networks that might otherwise be difficult to access" (Hancock et al, 2009, p. 22). Household and SMME respondents were identified using snowball sampling.

3.7.2 Purposive Sampling

"Purposive sampling refers to selecting participants who serve a specific purpose consistent with a study's main objective" (Collingridge & Gantt, 2008, p. 391). There are various types of purposive sampling techniques one of which involves selecting participants based on their experience with the phenomenon being studied which is called criterion sampling. Another technique called "maximum variation sampling" involves the selection of participants who are able to provide a number of descriptions of the phenomenon being studied (Collingridge & Grant, 2008). In purposive sampling the researcher uses his judgment to identify the individual that would "provide the best perspective on the phenomenon of interest, and then intentionally invites those specific perspectives into the study" (Abrams, 2010, p. 538). Teddlie & Yu (2007) on the other hand define purposive sampling as the selection of units which could consist of groups of individuals, individuals or institutions for the sole purpose of answering a specific research study question. Purposive sampling was selected for the purpose of this study as senior individuals with experience or that are experts in the phenomenon being studied were selected from Telkom, 8ta, Vodacom, CellC, MTN, Internet Solutions, FTTH Council Africa and ICASA to participate in the semi-structured in-depth interviews.

3.8 Research Instruments

A good audit trail is crucial in qualitative research and organization is key in "keeping records of data or reflective notes or memos, or documents" (Hancock et al, 2009, p. 24). The storage of records that are saved also needs to be in line with regulation pertaining to data protection which includes "anonymisation procedures in labelling digital or analogue recordings or documents or text" (Hancock et al, 2009, p. 24).

A qualitative interview schedule will be developed for the semi structured in-depth interviews and interviews will be recorded and transcribed for later analysis. As part of preparing the material for analysis, the in-depth interviews will be transcribed from oral to written text for data findings presentation and analysis and then verified to ensure that the data provided is valid, consistent and reliable. The use of code numbers is recommended by Hancock et al (2009) for the identification of tapes and electronic records. And where approval is not granted for the use of recordings in an interview then notes can be used with the permission of the interviewee. A diary is also recommended for interviewers where an audit trail of the data collected and analysis process is recorded. For the purpose of this study a tape recorder was used for the face to face interviews and some of the telephonic interviews. The Interviews were then transcribed in full for data collection purposes, coding and the analysis of the data findings.

For the household, SMME and government interviews a qualitative survey was developed. The qualitative survey included indicators to measure the relationship between demographics and uptake this was mainly to assist the researcher to measure the link between poverty, literacy and broadband uptake. The researcher ensured that the questions were not leading and simplified the qualitative surveys for the households, SMME and government as well as geared the language used for the respondents. A sheet explaining the terminology was included as part of the research instruments and whose purpose was mainly to simplifying the interview process by providing the respondent's with a list of definitions to the terminology used in the qualitative survey. A consent form also formed part of the research instruments and required the respondent's signature as an acknowledgement of their willingness to participate in the research study. An information sheet also formed part of the research instruments and provided a summarised background and overview of the research study to the respondents. A letter to GCRO requesting for land cover raw data for the mapping exercise and also outlining the reasons why the data was required also formed part of the research instruments. An appendix will be included as part of the final research report with copies of the interview schedules used, transcriptions from the in-depth interviews and copies of the research letters.

3.8.1 Mapping

Maps were produced as part of the research instruments. The mapping was produced using GCRO (2009) data to assist the researcher in identify where the population sample was located. Of interest was a mapping of Metsweding Municipality to identify where mining, tourist sites, commercial sites and rural/ agricultural areas were located. The mapping was also done to identify the commercially viable and none commercially viable areas of the rural parts of Metsweding municipality.

The process first involved collecting land cover raw data for Metsweding municipality from GCRO. Before the land cover raw data could be given the GCRO required an official letter requesting for the raw data and a reason stating why the data was required and was supplied. The requested raw data required was as follows:

1. Representative layer indicating the rural, urban and peri-urban parts of Metsweding Municipality – GTI land cover, GCRO (2009).

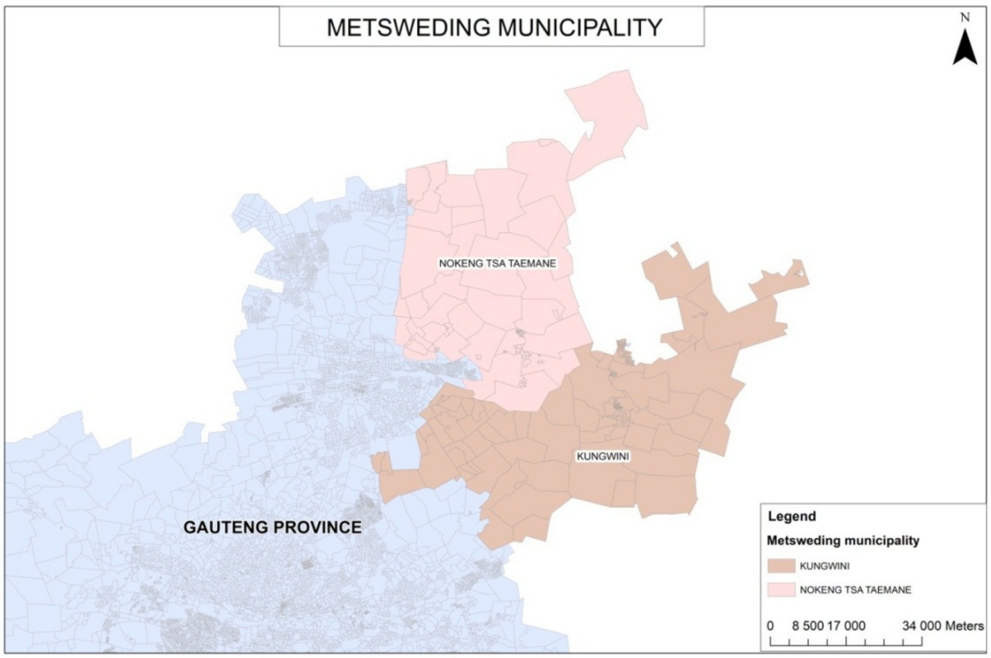
2. Representative layer indicating the various commercial activities located within the municipality which should include mining, agriculture and tourism - – GTI land use per building or ESKOM SBC, GCRO (2009).

3. Representative layer indicating where the population is located within the municipality - – Lightstone Demprokey X, GCRO (2009).

Once GCRO issued the raw data, with the assistance of Tsholo Diphoko I was able to tabulate the data into maps using the ArcGIS software (ArcGIS, 2010) at the GIS lab in the school of Geography, Archaeology and Environmental studies located at the University of Witwatersrand campus. I learnt how to tabulate the raw data using ArcGIS with the assistance of Tsholo Diphoko a student at the school of Geography; Archaeology and Environmental studies located at the University of Witwatersrand campus. All the maps were produced with the assistance of Tsholo Diphoko. Figure

25 below highlights a map that was produced of Metsweding Municipality and which revealed that Metsweding municipality consisted of two local municipalities namely Nokeng Tsa Taemane and Kungwini.

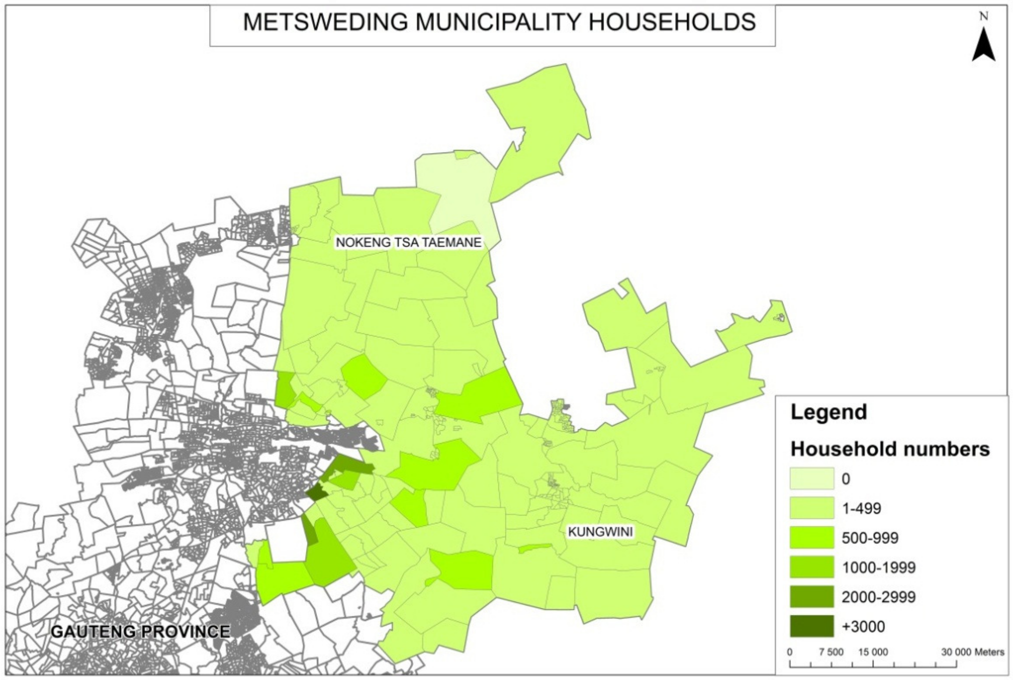
Figure 25: Metsweding Municipality



Source: *GCRO, 2009; ArcGIS, 2009*

A second map was tabulated highlighting the number of households across Metsweding Municipality, see figure 26 below. The map reveals that the household density was mainly around the urban edge of Metsweding municipality bordering Tshwane. About two thirds of Metsweding municipality had very low density of households. This map enabled the researcher to identify the areas where the households were located as this was important for identifying target areas for the household sample. All household interviews were completed in the rural areas, whereas the SMME interviews were conducted in both the rural and the peri-urban areas with the majority being selected from the peri-urban parts of Metsweding due to a minimal number being located in the rural areas of Metsweding.

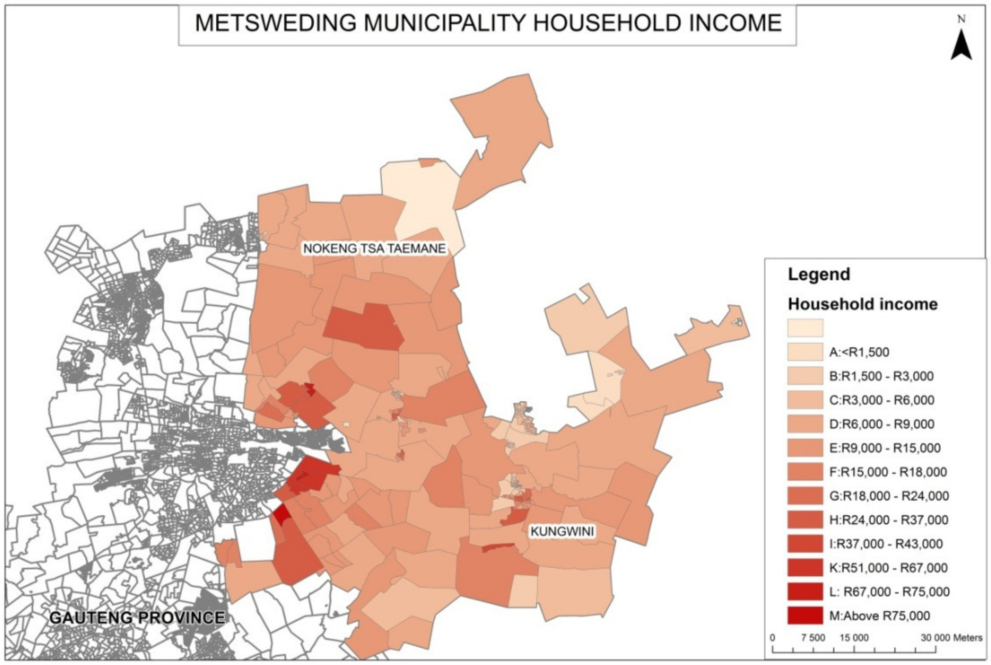
Figure 26: Metsweding Municipality Households



Source: *GCRO, 2009; ArcGIS, 2009*

A third map was tabulated indicating the household incomes across Metsweding Municipality, see figure 27 below. The map reveals that households with higher income were also positioned around the urban edge of Metsweding municipality bordering Tshwane. This map enabled the researcher to identify income distribution of households which was important in identifying target areas for the household sample based on income.

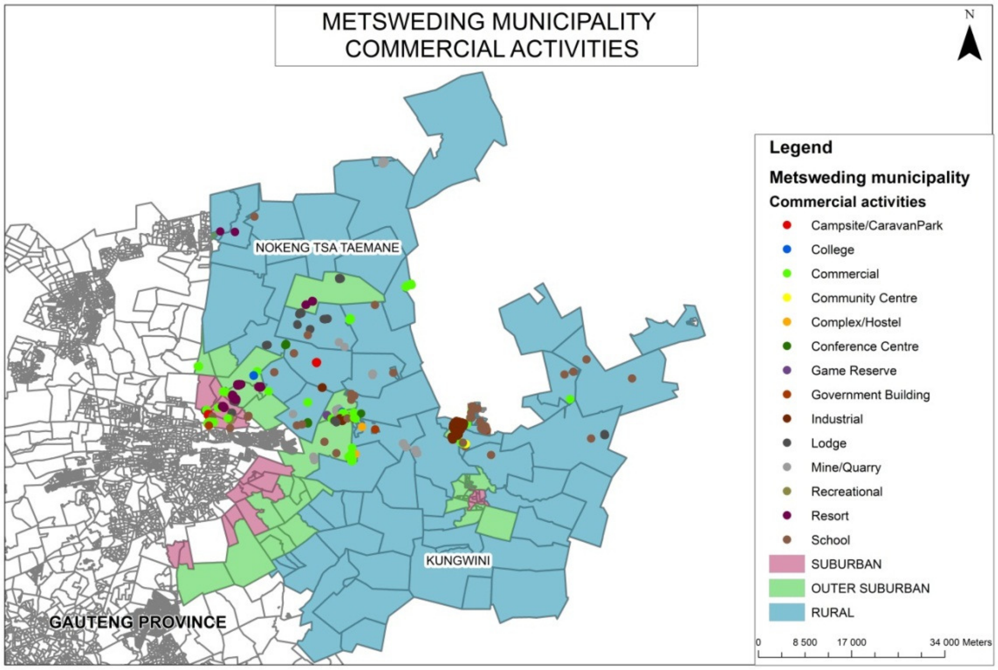
Figure 27: Metsweding Municipality Household income



Source: *GCRO, 2009; ArcGIS, 2009*

A fourth map was tabulated that indicated the commercial activities across Metsweding Municipality, see figure 28 below. The map reveals that majority of the commercial activity is centred on the urban edge and peri-urban areas of Metsweding Municipality. The majority of the resorts, game reserves, lodges and mines fell within the peri-urban areas while only 2 or 3 lodges fell within the rural areas of Metsweding. It was also identified that a couple of mines and quarry businesses fell within the rural areas of Metsweding. Kungwini local municipality had no commercial activity with the exception of one lodge. The map helped the researcher in identifying the target sample of businesses or commercial activities that fell within the rural and peri-urban parts of Metsweding municipality.

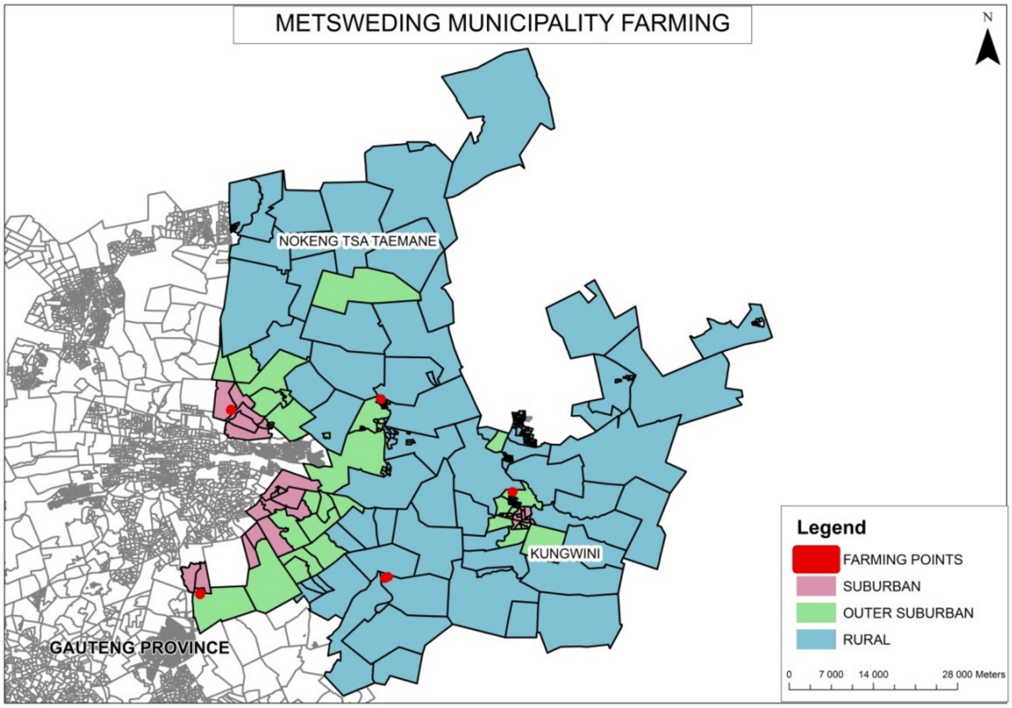
Figure 28: Metsweding Municipality Commercial Activities



Source: *GCRO, 2009; ArcGIS, 2009*

The fifth map was tabulated and indicated the location of the farming areas across Metsweding Municipality, see figure 29 below. The map reveals that there were only five farming points in Metsweding municipality. The map assisted the researcher in identifying the location of the farming target sample required as part of the secondary data collection.

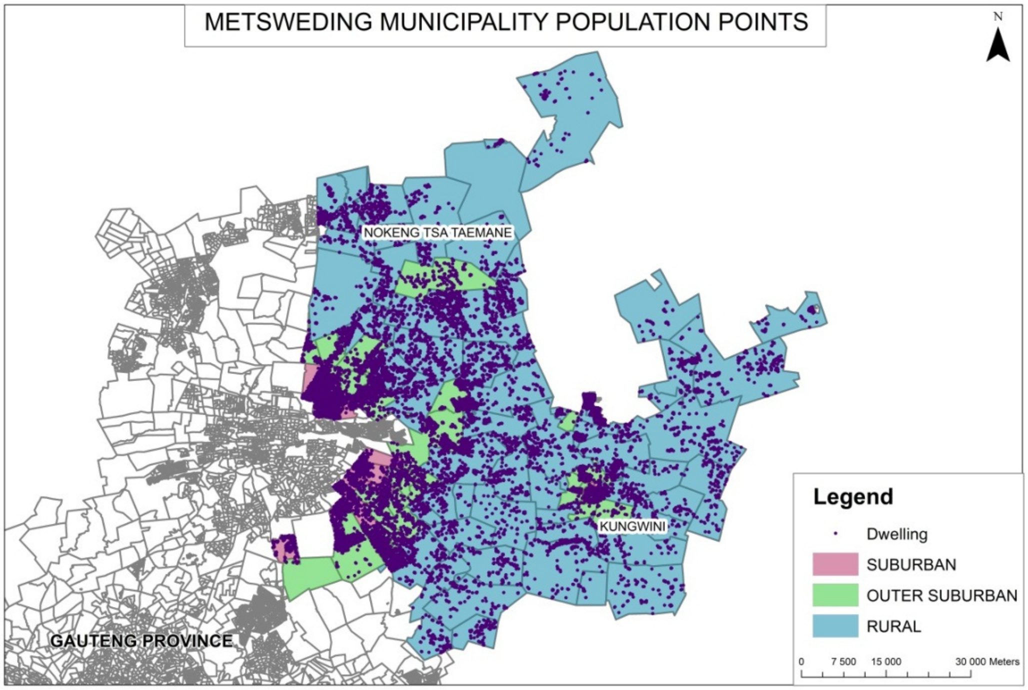
Figure 29: Metsweding Municipality Farming



Source: GCRO, 2009; ArcGIS, 2009

The sixth map that was tabulated indicated the population points across Metsweding Municipality. The map reveals that the population points were denser around the urban and peri-urban parts of Metsweding municipality. The population point's level of density was relatively low in the rural parts of Metsweding municipality. The map was merely used to identify the population spread within Metsweding municipality.

Figure 30: Metsweding Municipality Population points



Source: *GCRO, 2009; ArcGIS, 2009*

The seventh map was tabulated that indicated the total population across the different parts of Metsweding Municipality.

3.9 Research Procedure

An information form providing the background to the research study and a consent form will form part of the interview process. Each participant will be required to read the background to the research study provided in order to understand the purpose of the research study. Each participant will also be required to sign the consent form before the interview can commence. A tape recorder will be used only once permission has been accorded for the in-depth face to face interviews.

3.10 Data Analysis

The process of analysing data in qualitative research involves a summary of the "frequencies of variables", identifying the differences in "variables and statistical tests" used to provide an estimate on the "statistical significance of the results" (Hancock et al, 2009, p. 24). "Analysis of data in a research project involves summarising the mass of data collected and presenting the results in a way that communicates the most important features" (Hancock et al, 2009, p. 24). Counting the number of times that a particular theme occurs in the data and the comparison of measurements with each other forms part of the qualitative analysis process. Analysis can either be in the form of verbal behavioural categorization of data which is used for the purpose of classifying, summarising and tabulating the data. There are normally two levels of analysing content, the first level provides a descriptive account of the data which normally includes information on what was said, written or observed (Hancock et al, 2009). The second level of analysis is interpretative analysis which "is concerned with what was meant by the response, what was inferred or implied" (Hancock et al, 2009, p. 24).Chapter 5 details the findings from the analysis of the primary data findings from the semi structured in-depth interviews with the telecommunication operators and analysis of existing policy and regulation documents. Analysis of the data findings from secondary data in the form of qualitative survey with the Households, SMME and Government was carried out in four areas of Metsweding municipality within Cullinan and Bronkhorstspruit. The analysis of the data findings are aimed at providing answers to the four research sub questions which are outlined in chapter 3 and which are as follows:

1. How do the supply side factors affect broadband evolution in rural areas?
2. How do demand side factors influence policy for broadband in rural areas?
3. To what extent does existing policy enable the investment in and absorptive capacity of broadband?
4. To what extent does existing policy and regulation enable broadband evolution and ecosystem development in rural areas?

3.11 Validity and reliability of data

Schmittlein (1984) proposes the use of “a mixed binomial error model” which enables one to evaluate the validity and test the reliability of data. The approach is used to test “the distribution of true ability over the population” (Schmittlein, 1984, p.23). According to Schmittlein (1984) model an individual’s choice of objects is validated against an objective standard. “For the primary model considered here these data can be summarized by the distribution, over individuals, of the number of "matches" or agreements between a person’s choices and the objective criterion. A similar procedure is used for evaluating test-retest reliability. The distribution for the number of matches is again used; but here the matches will refer to agreement between the individual's K choices on this occasion, and the K choices made by that individual on a previous occasion” (Schmittlein, 1984, p.23). For the purpose of this study the researcher was able to compare data from the in-depth interviews, qualitative surveys and content analysis in search of consistency of data and responses provided as this was an indicator used to validate that the data was indeed accurate and reliable if consistency was identified.

3.12 Limitations

This will be a baseline research which will focus on Metsweding District Municipality and not all rural areas in South Africa.

CHAPTER 4: UNDERDEVELOPED RURAL BROADBAND ECOSYSTEM

4. Introduction

This chapter presents the data findings from the primary data, secondary data and content analysis. The researcher used the directed approach and as part of the directed approach the initial step involved the researcher first identifying key concepts or variables which would be used as coding categories. The process started with the identification of the codes based on the conceptual framework outlined in figure 23 put together by the researcher under the literature review section. The codable units were identified as the elements of the broadband ecosystem in the conceptual framework. Once the concepts were identified the researcher grouped and coded these under the main theme which was identified as the broadband ecosystem and these consisted of the supply side factors, demand side factors and the absorptive capacity of the broadband ecosystem. The main theme was broken down into categories which the researcher coded as the supply side factors, demand side factors and the absorptive capacity. The categories were broken down further into sub categories that were grouped and coded as generic codes and these represented the elements within the supply side factors which were identified as infrastructure and spectrum, the demand side factors which were identified as services, applications and content and the absorptive capacity factors which were identified as investment, quality of human resources, governance structure and efficiency and productivity. The main theme, the category codes and the generic codes were then grouped on an excel spread sheet using a categorisation matrix for the easy grouping of the data findings into the correct code categories.

1. One of the main category under the broadband ecosystem theme was coded as supply side factors and the following generic codes were identified:
    a. Infrastructure
    b. Spectrum
2. One of the main category under the broadband ecosystem theme was coded as demand side factors and the following generic codes were identified:

    a. Services
    b. Content and applications
3. One of the main category under the broadband ecosystem theme was coded as absorptive capacity and the following generic codes were identified:
    a. Investment
    b. Quality of human capital
    c. Efficiency and productivity
    d. Governance structure

After the code identification the next process involved the data collection and involved the review of primary data in the form of feedback from the semi-structured in-depth interviews with senior representatives from the Telecommunication industry. This comprised of fixed and mobile operators, an ISP, the regulator and a telecommunication body. Telkom, MTN, Vodacom, 8ta, CellC, ICASA, FTTH Council and Internet Solutions were selected as the respective representatives to participate in the semi-structured in-depth interviews. The in-depth interviews were completed either telephonically, on a face to face basis and an option for self-completion was given to those respondents that were unavailable for either a telephonic or face to face interview.

The review of primary data also involved the document analysis of existing policy documents which include the Electronic Government the Digital Future 2001 (RSA, 2001), Broadband policy 2010 document (DoC, 2010), Radio Frequency Spectrum Policy for South Africa 2010 (DoC, 2010), ITA for a Radio Frequency spectrum Licence for the purpose of providing a mobile broadband wireless access service in the 2.6GHz and 3.5GHz band (DoC, 2010), Draft Spectrum assignment plan for the combined licensing of the 800MHz and 2.6GHz bands (DoC, 2011), Draft ITA for Radio Frequency Spectrum to Provide Mobile Broadband Wireless Access Service for Urban and Rural Areas Using the Complementary Bands 800MHz and 2.6GHz (DoC, 2011), (RSA, 2001). ANC policy discussion document 2012 (ANC, 2012), The ICT Policy Colloquium discussion document 2012 (DoC, 2012) and analysis of existing regulation which include Telecommunications White Paper 1996 (RSA, 1996), Electronic Communications Transaction Act 2002 (RSA, 2002), the Electronic Communication Act 2005 (RSA, 2005), Electronic Communication Act Amendment bill 2012 (DoC, 2012), and the analysis of plans which include the National Information Society and Development Plan (ISAD) 2005 (PNC, 2005) and USAASA Strategic plan 2012 – 2015 (USAASA, 2012).

This chapter also reports back on the secondary data findings, the secondary data findings was in the form of findings from the qualitative surveys conducted on Households, SMMEs and a qualitative survey with the local municipality IT department, the local government clinic and the local public school. The qualitative surveys were carried out in four areas within Metsweding municipality which fell within Cullinan and Bronkhorstspruit localities. Web content formed a third source of data and included the review of documents from online sites such as mybroadband, ITweb, IT-Online, Saitnews, themediaonline and africatelecomsonline. The content analysis of web documents was aimed at filling in the gaps where there was no or little supporting data that was collected from the primary and secondary data on a particular question. South Africa has experienced a number of changes in its policy and regulatory environment over the years which have led to "significant market liberalisation, competition, technological change and restructuring in the telecommunications sector" (DoC, 2011, p.13). The document analysis of the policy and regulation documents was guided by these developments and a chronological format was followed in the data collection in order to track the evolution of the policies and regulation in the South African Telecommunication industry in relation and also to track the broadband market development in South Africa. These market changes are mapped out below in figure 31 and chronologically highlights key milestones in South Africa's telecommunications and broadband market development from 1991 when Telkom was established as the incumbent fixed line operator and right through to 2010 when the broadband policy was approved by cabinet and up to 2012 where there were several policy documents that were published that addressed the broadband market development in South Africa also touching on rural areas. Figure 31 maps out a chronological listing of developments in the telecommunications industry relating to green and white papers which start from 1996 with the White Paper on Telecommunications.

Figure 31: South Africa: Progress with telecommunications sector liberalisation and broadband evolution

Year	Development
1991	Incumbent fixed line operator, Telkom, established
1993	First mobile operator, Vodacom, licensed.
	SAT-2 Cable becomes operational
1994	Second mobile operator, MTN, licensed
	Open up VANS and customer equipment market
1996	Enactment of Telecommunications Act of 1996
	South African Telecommunications Regulatory Authority (SATRA) created
1997	WTO basic telecommunications agreement signed by SA. Committed to opening up the telecommunications sector to competition by 2007
	Telkom partially privatised through sale of 30% share
1998	State Information Technology Agency Act, 88 of 1998
2000	ICASA Act 13 tabled
	Independent Communications Authority of South Africa (ICASA) created as the telecommunications and broadcasting regulator through the merger of SATRA and the Independent Broadcasting Authority (IBA)
2001	Third mobile operator, Cell C, licensed
	Electronic Government the Digital Future 2001

	Telecommunications Amendment Act, No. 64 of 2001
	SAT-3/WASC/SAFE cable system became operational
2002	End of Telkom's exclusivity period
	Draft regulation issued by ICASA
	International carrier of carriers license and multimedia license awarded to Sentech
	Electronic Communications Security (Pty) Ltd Act, 68 of 2002
	Electronic Communications Transactions Act No. 25 of 2002
	The first ADSL package, a 512/256 kbit/s offering, was introduced in August 2002 by Telkom
2003	Telkom privatized further with listing of 20% of government's share on JSE and NYSE
2004	3G licences awarded to Vodacom and MTN
	ICASA granted seven licences to USALs (Under Serviced Area Licensees).
	Telecommunications Amendment Act, No. 2 of 2004
	Sentech launches wireless broadband service, MyWireless
	Vodacom pioneers 3G services in the country in 2004
2005	Draft Convergence Bill published for public discussion
	Restrictions on VoIP lifted
	SNO, Neotel licensed in 2005
	Electronic Communications Act of 2005
	The National Information Society and Development Plan (ISAD) 2005
	On 1 September 2005 Telkom releases its 1 Mbit/s ADSL offering
	MTN Launches 3G broadband services
	CellC launches EDGE-based services in 2005 enabling it to offer value-added services

	such as MMS, Internet access and content downloads
2006	Electronic Communications Act (ECA) (previously known as Convergence Bill) enacted, repealing the Telecommunications Act of 1996 and introducing a converged technology-neutral licensing regime
	Mobile number portability implemented
	Neotel commences providing wholesale backhaul and voice gateway services
	In late 2006, Telkom commenced with trials for 4 Mbit/s ADSL
2007	Another seven USAL licences granted
	Neotel commences providing retail voice and data services to corporate customers
	Minister determines that local loop unbundling process must begin immediately and must be completed by 2011
	Minister directs ICASA to urgently prescribe a list of essential facilities, and facilitate access by other operators to SAT-3 submarine cable landing stations controlled by Telkom.
	Broadband Infraco Bill, 2007
	Telkom launches full commercial WiMAX services in June 2007, first at 14 sites in Pretoria, Cape Town and Durban, and a further 57 sites are planned for 2007/8
2008	ICASA issues for discussion 10 draft regulation mostly on competition and markets
	Incumbent operator's and other service providers licences converted to I-ECNS and ECNS
	ICASA issues a Government Gazette confirming VANS licences would be converted to ECNS and I-ECNS licences
	Broadband Infraco becomes a stand-alone state owned enterprise but its licences are subject to consultation
	In May 2008, WBS partnered with Vodacom and Intel Corporation to roll out an 802.16e WiMAX network

	Regulation on Exemption from licencing published by ICASA
	Telkom launches WCDMA 3G broadband offers into the market
	In May 2008, Neotel launched consumer services, their broadband using CDMA technology
2009	Broadband Infraco receives its I-ECNS licence
	ICASA continues implementation of some of the regulation pertaining to the ECA.
	First phase of geographic number portability implemented, allowing porting of large number blocks.
	License fee regulation (ICASA)
	CCC Regulation by ICASA
	Interconnection and facilities-leasing regulation (ICASA)
	Standard terms and conditions for individual and class licences published by ICASA
	SEACOM cable
	In late 2009, Telkom began trialing 8 and 12 Mbit/s ADSL offerings
2010	Call termination rate regulation is finalised by ICASA on a gliding path from 2011 – 2013
	Meanwhile ICASA issues a plethora of regulation for comment and implementation, and publishes final facilities-leasing regulation. It also publishes a "guideline" for the determination of markets and market power, and a draft call termination regulation with an accompanying explanatory note. The guideline attempts to set out the methodology which ICASA will adopt when conducting market reviews under Chapter 10 (competition) of the ECA
	Radio Frequency Spectrum Policy for South Africa 2010
	Universal Service and Access Obligations Review discussion document
	Geographic number portability extended to include porting of individual numbers in May 2010. Final carrier preselect regulation published
	ICASA issues an ITA for spectrum in the 2.6GHz and 3.5GHz bands, which is

	subsequently withdrawn
	Broadband policy for South Africa (Government Gazette 33377, July 2010)
	EASY Cable becomes operational
	In August 2010, Telkom officially introduced ADSL at 10 Mbit/s
2011	Discussion document for local loop unbundling published 7th of November 2011. Findings note published on the 30/11/2011 whereby ICASA stated that the obligation to lease facilities under Chapter 8 of the Electronic Communications Act applies to all licensees providing Electronic Communications Network Services, but would be confined to fixed line networks
	Draft Policy directions for electronic Communication Services in high demand spectrum 2011
	Draft Invitation to Apply for Radio Frequency Spectrum to Provide Mobile Broadband Wireless Access Service for Urban and Rural Areas Using the Complementary Bands 800MHz and 2.6GHz gazetted on the 15/12/2011. Submissions were made by the 12/03/2012.
	Review of broadband value chain to identify market failures across the sector. The DoC is targeting the cost of voice calls that is mobile, wholesale (Interconnection/Mobile Termination Rates) and fixed public access, wanting it to be reduced by 30% by 2014.
	Explanatory Memorandum on the Repeal of the Digital Migration Regulation and the publication of the Draft Digital Terrestrial Television Regulation.
	Regulation regarding contributions to USAF (ICASA)
	National Planning Commission_National Development Plan
	WACS Cable becomes operational
2012	USAASA Strategic plan 2012 – 2015
	ANC policy discussion DoC 2012
	ICT Policy Colloquium discussion DoC 2012
	Electronic Communication act Amendment bill 2012

	Price reduction of the Telkom IPConnect product, to foster retail competition in the market for fixed line ADSL services (being a wholesale input price reduction)
	ICASA decision on local loop unbundling programme for 2012

Source: *Mybroadband, 2005; DoC, 2011; DoC, 2012; Neilson, Falcone & Mashinini, 2012; Song, Date Unknown; africantelecomsnews, Date Unknown; Wikipedia, Date Unknown*

The chronology of South Africa's telecommunications market development and the broadband evolution highlights that the approach to the broadband evolution has not been systematic and lacked structure and planning. Figure 31 above draws our attention to the fact that the Electronic Government the Digital Future document which was published in 2001 and the Electronic Communications Transactions Act which was published in 2002 both addressed the development of an e-Commerce and a national e-Strategy however this was done in hindsight of the fact that there was no policy or regulation addressing the broadband market development which was a fundamental critical requirement as a platform to enable and support the development and implementation of electronic services. It is also worth noting that the first ADSL package was introduced to the market by Telkom in 2002. The Telecommunications Amendment Act Number 64 was published in 2001, two years later after the first broadband service was introduced to the market yet the amendments made under the under-serviced area licencing requirements only made reference to the provision of "Voice over internet protocol services (VoIP), fixed-mobile services and public pay telephones" (RSA, 2002, p.16) with no consideration for broadband services. Mobile wireless broadband services were subsequently launched in 2004 by Sentech and Vodacom followed by MTN and CellC in 2005. Vodacom and MTN were awarded 3G licences in 2004 and subsequently launched 3G mobile broadband services in 2004 and 2005 respectively yet ten years later rural broadband market development remains a major problem. The Convergence Bill was subsequently published in 2005 again addressing converged platforms and services yet policies addressing the broadband evolution were still not visible as again broadband was the underlying key technology in a converged environment as converged platforms and services are based on the fundamental internet protocol (IP) layer. A plethora of undersea cables became operational between 1993 when the first undersea cable SAT-2 became operational to 2011 when the WACS cable became operational all in a bid to provide cheap and high international internet bandwidth connectivity to South Africa yet again the undersea cables important role towards the growth of the broadband evolution was only addressed by USAASA and DoC in 2010. USAASA only started addressing the need to include broadband access and infrastructure into the scope of the Universal Access and Service funds in 2010 as part of the Universal Service and Access Obligations Review document of 2010. It was also only in 2010 when the Broadband policy for South Africa was published addressing the broadband market development requirement, this was however 10 years too late which still did not address a framework and strategy for the broadband evolution in rural areas. It is also worth noting that Radio Frequency Spectrum policy was only published in 2010, additionally spectrum frequency for rural broadband market development was only addressed in 2010 and 2011 respectively however the ITA on the digital dividend spectrum were subsequently withdrawn.

4.1 Supply Side Considerations

This section outlines the data findings from the supply side elements consisting of infrastructure and spectrum. The data findings are from the primary study in the form of document analysis of existing policy and regulation documents and semi-structured in-depth interviews, secondary study in the form of qualitative surveys conducted with households, SMME and Government and content analysis findings.

Table 9 below summarises the supply side data findings from the semi-structured in-depth interviews and qualitative surveys which are discussed in detail below in section 4.1.1 and section 4.1.2.

Table 9: Summary of supply side Data Findings

Supply Side Data Findings	
Infrastructure	**Radio Frequency Spectrum**
Operators definition of rural areas differ from that of the DoC	Lack of spectrum in the lower frequency bands a challenge to broadband rollout in rural areas
Initial Universal Service and Access obligations mainly catered for voice and internet connectivity with no focus on the rollout of broadband infrastructure and broadband access	Spectrum administrative and annual fees a prohibition
Roll out of broadband networks in rural areas uneconomical	Operators are being forced to re-farm existing spectrum due to lack of access to the 800MHz and 2.6GHz spectrum
Rural termination rate currently does not exist for broadband	Flawed Digital migration process a barrier to the provision of broadband access to rural areas
The economics of broadband differ from the economics of voice	Government played conflicting roles which has hampered its capability to address the spectrum challenge
No studies exist to determine the coverage zones the different areas fall into	Spectrum is currently being used inefficiently
No framework exists to direct investment to the development of a broadband network in rural areas	
It costs an operator more to maintain a base station in rural areas than in the metropolitan area	

Fibre backbone network rollout is not a priority for rural areas as its main priority is to connect the metro hubs	
Administrative process for getting rights of way is problematic	
Rapid rollout is problematic in rural areas	
Governance framework and coordination between government and the private sector remains a challenge	
3G coverage in rural areas is minimal	

Source: *Macharia, 2013*

4.1.1 Infrastructure drivers of broadband network deployment

The data findings from the document analysis of existing policies and regulation documents revealed the following with regards to infrastructure. The Telecommunications White Paper 1996 highlights that during Telkom's exclusivity period its main role was to provide universal access and services with a focus on expanding telecommunication infrastructure and the provision of public switched telephone networks (PSTN) (RSA, 1996). The obligations tied to Telkom's exclusivity period are highlighted as "the rollout of 20 telephone lines per 100 population" (RSA, 1996, p.9) and public switched voice and data. The Telecommunications White Paper 1996 further highlights that the universal services fund goes directly to funding the expansion of networks to areas where no infrastructure exists. The Telecommunications White Paper 1996 makes provision for Telkom to utilise excess capacity from the parastatal's specifically in uneconomical areas where Telkom is unable to provide infrastructure. The Telecommunications White Paper 1996 made provision for after Telkom's 5 years exclusivity period that enables "SMMEs and community co-operatives" to provide in conjunction with Telkom, local loops in areas where Telkom has switching infrastructure but no local loop (RSA, 1996). The Electronic Communications Act of 2005 subsequently replaced the Telecommunications Act of 1996 in 2005 and further made provision for Ministerial policies and policy directions in matters pertaining to guidelines on licence fees, award of licences with incentives associated with individual licences where a binding commitment is made by an applicant "to construct electronic communications networks and provide electronic communications services in rural and underserviced areas" (RSA, 2005, p.12). The Electronic Communications Act 2005 makes provision for the prohibition of discrimination by operators and service providers and enabling transparency in matters relating to "access, provisioning of services, interconnection and facilities leasing" (RSA, 2005, p.46). The Electronic Communications Act of 2005 further makes provision for the licencing authority to issue "individual licences for the provision of electronic communications" networks at a national and provincial level (RSA, 2005, p.14). The Electronic Communications Act of 2005 further makes provisions for the use of funds from the universal fund in the "construction or extension of electronic communications networks in underserviced areas" (RSA, 2005, p.55). The National Information Society and Development Plan (ISAD) of 2005 came into place in 2005 also and identifies the availability of a national ICT infrastructure as being critical in addressing poverty and social inclusion (PNC, 2005). The National Information Society and Development Plan (ISAD) of 2005 highlight's the need for government and the telecommunications operators to subsidise the cost of infrastructure investment into "rural and remote communities if the goal of universal access is to be achieved" (PNC, 2005, p.27). The National Information Society and Development Plan (ISAD) of 2005 further highlight's the need for government "to promote ICT infrastructure for broadband connectivity" (PNC, 2005, p.27). The National Information Society and Development Plan (ISAD) of 2005 highlight's the existence of significant challenges despite the existence of a large government infrastructure network of being poorly interlinked and unevenly spread "across its spheres, between departments and between urban and rural areas" (PNC, 2005, p.46). The Broadband Policy 2010 was subsequently approved by cabinet in 2010 and the Broadband Policy 2010 document acknowledges “information and communication infrastructure as being a key enabler of an information society (DoC, 2010). The Broadband Policy 2010 document identifies broadband infrastructure as being key “in achieving the goal of digital inclusion, enabling universal, sustainable, ubiquitous and affordable access to ICT’s by all, and providing sustainable connectivity and access to remote and marginalized areas at national, provincial and municipal levels” (DoC, 2010, p.4). The Broadband Policy 2010 document acknowledges the significant role that the public and private sectors have played in the provision of broadband infrastructure but highlights that the contributions have not been sufficient and require “direct policy intervention and strategic investment” (DoC, 2010, p.5). The Universal Service and Access Obligations Review discussion document which was also published in August 2010 highlights that the services that were initially included in the Universal Service and access obligations mainly targeted voice services (ICASA, 2010). The Universal Service and Access Obligations Review discussion document 2010 states that “traditionally UA/US has often been linked to fixed telephone access, but increasingly mobile access or other wireless networks are also involved” (ICASA, 2010, p.9). Although the second round of obligations imposed on Neotel and Sentech included the rollout of 2500 and 500 internet labs in rural areas respectively (Hodge, 2004) the initial scope for universal service and access obligations was mainly voice and not broadband or internet access (ICASA, 2010). The “previous obligations only stipulated connection of internet access” (ICASA, 2010, p.14) and did not address infrastructure availability related to broadband as highlighted in the Universal Service and Access Obligations (USAO) Review discussion document 2010 and considerations are being made to include broadband internet access into the USAO scope. The USAASA Strategic plan 2012 - 2015 – 2015 document highlights one of the focus areas for USAASA going forward as assisting the DoC in driving new projects such as “broadband infrastructure rollout to underserviced areas” (USAASA, 2012, p.20). The USAASA Strategic plan 2012 - 2015 – 2015 document highlights broadband access as one of the services that needs to be included in the scope of the universal service policies “and the availability of at reasonable costs of both access … as well as the network that transport these services also need to be considered" (USAASA, 2012, p.21). The USAASA Strategic plan 2012 - 2015 – 2015 document goes further to highlight one of its strategic objectives as to "increase the delivery of infrastructure towards broadband connectivity" (USAASA, 2012, p.43). The ICT Policy Colloquium discussion document 2012 subsequently came to play in 2012 and identifies individuals from rural and disadvantaged communities as areas of key focus for the provision of access (DoC, 2012). The ICT Policy Colloquium discussion document 2012 does highlight the need for Broadband Infraco "to make available long distance telecommunications network infrastructure capacity mainly to licensed private sector partners in order to unlock economic growth especially in the underdeveloped and underserviced areas" (DoC, 2012, p.6). The ICT Policy Colloquium discussion document 2012 recognises the important role that a "national broadband network and connectivity" plays towards the country's overall growth and proposes that the role of policy makers must be extended further to assuming a leadership role in the formulation and implementation of a national broadband plan similar to that assumed by the Ministry of Transport in "the ownership of road and rail infrastructure" (DoC, 2012, p.24 & p.25). The ICT Policy Colloquium discussion document 2012 highlights the minimal policy mention that has been given to the issue of universal broadband infrastructure within government structures and the provision of infrastructure to enable citizens to interact with government (DoC, 2012). The ICT Policy Colloquium discussion 2012 further highlights that the regulator and the universal service funds were established as mechanisms that would address the challenges of providing access to these areas (DoC, 2012, p.39 & p.40). The ICT Policy Colloquium discussion 2012 further highlights that the Electronic Communications Act 2005 made provision for the Universal Service and Access Agency of South Africa through a fund to develop electronic communications networks in rural and under serviced areas (DoC, 2012, p.43). The ANC policy discussion document 2012 proposes that policy consideration must be given to the provision of connectivity in rural areas through the channelling of excess capacity to rural areas aimed at enabling "full access to high speed internet networks by 2030" (ANC, 2012, p.12). The ANC policy discussion document 2012 goes further in proposing that access to high speed internet access must be made a "basic utility for South Africans" and government must take the responsibility of maximising the opportunity "for all South Africans to benefit from the digital economy by" enabling digital infrastructure to all (ANC, 2012, p.14). The ANC policy discussion document 2012 proposes that targets should be defined that will enable high speed internet coverage and access to 100% of the population by 2030. The aim is to ensure that all South Africans will have access to the ICT infrastructure as well as receiver equipment which includes computers that will enable connectivity to the internet (ANC, 2012, p.9).

On the other hand the findings from the semi-structured in-depth interviews revealed that all the respondents that took part in the semi-structured in-depth interviews shared the same view that rolling out broadband networks into rural networks was uneconomical for telecoms operators.

MNOR1-8ta response was that "majority of the broadband is actually concentrated in the metros. And what we see on our networks is that two thirds of the network and two thirds of our traffic is then concentrated in Gauteng. Quite a bit of our traffic is concentrated in these economical areas. And that is just on our data connection so what I am saying is that if you look at broadband just in the metros alone you will see a very big split and if you go into the rural areas it's a drop in the ocean now because those areas don't generate the right volumes" (MNOR1-8ta, Interview date 17th August, 2012). MNOR1-8ta stated that rural is often referred to as any area that falls outside the metros and went further to highlight that it was the earning potential of a specific area that determined its potential as a target area for broadband network rollout and not the number of people in the specific area. MNOR1-8ta pointed out that some rural settlements had a high concentration of people concentrated in that area but lacked the earning potential. When looking at areas of coverage MNOR1-

8ta highlighted 3 values that mobile operators looked at; the number of people in the area, the income of the people and the density as identifiers that they used to determine the market potential of a specific area. MNOR1-8ta further highlights that building a network tends to be very capital intensive and if the payback and return on investment on infrastructure is not viable then from a capital perspective operators will only invest where there is a return. MNOR1-8ta gave examples of two areas Bathopelo and Kuliseshaba where they had deployed 2G and 3G base stations and the 3G base stations essentially provided broadband services. However the broadband consumption in these areas is very minimal which points back to the issue concerning affordability. MNOR1-8ta states that from an operators perspective the question is to what percentage of your loss making base does an operator deploy to? and responded by stating that, "that's not for the majority typically its actually 10 – 15% if you look at it that you're willing to make a loss on a deployment. So capital and operating costs (Capex and Opex) to maintain that is significant" (MNOR1-8ta, Interview date 17th August, 2012). FNOR1-Telkom responded that when rolling out a broadband network operators were faced with several challenges one being that if an operator already had an existing voice network in a particular area they could essentially build the broadband network on top of the existing network, however the operator would be required to get more backhaul capacity which comes at an additional cost to support the broadband service. Additionally the operator would be required to do more radio frequency spectrum planning however broadband is different from voice technology in that there is no two way conversation taking place like in voice where the operator is in a position to cross subsidise the cost of maintaining the base station as money is flowing effectively from the urban rich user to the rural base station due to services such as please call me back. FNOR1-Telkom further argued that with broadband there is no terminology like rural termination rate that addresses the rural / urban implicit cross subsidisation and the full cost of the broadband had to be borne by the rural user. FNOR1-Telkom went further to state that "your broadband server doesn't call you and doesn't pay for the connection you have to pay everything for the broadband" (FNOR1-Telkom, Interview date 17th

August, 2012). The economics of broadband are therefore very different from the economics of voice. FNOR1-Telkom further highlighted that where the economics are feasible you normally have more than one operator providing services in an area "but beyond some point it will be feasible for maybe one or two operators or maybe no operator without government subsidy" (FNOR1-Telkom, Interview date 17th August, 2012). FNOR1-Telkom highlights that there have been no economic studies done to determine the zones that the different areas fall into where you have the white zone being an area with no coverage, the grey zone being an area that is normally covered by one, two or more operators and a black zone being an area normally takes care of itself as it falls in the overlap coverage zones by default and not planning. FNOR1-Telkom believes that the problem of providing broadband network access to rural areas is one that has not been fully quantified in order to solve it. MNOR1-MTN highlighted that although it costs less to put up a base station in rural areas as an operator one had to look at some form of return on investments and in rural areas there was never going to be that type of return that operators were looking for. MNOR1-Vodacom highlighted that mobile operators did not see the opportunity to roll out broadband networks to rural areas as it was not economically viable. FCR1-FTTH Council responded that mobile operators have really been building substantial network coverage however rural areas have proved to be difficult markets because the people are generally not wealthy making the areas not commercially viable and therefore the economics went against the areas. On the other hand existing regulation does make provision for funding of access in rural areas, MNOR1-MTN responded that although less infrastructure was required in rural areas it costs an operator more to maintain a base station in the rural areas than in the metropolitan area due to challenges faced relating to the availability of electricity, air conditioner and backup services. FNOR1-Telkom highlighted that operators were rolling out fibre networks through rural communities but not with the aim of connecting these communities but were building the fibre networks to create traffic hubs to connect the cities Cape Town, Johannesburg, Durban at a cheaper price. However FNOR1-Telkom argued that there was a lot of elements that need to be factored in to connect the village to the fibre backbone network and stated that "this is the debate we had in Zambia you put fibre right through the village and you don't touch them and the reality is that you could put a switch through that fibre link and but again that is going to cost money. Does the village generate enough traffic, enough revenue, to put down a switch? Secondly you've got fibre but it's not fibre to the hut, fibre needs some other wireless broadband infrastructure to connect to that backbone" (FNOR1-Telkom, Interview date 17th August, 2012). You've still got to put a lot of elements to fibre for people to connect through that fibre. Essentially running a fibre backbone network through a rural area has no impact on the broadband market development in rural areas. FNOR1-Telkom argues that in rolling out the fibre backbone network through a rural area "you're not picking up the majority of the rural people, you might pick up a few. Telkom does have networks that branch out, we've got fibre 143, 000 km, so doing the economics of networks says 10% of your cost is in this long distance national backbone, 30% is in branching out between the cities like in the provinces and the other 60% is in the last mile that the wireless towers, the adsl, the copper lay. So you're talking orders of magnitude between that fibre you saw and all the other staff that takes to connect people to that fibre" (FNOR1-Telkom, Interview date 17th August, 2012). MNOR1-MTN highlights that fibre not copper is the way to go with building a backbone network however the initial priority or focus area is in connecting the cities or metropolitans first. MNOR1-MTN further highlights that they as an operator are busy with massive trenching which is aimed at connecting Johannesburg, Durban and Cape Town, the focus on rural areas will likely happen at a much later stage as at "this stage you have to connect these metropolitans it's almost like the normal road before you build all those nice little roads in the suburb's you need to build the highway and that's what were busy doing were busy trenching, laying down fibre and creating the highway" (MNOR1-MTN, Interview date 23rd August, 2012). FNOR1-Telkom also highlights the challenges associated to the rental cost of manning a mast or site housing a base station which government could influence through concessions as the land in most instances belongs to the municipalities and airport companies which are all government owned. FNOR1-Telkom highlights the administrative process of getting rights of way from Sanral as another challenge that is faced by operators, as building networks requires operators to trench an area in order to get to a base station. FNOR1-Telkom argues that although Sanral is a private company it is outsourced to government and no framework exists that highlights the input costs of operators that government could use as a basis to waiver the costs for operators and subsequently lower the end user price as currently all costs are borne by the end-user. MNOR1-Vodacom also highlights similar challenges when he states that mobile operators do not see the opportunity in rural areas due to the lack of economic viability. MNOR1-Vodacom further argues that "rolling out broadband networks is going to be more expensive in rural areas because the backbone is just not available so there is no fibre in rural areas so if you want to provide broadband you need a lot of high bandwidth to get to the base station which can be distributed to the subscribers. To get high bandwidth, you need fibre or microwave systems, microwave radio that's point to point radio. And were having a problem with ICASA, let me deal with fibre first it's just not there in rural areas and its expensive to dig because it involves trenching, digging a trench, laying the fibre so the majority of the cost is in the civil works the trenching" (MNOR1-Vodacom, Interview date 28th August, 2012).. ISPR1- Internet Solutions views on the availability of the network infrastructure in rural areas were that the existing broadband ecosystem in the rural areas was poor. ISPR1- Internet Solutions highlighted that one only had to look at the coverage maps of the two major mobile operators to see that broadband coverage in the rural areas was inadequate. ISPR1- Internet Solutions felt that mobile operators purported that they provided GSM and 2G coverage to rural areas however he felt that this did not count as mobile broadband and that 3G coverage in rural areas was not widespread. ISPR1-Internet Solutions stated that "ISPs would be able to derive value from providing broadband services in rural areas only if they could recover the cost of the initial investment in these areas. Average revenue per user is typically (but not always) lower in rural areas than in urban areas because of the positive correlation between ARPU and income levels. This is likely to remain the case until a broadband based economy develops" (ISPR1 - Internet Solutions, written response date 23rd August, 2012). ISPR1-Internet Solutions projected that to provide broadband access to remote areas would cost an ISP 100 times the cost to reach the urban base using traditional technologies. RR1-ICASA feedback was that operators faced network deployment challenges in the form of municipalities' failure to issue "land use or rights of way approval so that networks can be constructed" (RR1-ICASA, written response date 25th August, 2012). RR1-ICASA felt that many rural areas remained uncovered due to the bottle necks that existed in the local municipalities and also because of the "the high price of access to base station sites that such municipalities seek to charge" (RR1-ICASA, written response date 25th August, 2012). RR1-ICASA stated that in an attempt to clear these network deployment challenges ICASA was working on drafting "Rapid Deployment Guidelines (Section 21 of the ECA) which would guide all municipalities in how best manage and respond to requests for access to government land that would support the deployment of electronic communications networks" (RR1-ICASA, written response date 25th August, 2012). MNOR1-CellC view was that operators experienced challenges with regards to rapid rollout especially when rolling out networks to rural areas as each province had a different rule with regards to digging up roads. MNOR1-CellC gave examples of some areas that only allowed 5 diggings in a year and in instances where you had 300 licensees and 20 licensees wanted to take up the allocated diggings if an operator was not part of the party then there was a problem. MNOR1-CellC indicated that municipalities had no set of national guidelines or rules related to digging that existed and that applied to both urban and rural areas that licensees could use which posed a major challenge. MNOR1-CellC also provided an example of Cape Town where even though operators co-located on a site each operator was required to pay a rental cost for that site as opposed to paying one rental cost which compounded the costs of communication. MNOR1-CellC highlighted the problem of ducts in rural areas as a challenge if an operator did not have fibre, cable or links to pull backhaul to a base station. The other challenge that MNOR1-CellC highlighted was if the operator opted to apply for a link from Telkom the lead time or the link option taken whether platinum, gold or silver elongated the process as the cheaper links had a longer lead time. MNOR1-CellC highlighted an example of Mpumalanga where they were faced with the challenge of Eskom not supplying them with power which was critical in running a base station. If Eskom was not supplying power to a particular rural area then it would be a challenge for the operator to build a base station in that particular area. Connecting to the last mile using Telkom's point of presence and switches in rural areas was another major challenge on top of getting power from Eskom that operators faced in rural areas. MNOR2-CellC personal view was that government should be taking the lead role of coordinating and effecting broadband access in rural areas and highlighted that current barriers exist relating to governance problems between municipalities and provinces where one finds municipalities and provinces building their own networks. MNOR2-CellC felt that government had been addressing the issue of broadband rollout through Broadband Infraco in 2005 with the decision to rollout fibre, city to city however the whole concept failed as it was put together in a silo and there were major loop holes with the concept. One of the reasons why the whole process failed according to MNOR2-CellC was that government failed to identify the platform that would be used to rollout broadband to rural areas "will you go through fibre? Or is it wireless and if it is wireless, is it GSM or satellite or is it going to be copper through ADSL? "(MNOR2-CellC, interview date 30th August, 2012). So it wasn't clear which access technology Broadband Infraco was going to use to rollout the broadband network. The other attempt made by government to address rural broadband access rollout was through Sentech according to MNOR2-CellC where the plan was for Sentech to be a satellite based company over and above being a broadband signal distributor however the whole Sky wave business model failed as they were using satellite which was expensive to rollout to the rural areas. Other attempts made to address rural broadband access according to MNOR2-CellC were the G-link initiative where other provinces including Gauteng came up with the initiative to link Gauteng to other provinces through a wide area network. Limpopo, Mpumalanga and Western Cape all spoke of building their own wide area network which highlighted the gap that existed between government and the private sector. MNOR2-CellC highlighted that government invited the industry players to discuss the vision 2020 document however the issue of rapid deployment was not addressed which the industry players felt was the best way to approach the rural broadband rollout. However according to MNOR2-CellC the challenge faced by operators was that it took 18 months and more to get a permit for rapid deployment. MNOR2-CellC highlighted that there was some progress being made with rules and public processes being rolled out at municipality level. Secondly MNOR2-CellC felt that there was a need for a special interconnect framework for rural that could accelerate infrastructure rollout.

4.1.2 Radio Frequency Spectrum for rural broadband development

This section outlines the data findings with regards to spectrum from the primary study in the form of document analysis of existing policy and regulation documents and content analysis findings. There was limited information that the researcher came across in the document analysis of existing policy and regulation that spoke specifically to enabling spectrum for broadband access rollout in rural areas.

The findings from the document analysis of existing policies and regulation documents revealed the following. The Radio Frequency Spectrum Policy for South Africa 2010 was published in April 2010 and the document states that "the use of the radio frequency spectrum must promote the proper use of the digital dividend, regarding access to services using the radio frequency spectrum by encouraging the use of wireless broadband technologies particularly in underserviced areas" (DoC, p.15, 2010). The Radio Frequency Spectrum Policy for South Africa 2010 document encourages the implementation of digital technologies as they "are more spectrum efficient than analogue" and will facilitate the introduction of broadband access which in turn will "act as a catalyst for socio-economic development" (DoC, p.17, 2010). The Radio Frequency Spectrum Policy for South Africa 2010 document highlights wireless technology as being the most appropriate form of technology that would enable electronic communication services to rural areas "due to the population distribution, lack of infrastructure, terrain" (DoC, 2010, p.18). The Radio Frequency Spectrum Policy for South Africa 2010 document highlights that spectrum usage will "be used to promote universal access and service" (DoC, 2010, p.18). An ITA was subsequently published in May 2010 for a Radio Frequency Spectrum licence for providing a mobile broadband wireless access service in the 2.6GHz and 3.5GHz bands addressing spectrum in the 2.6GHz and 3.5GHz bands specifically for the purpose of providing national mobile broadband coverage (DoC, 2010). The broadband policy 2010 (DoC, 2010) was subsequently published in July 2010 and highlighted its recognition of the use of spectrum for broadband by stating that 'the radio frequency spectrum is a scarce national resource and that the allocation shall be guided by the developmental objectives in the public interest" (DoC, 2010, p.13). The ITA for radio frequency spectrum to provide mobile broadband wireless access service for urban and rural areas using the complementary bands 800MHz and 2.6GHz 2011 (DoC, 2011) and a notice inviting comments regarding the draft spectrum assignment plan for the combined licensing of the 800MHz and 2.6GHz bands 2011 (DoC, 2011) were subsequently published in December 2011. The draft spectrum assignment plan for the combined licensing of the 800MHz and 2.6GHz bands 2011 (DoC, 2011) highlighted that the national policy objections of licensing high demand spectrum was to enable the introduction of new "rural providers of electronic communications, including broadband" and to impose obligations on universal access and service that would drive the "uptake and usage of electronic communications in rural and urban poor settlements" (DoC, 2011, p.6). The draft spectrum assignment plan for the combined licensing of the 800MHz and 2.6GHz bands 2011 (DoC, 2011) further highlights its policy objectives as striving to "facilitate affordable, accessible and universal access to infrastructure to citizens, businesses, communities and the three spheres of government and to stimulate the usage of broadband services to promote economic development" (DoC, 2011, p.3 & p.4). The draft spectrum assignment plan for the combined licensing of the 800MHz and 2.6GHz bands 2011 (DoC, 2011) identifies the 800MHz and 2.6GHz bands as being suitable for the provision of broadband access and further states that the "bands complement each other in the sense that they fulfil the requirements for capacity and coverage which make them suitable for rural and urban areas and bridging the digital divide" (DoC, 2011, p.4). The draft spectrum assignment plan for the combined licensing of the 800MHz and 2.6GHz bands 2011 (DoC, 2011) further highlights that the operator that will be licenced for the 800MHz and 2.6GHz shall be required to build an open access network (DoC, 2011). The ITA for a Radio Frequency Spectrum licence for providing a mobile broadband wireless access service in the 2.6GHz and 3.5GHz bands 2010 (DoC, 2010) and the draft ITA published in 2011 for the combined licensing of the 800MHz and 2.6GHz bands 2011 addressing Electronic Communication Services in high demand spectrum in the 800MHz and 2.6GHz bands were both subsequently withdrawn by the DoC (DoC, 2011). The ANC policy discussion document which was subsequently published in March 2012 highlights that radio frequency spectrum must be used as a public asset (ANC, 2012). ANC policy discussion document 2012 goes further to highlight that as one of the goals of diffusing "ICTs across society" the requirement to achieve universal coverage should be one of the underpinning criteria's (ANC, 2012, p.13). ANC policy discussion document 2012 goes further to state that for the purpose of maximising the value of the high demand spectrum "government must set aside spectrum for the provisioning of wholesale services or open access network" (ANC, 2012, p.13). ANC policy discussion document 2012 goes further to state that the infrastructure must be prioritised to support the provision of communication services such as e-services to public departments such as government, schools and police stations and the excess capacity should be assigned to the provision of connectivity to rural areas "to help achieve full access to high speed internet networks by 2030" (DoC, 2012, p.14). ANC policy discussion documents 2012 highlights the need for a quicker implementation of digital broadcasting so as to free up the "digital dividend spectrum" for allocation to services such as mobile broadband (ANC, 2012, p.22). The ICT Policy Colloquium discussion document was subsequently published in April 2012 and states that "matters pertaining to spectrum will become a major focal point in shaping wireless broadband growth in South Africa" (DoC, 2012, p.21). The

ICT Policy Colloquium discussion document 2012 goes further to highlight that once the digital dividend spectrum is freed up the expansion priority must be provided to the expansion of broadband services (DoC, 2012, p.21). The ICT Policy Colloquium discussion document 2012 highlights one of the challenges facing the ICT industry with regards to broadcasting as a delay in harnessing spectrum for the purpose of growing the broadband footprint due to delays in the digital migration broadcasting process (DoC, 2012). The industry to date is still awaiting directions from the minister of communication on how to proceed with the licensing of the high demand spectrum (Mybroadband Staff Writer, 2012).

The mobile operators in the semi-structured in-depth interview feedback highlighted a number of challenges currently faced by operators on spectrum. MNOR1-8ta stated in his interview feedback that having access to a sub 1GHz spectrum for an operator was very vital. MNOR1-8ta indicated that spectrum in the 1000MHz, 900MHz, 800MHz and 700MHz constituted spectrum that fell in the sub 1GHz region and lack of access to any of these bands meant that operators could not target certain areas with access. This he mainly argued was because using higher frequency spectrum to cover the spread of these people was uneconomical for operators. In relation to the role of spectrum in the development of broadband access in rural areas MNOR1-8ta stated that spectrum that fell within the sub 1GHz spectrum range could be used for voice as well and was not specific to broadband. MNOR1-8ta gave an example of CellC who were currently re-farming their 900MHz spectrum for 3G broadband as it was currently used for GSM services. FNOR1-Telkom view was that the 700MHz and 800MHz spectrum was predominantly for broadband use and provided wider coverage benefits for operators in rural areas and better indoor coverage in urban areas. However FNOR1-Telkom views differed on spectrum being the barrier to the broadband market development as he felt that companies like CellC already possessed 900MHz spectrum which was close to 800MHz and have the ability to provide broadband coverage in rural areas with the low spectrum. On Governments role in addressing barriers to the broadband market development in rural areas

FNOR1-Telkom felt that operators should not pay for spectrum because ultimately the end user bore the full costs. FNOR1-Telkom gave an example of an operator that had to extend the network 100KM out of town and required “point to point backhaul spectrum in various bands and microwaves” even though the spectrum was readily available the operator had to pay administrative fees and an annual fee to the regulator and felt that the government could issue the spectrum for free as the operator was using his own radio backhaul links to extend the network outside the area. MNOR1-MTN response to the question relating to the value of the digital dividend spectrum to mobile operators was that the 790MHz to 860MHz constituted the digital dividend spectrum. The digital dividend spectrum offered operators the benefit of being able to roll out less base stations to a wider area and was ideal for the rural deployment of broadband services. MNOR1-MTN highlighted that the 2.6GHz was complementary to 800MHz spectrum as it provided more capacity to operators especially in high density areas. MNOR1-MTN felt that the digital dividend enabled operators to tap into markets that were historically not serviced properly as they were previously deemed as not being financially viable. MNOR1-MTN felt that with the deployment of LTE using the 800MHz spectrum which enabled spectral efficient technologies like LTE, operators were in a better position to rollout broadband networks to rural areas cost effectively. MNOR1-MTN stated that the challenge facing operators currently with no access to the 800MHz spectrum was that they were being forced to re-farm their existing spectrum which was a challenge as they still had existing customers that still had to be serviced on the 2G and GSM technologies and taking away the spectrum and reusing for LTE or providing rural coverage proved a major challenge as it meant that they couldn’t acquire new customers for voice services due to insufficient spectrum. MNOR1-MTN indicated that Telkom currently had 143, 000km of fibre on the ground and MTN was busy trenching and laying 6000km of fibre network, however to achieve 100% broadband coverage for all wireless technology was the key technology to use and not fixed line. MNOR1-MTN however highlighted that there was no shortcut to laying fibre and that the process was going to take time and to achieve the 100%

broadband target by 2030 the 800MHz and 2.6GHz spectrum was required. MNOR1-MTN opinion was that mobile operators were better placed to rollout broadband coverage faster as they have got existing base stations and all that is required is to put radio defined software that could do both 3G and 4G at a fraction of what it would cost a new entrant to roll out a new network and at a shorter time frame. MNOR1-MTN view was that the big challenge that operators faced was that in other countries the digital migration had already taken place however the process in South Africa had been dragging on with no resolution in place resulting in South Africa falling behind with penetration rates. MNOR1-MTN personal views on how government could address these challenges was that government played a conflicting role of being a player and a policy maker and gave examples of government's shareholding in Telkom and broadband Infraco. MNOR1-MTN also gave an example of Sentech that was sitting on valuable spectrum which was not being utilised and his personal opinion was that this spectrum should be auctioned off to the highest bidder as they would be best placed to maximise the use of this spectrum. MNOR1-MTN view was that the rollout of LTE was being hampered because of the lack of spectrum while on the other hand government was pushing for Sentech play a part in LTE rollout, while at the same time government wanted to be a wholesaler and also wanted to rollout broadband infrastructure and felt that government lacked the critical skills required to achieve this and without the right mechanisms in place and the 2030 goal was not achievable. MNOR1-MTN view was that operators that proved that they have deployed networks "effectively and efficiently maximised the value" deserved to get a piece of the high demand frequency spectrum and not operators like Sentech that were sitting on valuable spectrum but were unable to show any subscriber acquisitions or use of the spectrum. MNOR1-MTN personal view was that "if you just give the viable spectrum to Sentech for one they've got to pay for it, two they've got to build the network and now it will all come out of treasury, so there will be a deficit to the treasury as opposed to a surplus coming into treasury my personal feeling again" (MNOR1-MTN, interview date 23rd August 2013). MNOR1-MTN personal recommendation on smart ways of issuing the digital dividend spectrum was for South Africa to adopt the "French model which actually promotes or incentivise mobile operators to adopt mobile virtual operators to prioritise rural deployment and achieve all the governments objectives while still in capital revenue" (MNOR1-MTN, interview date 23rd August 2013). On the value of the digital dividend to mobile operators MNOR1-Vodacom felt that the 800MHz spectrum offered more value to operators due to its capability to provide coverage to a wider area and better in building coverage over the 2.6GHz spectrum. On the role of spectrum in the broadband market development of rural areas MNOR1-Vodacom responded that the operators faced huge challenges providing broadband to rural areas mainly due to the lack of access to spectrum for microwave in the lower bands as this was the most appropriate spectrum for use in rural areas due to the slow processes at ICASA which took from six months to a year. MNOR1-Vodacom gave examples of instances where base stations they had built stood idle for over six months as they could not get backhaul to them. MNOR1-Vodacom felt that the 800MHz spectrum would not be sufficient for all operators' once available and that open access networks was the most viable solution where the operator that got the spectrum offered other operators access to its network from wholesale. MNOR1-Vodacom felt that open access network was the most viable solution for providing access to rural areas specifically because the cities and urban areas were already saturated with infrastructure and competition. However the Minister had to provide policy directions regarding the open access networks for the 800MHz spectrum and ICASA had to put conditions for licencing the 800MHz spectrum which ensured that open access networks was provided to other licensees. On the value of spectrum FCR1-FTTH Council stated that fibre formed the core of any network and was complementary and co-existed with wireless. Fibre providers were very dependent on wireless spectrum as it was cost effective in connecting up near the last circle in the fibre network or the last mile per subscriber in comparison to fixed line infrastructure which was quite expensive. FCR1- FTTH Council highlighted that wireless spectrum was the most appropriate for broadband development in both rural and urban areas however without the "efficient use of limiting spectrum" operators were not going to get the broadband development and broad penetration that was required. FCR1-FTTH Council felt that wireless spectrum was the most feasible and provided a business case for operators to rollout broadband access to both rural and urban areas. FCR1-FTTH Council stated that there was a lot of procrastination around spectrum matters and the political changes and "politically driven appointment process at the DoC level with a new director general, and a new minister every 2 sort of years minimum" (FCR1-FTTH Council, interview date 23rd August 2013) exuberated the spectrum challenge. MNOR1-CellC shared the same views with the other operators when he expressed that the 800MHz spectrum offered more value to operators than the 2.6GHz spectrum. However MNOR1-CellC proposed that ICASA adopt a combined approach when issuing licenses to the 800MHz and 2.6GHz spectrum where an operator was required to use the 2.6GHz spectrum in the rural areas to provide capacity overlay and 800MHz spectrum to rollout broadband access in rural areas. MNOR1-CellC highlighted that the 800MHz spectrum would enable the operator to build out less base stations that covered a wider area at half the cost. MNOR1-CellC highlighted the problem of ducts in rural areas as a challenge if an operator did not have fibre, cable or links to pull backhaul to a base station. The other challenge highlighted was that if an operator wanted to install a dish they had to apply for spectrum from ICASA which took from six months to over a year for the spectrum to be approved which further delayed the network rollout. The other challenge that MNOR1-CellC highlighted was if the operator opted to apply for a link from Telkom the lead time or the link option taken whether platinum, gold or silver elongated the process as the cheaper links had a longer lead time. RRI-ICASA response on the value of the digital dividend was that "spectrum is a valuable resource for the provision of wireless broadband access as it reduces the cost of the "last mile" (RR1-ICASA, written response dated 25th September 2012) of connectivity (i.e. the network to the end-user), when compared to the cost of deploying additional fixed lines. Spectrum for last mile services is particularly relevant for areas that may be classified as both low population density and low income, typically "rural areas". RR1-ICASA indicated that the regulator intended to include some form of obligations for rural coverage through the final assignment of the broadband spectrum. "The current view includes the assignment of spectrum through a spectrum beauty contest based on coverage obligations, followed by an auction if not possible, to determine any real difference between submissions. However, the Authority awaits a directive from the Ministry in this regard" (RR1-ICASA, written response dated 25th September 2012). However RR1-ICASA view was that spectrum did not resolve the issue of the digital divide "it merely represents an input to the provision of internet connectivity" (RR1-ICASA, written response dated 25th September 2012) and the lack of demand or uptake diluted the value gained through the assignment of spectrum. RR1-ICASA highlighted that there was no activities currently underway to promote the rollout of broadband access in rural areas and that the issue was currently a policy matter which the regulator could only act upon once a directive was issued on the high demand spectrum. On the question regarding the value of licenced and unlicensed spectrum to ISPs ISPR1-Internet Solutions felt that spectrum licences enabled ISPs to "provide services in uncontended spectrum" (ISPR1-Internet Solutions, written response dated 23rd August 2012). ISPR1-Internet Solutions view was that network content was less of an issue in rural areas than urban areas because of there was "less density of competing wireless service providers in rural areas" (ISPR1-Internet Solutions, written response dated 23rd August 2012). ISPR1-Internet Solutions however felt that unlicensed spectrum was only appropriate in providing services over shorter distances and that spectrum in the 800MHz range was more ideal for providing services over longer distances. ISPR1-Internet Solutions view was that this was "very important in rural areas because the population density in rural areas is much lower (per square meter) than in urban areas. This means that the amount of infrastructure investment to reach an average rural client is much higher than that required to reach an average urban client" (ISPR1-Internet Solutions, written response dated 23rd August 2012). ISPR1-Internet Solutions felt that the cost of rolling out fixed broadband infrastructure in rural areas was uneconomical and wireless spectrum was "essential to provide affordable services in rural areas"

(ISPR1-Internet Solutions, written response dated 23rd August 2012). ISPR1-Internet Solutions opinion was that even with spectrum some areas would still be uneconomical with a long timeframe for the return of investment and some form of public private partnership (PPP) "with a wholesale open access network using digital dividend spectrum (white spaces below 800MHz) to connect remote rural areas and higher frequency spectrum e.g. 2.6GHz in more densely populated areas" (ISPR1-Internet Solutions, written response dated 23rd August 2012) was necessary in some areas until a more affordable form of rural broadband became affordable. ISPR1-Internet Solutions felt that "government has focused too much on assuming that Telkom and the incumbent mobile carriers can develop broadband in rural areas" (ISPR1-Internet Solutions, written response dated 23rd August 2012) however government could address the challenge by allocating the 800MHz and 2.6GHz spectrum "to a wholesale open access service provider whose role would be to allow any ISP to use their network on a non-discriminatory basis" (ISPR1-Internet Solutions, written response dated 23rd August 2012). ISPR1-Internet Solutions felt that this would reduce the problem of duplication of infrastructure and enable the effective and efficient use of scarce spectrum. One of the challenges that the industry was facing according to ISPR1-Internet Solutions was that ICASA continued to "delay the allocation of available spectrum which sits idle. In addition spectrum is not allocated on a use-it-or-lose-it basis and too many existing spectrum holders are either using spectrum inefficiently or simply holding onto allocations to keep competitors out" (ISPR1-Internet Solutions, written response dated 23rd August 2012). MNOR2-MTN views on the value of the digital dividend to telecom operators was that it remained of immense value to telecom operators as it enabled faster rollout to a wider land surface at a much lesser cost and that the cost of providing broadband access to rural areas would be at a greatly reduced cost. However MNOR2-MTN highlighted that the 800MHz spectrum was currently being used for broadcasting and was currently not available to operators. There was a migration plan to migrate the broadcasters from the 800MHz spectrum however the process had been dragging on for years. As an interim solution operators according to

MNOR2-MTN were currently re-farming the existing spectrum where operators are re-allocating current spectrum to broadband use from voice use. This had implications in that operators were forced to limit the markets that they could reach or serve because of limited capacity which also meant that there was less spectrum for voice calls. MNOR2-MTN felt that the only way to resolve this issue was for the DoC to set clear policies to expedite the digital migration and clear targets on deadlines as operators urgently required access to the 800MHz spectrum. MNOR2-MTN also felt that the process of issuing spectrum was flawed and that the department lacked technological knowledge.

4.2 Demand Side Considerations

This section outlines the data findings from the demand side elements consisting of services and content and applications. The data findings are from the primary study in the form of document analysis of existing policy and regulation documents and semi-structured in-depth interviews, secondary study in the form of qualitative surveys conducted with households, SMME and Government and content analysis findings.

Table 10 below summarises the Demand side data findings from the semi-structured in-depth interviews and qualitative surveys which are discussed in detail below in section 4.2.1 and section 4.2.2.

Table 10: Summary of Demand Side Data findings

Demand Side Data Findings	
Services	**Content and Applications**
Affordability of broadband services in rural areas is a problem	e-Health and e-Education applications are lacking in Metsweding Municipality

Broadband is categorised as a secondary need in rural areas	The provision of content and applications in a local language does not exist in Metsweding Municipality
There is no business case for broadband as a standalone service in rural areas	
Affordable devices for broadband use such as netbooks, tablets, laptops, PC's, Ipads and smartphones are key to rural broadband adoption	
Education on the benefits of broadband key in broadband market development in rural areas	
Broadband is a sophisticated technology that requires some form of literacy	
There was a gap in Metsweding municipality with regards to the population having access to broadband services and infrastructure	
Government departments in Metsweding Municipality were lacking an online presence	

Source: *Macharia, 2013*

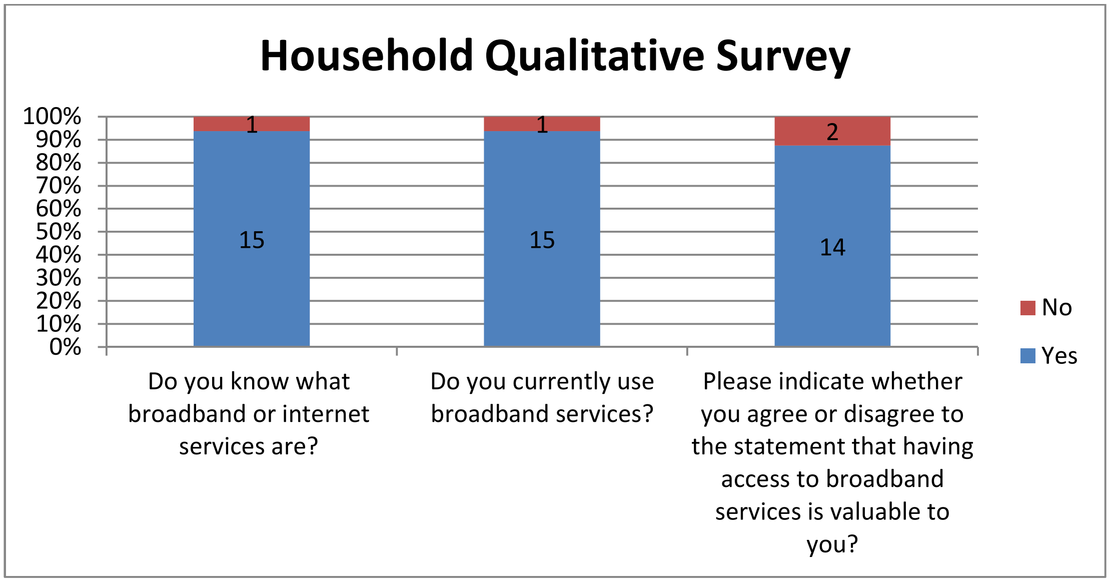
4.2.1 Enablers of usage drivers for Broadband Services in rural areas

This section outlines the data findings with regards to broadband services from the primary study in the form of document analysis of existing policy and regulation documents, semi-structured in-depth interviews, secondary study in the form of qualitative surveys conducted with households, SMME and Government and content analysis findings.

The findings from document analysis of existing policies and regulation documents revealed the following. The Telecommunications White Paper which was published in 1996 highlights that the universal services fund goes directly to subsidising targeted end users "to promote affordability of telephone take-up and use" (RSA, 1996). An interesting point that the National Information Society and Development Plan (ISAD) of 2005 highlights is that although essential, physical infrastructure is not sufficient in addressing the development of an information society (PNC, 2005). The National Information Society and Development Plan (ISAD) of 2005 highlights that increasing awareness on the benefits of ICT is key in driving the usage and access of ICT services by all (PNC, 2005). The Electronic Communications Act which was subsequently published in July of 2005 makes provision for Ministerial policies and policy directions in matters pertaining to guidelines relating to licence fees, award of licences and incentives associated with individual licences where a binding commitment is made by an applicant "to construct electronic communications networks and provide electronic communications services in rural and underserviced areas" (RSA, 2005, p.12). The Electronic Communications Act of 2005 further makes provision for the licencing authority to "issue individual licences for the provision of electronic communications" networks at a national and provincial level and also issue individual licences for the provision of "electronic communication services consisting of voice telephony utilising numbers from the national numbering plan" (RSA, 2005, p.14). The Broadband Policy for South Africa document which was published in July 2010 further highlights one of the DoC policy decisions as to increase affordability, The Broadband Policy for South Africa 2010 document highlights that the provision of broadband services to underserviced areas is quite costly and as part of its interventions the Government aims to expand access to marginalised areas through the Universal Service and Access Agency of South Africa which will ensure that affordable broadband services are available to all (DoC, 2010, p.8). The Broadband Policy 2010 document highlights universal access of broadband to "all public and private institutions" and civil society as a key priority area of focus which is aimed at enabling access to broadband and driving increased demand and uptake of ICT across “government departments especially in education and health” (DoC, 2010, p.8). The Broadband Policy document 2010 further states that “all public and private institutions, as well as civil society, must have access to broadband services” (DoC, 2010, p.13) aimed at enabling the demand and uptake in government departments and specifically in health and education. The Universal Service and Access Obligations Review discussion document which was subsequently published in August 2010 highlights that the services that were initially included in the Universal Service and access obligations mainly targeted voice services (ICASA, 2010). The Universal Service and Access Obligations Review discussion document 2010 states that “traditionally UA/US has often been linked to fixed telephone access, but increasingly mobile access or other wireless networks are also involved” (ICASA, 2010, p.9). Although the second round of obligations imposed on Neotel and Sentech included the rollout of 2500 and 500 internet labs in rural areas respectively (Hodge, 2004) the initial scope for universal service and access obligations was mainly voice and not broadband or internet access (ICASA, 2010). The “previous obligations only stipulated connection of internet access” (ICASA, 2010, p.14) and did not address broadband infrastructure availability and cost of access related to broadband access as highlighted in the Universal Service and Access Obligations Review discussion document 2010 (ICASA, 2010). The ANC policy discussion document which was published in March 2012 highlights part of the objectives of its National ICT policy as to “inform regulatory interventions” that will enable a digital infrastructure that will ensure connectivity between households and business sectors across the country and including those in rural areas (ANC, 2012, p.9). As part of its policy proposal ANC policy discussion document 2012 outlines its focus on developing and strengthening “its capacity to stimulate demand to increase broadband usage and uptake by generating relevant content” (ANC, 2012, p.29) targeting its various communication mediums and audiences which includes its “online presence” (ANC, 2012, p.29). The ICT Policy Colloquium discussion document 2012 highlights the lack of policy focus on the matter regarding the deployment of broadband infrastructure specifically within government structures for the purpose of providing the public with access to government. The ICT Policy Colloquium discussion document which was subsequently published in April 2012 highlights that provision was made in the Broadband policy document 2010 for an implementation plan that ensures the involvement of national government in enabling “the connection of government and its entities through broadband services” and “enabling e-government services” (DoC, 2012, p.67). The ICT Policy Colloquium discussion document 2012 also proposes as part of its national integrated policy for the implementation of a reduced customs duty on raw material imported for the purpose of manufacturing ICT related equipment and products as well as tax incentives (DoC, p.95, 2012). The ICT Policy Colloquium discussion document 2012 also makes provision as part of the E-rate initiative for service providers supplying internet services to public schools and training institutions to do so at minimum a 50% discount rate. “The discount is applicable to the total levied” and includes internet connectivity charges, support calls made to the service provider and equipment required to enable internet connectivity (DoC, 2012, p.38). The USAASA strategic plan 2012 – 2015 which was published in 2012 recognises in its strategic plan that the largest growth in the telecommunication industry will come from mobile internet access and goes further to state that “an explosion in internet growth and usage is predicted to double in the coming years to 9 million” which it mainly attributes to presence of the undersea cables (USAASA, 2012, p.28).

Data findings from the demand side consideration also included feedback from the semi-structured in-depth interviews with telecom operators, ISP, regulator and telecom body. MNOR1-8ta highlighted affordability of broadband services in rural areas as one of the big problem areas based on economic activities “from a population, income, density perspective, categories, class and markets” (MNOR1-8ta, interview date 17th August 2012). MNOR1-8ta highlighted that 8ta had a broadband strategy and aimed to go national with the provision of broadband services however the operator was constrained as they were the only operator without the 900MHz spectrum which was limiting and frustrating for them as an operator. MNOR1-8ta opinion on the availability of broadband services in rural areas was that operators required a clear communication service that included both voice and broadband communication. MNOR1-8ta was clear that broadband cannot be offered as an isolated service and had to be offered together with voice as a major component or with applications such as e-Education or e-Health. MNOR1-8ta opinion was that there was no business case for broadband as an isolated service and this would have an effect on the broadband evolution in rural areas. MNOR1-8ta was clear that a government led broadband strategy that is driven hard was the ticket to solving the problem and gave an example of countries that had rolled out FTTH (Fibre to the home) which had "clear government subsidies, clear tax incentives or clear interventions to make them happen" (MNOR1-8ta, interview date 17th August 2012). Operators had to ask whether the market understood what to do with broadband services, whether the right devices to enable broadband connectivity were available, whether the market was aware that broadband existed and whether it was literate enough with regards to broadband services according to MNOR1-8ta. MNOR1-8ta indicated that an operator had to go a step further and ask whether the user was literate enough to know how to use the broadband device and whether the operator provided education around broadband to the market. With regards to enabling access to broadband services operators had to take baby steps according to MNOR1-8ta. MNOR1-8ta highlighted that as an operator you had to have a clear device, network and service strategy otherwise without addressing these three the broadband problem was not going to be solved. For an operator to provide broadband services to rural areas affordable devices and a network were critical according to MNOR1-8ta. MNOR1-8ta highlighted that looking at the market split between post-paid and prepaid the market was predominantly prepaid especially in the outside metros and from a commercial perspective majority of the population was not credit worthy, cannot afford devices and are not willing to spend. With regards to a device strategy MNOR1-8ta highlighted that the market required a device that was less than R 1000, that could do both voice and data communication as the size of the current cellphone screens was not the right size for experiencing internet. MNOR1-8ta view was that there was some form of government subsidy that was required for devices for broadband use such as netbooks, tablets, laptops, PC's, Ipads and smartphones as the masses did not have the earning power. The market also needs to be educated on how to use the devices as broadband was complicated to understand and according to MNOR1-8ta this training takes a number of years and different forms hence it is important for operators to have a clear voice and data. MNOR1-8ta argued that if the urban market already people struggled with understanding broadband because of its complexities this was definitely going to be a barrier to uptake for people in the rural areas as well. On the affordability and availability of devices such as laptops, smartphones and tablets in rural areas MNOR1-8ta responded by highlighting that in the GMS world the entry price points for voice devices was USD$10 or R 100 which are the cheap phones that people use, while in the broadband market the entry price points for devices for broadband use such as netbooks, tablets, laptops, PC's, Ipads and smartphones was R 1000 or USD$100. MNOR1-8ta gave an example of India which was developing a low cost tablet that would cost USD$100 or R 100 and argued that for the uptake of broadband and 3G services to increase devices for broadband use such as netbooks, tablets, laptops, PC's, Ipads and smartphones that were below the USD$30 or R 300 price point were required in the market. "On a device level there is some subsidisation required to devices at this point in time and the reason why Device costs is still too high" (MNOR1-8ta, interview date 17th August 2012) and operators need to start off with basic devices for broadband use such as netbooks, tablets, laptops, PC's, Ipads and smartphones and not smart devices in rural markets to enable them to establish pockets of connectivity and services in rural areas. MNOR1-8ta highlighted that operators were pushing for devices for broadband use such as netbooks, tablets, laptops, PC's, Ipads and smartphones at these price point but they were not there yet because of a lack of economy of scale or bulk purchasing power. This was mainly attributed to the current high costs of devices for broadband use and the fact that the battery power for the devices for broadband use such as netbooks, tablets, laptops, PC's, Ipads and smartphones had a short life span and consumed more power. MNOR1-8ta highlighted that "as battery technologies advance in terms of capacity and prices drop, there will be more proliferation of devices" (MNOR1-8ta, interview date 17th August 2012) and also once countries with large buying power like China and Brazil start pushing for smaller devices for broadband use such as netbooks, tablets, laptops, PC's, Ipads and smartphones only then will countries in Africa start benefiting from reduced device costs. FNOR1-Telkom views on the availability of broadband services in rural areas was that everyone knew how to use voice services and understood its benefits, however with broadband services a level of sophistication and literacy was required for one to be able to utilize broadband. Understanding the benefits of broadband services was an important component of utilizing broadband services; however what was lacking according to FNOR1-Telkom was a framework from government that looked at the provision of e-government services. FNOR1-Telkom view was that without people understanding the social economic benefits of broadband, relevant applications and availability of e-government services there would be no traction gained. FNOR1-Telkom felt that there were two issues around the affordability of broadband services in rural areas one was the costs which were much higher and the willingness to spend on broadband services. FNOR1-Telkom view was that because broadband was secondary on the hierarchy of needs, consumers were not willing to "look at broadband independently as a spend" and operators had to look at "the hierarchy of needs and willingness to pay" (FNOR1-Telkom, interview date 17th August 2012). FNOR1-Telkom shared a similar view on the cost of devices for broadband use such as netbooks, tablets, laptops, PC's, Ipads and smartphones which he identified as being the biggest problem in providing broadband to rural areas as broadband required smartphones or tablet devices which cost an average of USD$389 or R 2500 in the market compared to cellphone's which one could purchase at R 99. FNOR1-Telkom argued that with voice services people in rural areas generally acquired devices through a PEP contract at very low prices or through a "hand me down" and that's how voice grew in these areas. However with broadband people are not willing to hand down devices like tablets or smartphones to their domestics or gardeners as these are much more expensive and come with a longer payback period argued FNOR1-Telkom. The handset layer therefore presents challenges with regards to broadband evolution in rural areas and some form of government intervention is required in the form of government subsidies argued FNOR1-Telkom. On operators driving adoption of broadband services in rural areas MNOR1-Vodacom felt that they as an operator weren't doing enough and that it was the "mentality that says that there isn't much economic activity in rural areas. We need to change our mentality, thinking only about profits and also look at what's good for the country because eventually the uptake in those areas will be great because it will be beneficial to the economy and will create value" (MNOR1-Vodacom, interview date 28th August 2012) however MNOR1-Vodacom highlighted that this would take time to achieve. On the value of providing broadband services to rural areas by mobile operators, MNOR1-CellC highlighted that the minister of communication had made a commitment and there was acknowledgment of the vision 2020 which set a target of broadband for all by 2020. One of government's objectives was to "bridge the communication gap between the rural and urban" and when it came to e-government and e-services the most affected communities were those in the rural and underserved areas according to MNOR1-CellC. MNOR1-CellC felt that the value for telecom operators was to provide broadband services to rural areas without discriminating these areas in terms of money and services. According to MNOR1-CellC "the very same way that your providing services in Sandton and if you can do that in Nqunu or Limpopo Molemole municipality as an operator its one way of generating revenue as well" (MNOR1-CellC, interview date 30th August 2012). MNOR1-CellC gave an example of Masese in Limpopo which had not had mobile coverage for over 18 years and where they recently put up 3 base stations through a SITA and ICASA initiative. They were surprised by the high level of uptake and appetite for the services in the area after 3 weeks of putting up the base stations. On the current state of affordability and availability of devices for broadband use such as netbooks, tablets, laptops, PC's, Ipads and smartphones in rural areas MNOR1-CellC shared the same opinion as the other operators on the cost of devices and responded that rural areas will never be able to afford devices such as smartphones, tablets or iPads without innovative purchasing solutions and economies of scale when purchasing. MNOR1-CellC stated that "fortunately in this country in south Africa we do have the electronic communications act where there is one provision in terms of section 88 that gives the minister the authority to subsidise the need of people. Need by definition could be pensioners those that can afford that subsidy will only ring-fence people that are staying in underserved areas. Now underserved area by definition then that would be rural as one solution" (MNOR1-CellC, Interview dated 30th August, 2012). Another solution that could resolve the problem of affordability of devices for broadband use such as netbooks, tablets, laptops, PC's, Ipads and smartphones that was highlighted by MNOR1-CellC was for the government to look at "governing rules like your import tax, local tax" (MNOR1-CellC, Interview dated 30th August, 2012) in relation to the importation of equipment. On the value of providing broadband services to rural areas to operators MNOR2-MTN opinion was that it would act as a catalyst to the socio-economic development of rural areas. MNOR2-MTN felt that it was not about making money even though he admitted that all operators want to make money but rather it was a "win-win situation" which enabled people to consume their services and in return people benefited from the services through added value and introduction of efficiencies into their lives. On the current state of the broadband ecosystem in rural areas MNOR2-MTN felt that although broadband services were present in rural areas however they were not enough. MNOR2-MTN view was that operators were limited by the prohibitive costs of investing in rural areas and the lack of access to spectrum in the lower bands that would enable them to provide broadband services in these areas. Operators were hesitant to rollout expensive infrastructure now only for the 800MHz spectrum to be released later. On their view of the current broadband ecosystem in rural areas with regards to the demand factors RR1-ICASA response was that the regulator focused on the supply side of the ecosystem and had no mandate to regulate the demand side of the ecosystem however he did provide his opinion on affordability of devices that enabled broadband connectivity and highlighted that affordability of these devices was a barrier to the uptake of broadband services in rural areas however he highlighted that pricing strategies could not be viewed as a sole barrier as "wider socio-economic matters of poor education and low employment levels also significantly affect the actual consumption of devices" (RR1-ICASA, written response, 25th September, 2012). On the value of providing broadband services to rural areas ISPR1-Internet Solutions views was that it cost 100 times more to provide services in rural areas than in urban areas and ISPs would only derive value from providing broadband services in rural areas if they were able to recover the initial costs of investments. ISPR1-Internet Solutions felt that the average revenue per user in rural areas was low compared to urban areas and that this was likely to be the situation until a broadband based economy developed. On the current state of the broadband ecosystem in rural areas ISPR1-Internet Solutions view was that it was poor and pointed to the coverage maps of the 2 major mobile operators and fixed operator which indicated that the 3G coverage in rural areas was inadequate. ISPR1-Internet Solutions highlighted that the lack of affordable broadband services in rural areas "has slowed broadband penetration in rural areas and led to a growing divide between urban and rural areas" (ISPR1-Internet Solutions, written response, 23rd August, 2012). ISPR1-Internet Solutions shared the same views on the cost of devices for broadband use such as netbooks, tablets, laptops, PC's, Ipads and smartphones in rural areas and stated that "the only devices that are approaching the level of affordability required in rural areas are smartphones. Tablets, PCs, laptops etc. are mostly unaffordable. This is clearly shown when contrasting the PC penetration in South Africa vs. the overall internet penetration in SA" (ISPR1-Internet Solutions, written response, 23rd August, 2012). On how ISPs were enabling and driving adoption of broadband services in rural areas ISPR1-Internet Solutions highlighted that they did not provide services directly to consumers but provided broadband services to large enterprises and also on a wholesale basis to consumer focused ISPs. ISPR1-Internet Solutions highlighted that majority of their customers were rural ISPs and they "provide services to these ISPs using microwave services such as LMDS or broadband satellite services to access their points of presence" (ISPR1-Internet Solutions, written response, 23rd August, 2012). ISPR1-Internet Solutions stated that due to the lack of appropriate spectrum they relied on the "the footprint of incumbent providers" and also provided satellite services however these were too expensive for individual subscribers and were "typically enterprise grade services" (ISPR1-Internet Solutions, written response, 23rd August, 2012). The findings from the qualitative surveys conducted in Metsweding municipality with households, SMMEs and government departments revealed the following.

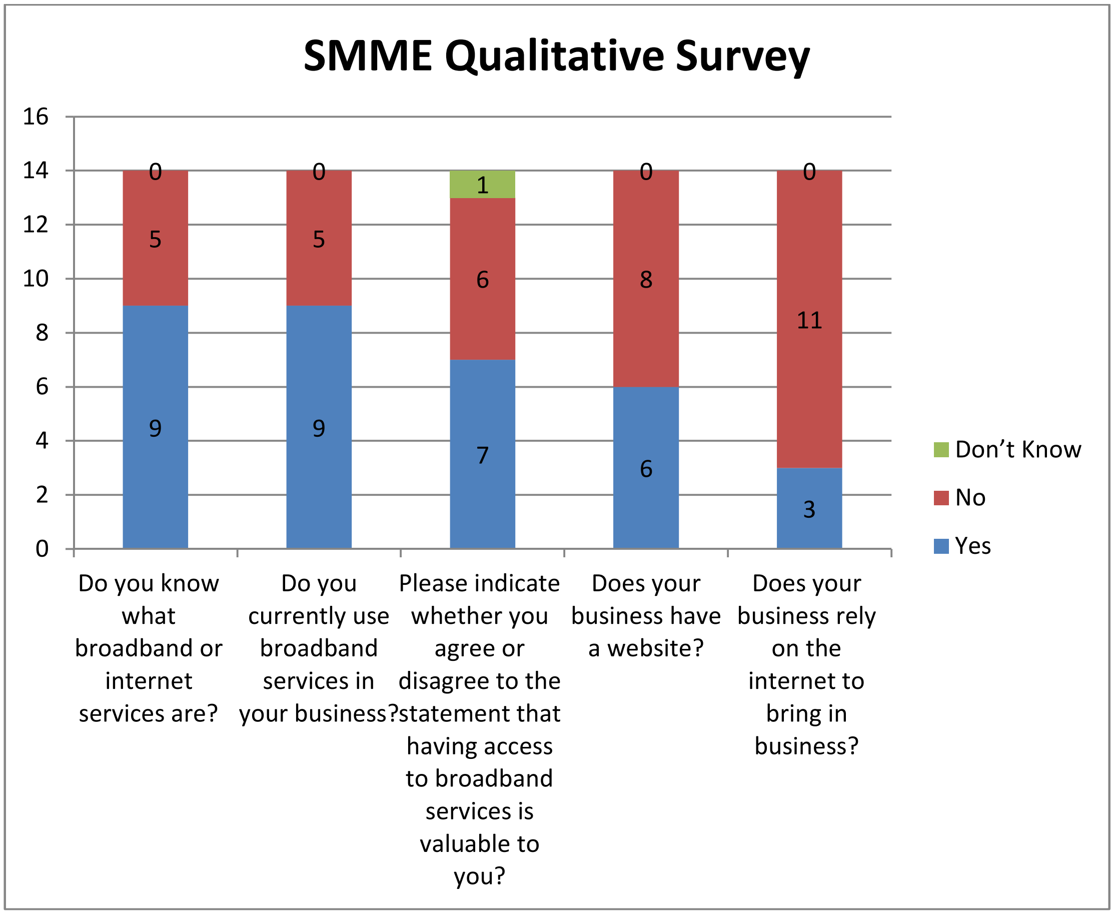
Figure 32: Household Qualitative Survey on Broadband Services in Metsweding municipality



Source: *Macharia, 2012*

Out of the 16 households that were interviewed for the qualitative survey on broadband services as indicated on figure 32 above 94% (15) of the households indicated that they were currently using broadband services and knew what broadband or internet services were. Only 6 % (1) of the households indicated that they neither used broadband nor knew what broadband or internet services were as illustrated in figure 32 above. 88% (14) of the households agreed that having access to broadband services was valuable to them and 12% (2) of the households disagreed that having access to broadband services was valuable to them as illustrated in figure 32 above. The majority of households that agreed that having access to broadband services was valuable to them indicated that they used broadband services for education and studying purposes, job hunting, general information search and social networking. HH11 indicated that having access to broadband services was valuable to them as it was the quickest means to get things such as banking, money transfer and social networking done.

Figure 33: SMME Qualitative Survey on Broadband Services in Metsweding municipality



Source: *Macharia, 2012*

Out of the 14 SMMEs that were interviewed for the qualitative survey on broadband services as indicated in figure 33 above, 64% (9) of the SMMEs indicated that they were currently using broadband services and knew what broadband or internet services were. Only 36 % (5) of the SMMEs indicated that they neither used broadband nor knew what broadband or internet services were as illustrated in figure 33 above. The majority of the SMMEs that did not currently use broadband services in their businesses indicated the reasons being that their businesses were too small and they either did not see the need for broadband or did not have the extra money for broadband services. SMME9 indicated the reason for not using broadband services as being based on the fact that their business was still new and establishing itself however there were plans to acquire internet services in the near future. SMME9 however indicated that they would need help from someone when acquiring the internet services as they knew nothing about internet.

50% (7) of the SMMEs agreed that having access to broadband services was valuable to them and 43% (6) of the SMMEs disagreed that having access to broadband services was valuable to them as illustrated in figure 33 above and 7% (1) of the SMMEs answered that they did not know whether broadband services were valuable to them. The majority of the SMMEs that agreed that having access to broadband services was valuable to them indicated the reasons being that it was a more efficient and faster mode of doing transactions and it saved time and money through internet banking and money transfers. SMME2 indicated that if his business had a website he felt that it would increase his business turnover through advertising. While majority of the SMMEs felt that it would increase the opportunities for their businesses by creating awareness of their businesses through internet advertising. Those that did not agree that having access to broadband services was valuable to them gave the reasons as follows; SMME6 indicated that the people in Metsweding did not do business over the internet and relied on the telephone to enquire on pricing and stock level of goods, SMME11 felt that only major businesses benefited from the internet and not small businesses, SMME12 did not trust the internet security for doing business and stated that “ we do farming on a small scale, don’t need the internet at all for business, prefer going to the market myself…believe in old fashion business” (SMME12, interview dated 20th August, 2012).

57% (8) of the SMMEs indicated that their businesses had a website and 43% (6) of the SMMEs indicated that their businesses did not have websites. 21% (3) of the SMMEs indicated that their businesses relied on the internet to bring in business and 79% (11) of the SMMEs indicated that they did not rely on the internet to bring in business. The businesses that relied on the internet indicated the reasons as follows; SMME5 indicated that their businesses relied on the internet to bring in business because their landline was always having problems and SMME4 indicated that the website served as a portal for their customers to place orders with their company and they were only required to come and pick up their orders. SMME10 used the internet for online banking and making EFT payments for orders made through the internet by the company and also for advertising the business. The businesses that did not rely on the internet indicated the following reasons; SMME7 indicated that although the business had a website it was mainly for advertising and marketing their business to visitors looking for accommodation in Metsweding as majority of the customers in the areas did not use the internet for shopping. Majority felt that it was because majority of the customers in Metsweding municipality did not have access to broadband services or the internet so it was pointless to have internet access. SMME13 stated that "internet is not used to generate income just mostly used to be informed. In the rural area customers don't have computers and internet so it is pointless to invest much in electronic equipment" (SMME13, interview dated 20th August, 2012).

Figure 34: Government qualitative survey on broadband services in Metsweding municipality

	Local Municipality (IT Manager) - (GOVR1-Local Municipality)	**Public School (school principal) – (GOVR2-Public School)**	**Government Clinic (principal nurse) – (GOVR3-Government clinic)**
Do you know what broadband or internet services are?	Yes	Yes	No
Do you currently use broadband services?	Yes	No	No
Do you have a website?	Yes, do have a website but it's merged with Tshwane. It used	No, there is a department of Education website but we	No

	to be stand alone. Metsweding has been incorporated with Tshwane after 2011 elections	have no real influence on the website	
Do you rely on the internet to provide e-government services to the public?	Yes	Somewhat	No
Please indicate whether you agree or disagree to the statement that having access to broadband services is valuable to government?	Yes most certainly	Yes	Yes

Source: *Macharia, 2012*

GOVR1-Local Municipality and GOVR2-Public school responded that they knew what broadband services were however GOVR3-Government clinic indicated that she did not know what broadband services were. Only GOVR1-Local municipality indicated that they were currently using broadband services. On the feedback regarding whether the government departments used broadband services as indicated in figure 34 above GOVR1-Local municipality indicated that most of their systems were connected to servers and hence did not see the need for broadband, (GOVR1-Local municipality, interview dated 22nd August, 2012). GOVR2-Public School responded that “we don’t have proper text books and stationary, internet connection would be a luxury. However I use my personal connection (3G) when there is important things that need to be done, also as a principal I have to be proactive” (GOVR2-Public School, interview dated 22nd August, 2012). GOVR3-Government clinic responded that they were still waiting for the broadband connection which they had applied for in 2009 and had not been connected to date. GOVR3-Government clinic indicated that they felt marginalised as they did not “know what is happening out there” (GOVR3-Government clinic, interview dated 22nd August, 2012).

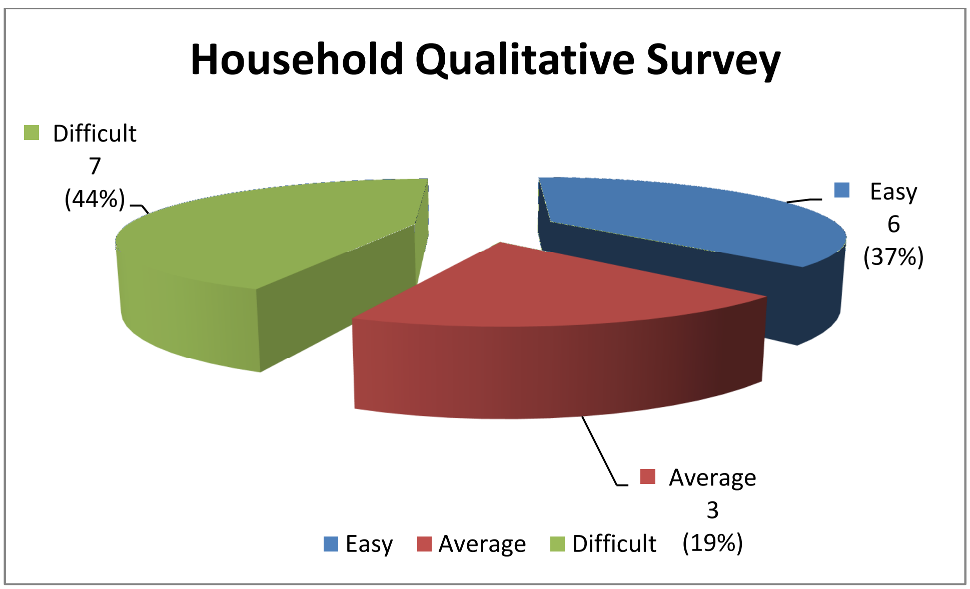
GOVR3-Government clinic indicated that although they had 3 computers there were no relevant programmes running on the computers that were relevant to their work.

On whether the government departments had websites in Metsweding Municipality GOVR1-Local Municipality responded that they did initially have a stand-alone website for the Local Municipality but this had since been merged with the City of Tshwane website after the 2011 elections. GOVR2-Public school indicated the Department of Education did not have a physical presence in Metsweding Municipality nor a website. However GOVR2-Public school indicated that the Department of Education had a website however they did not have an influence on the website. GOVR3-Government clinic indicated that they did not have a website in Metsweding Municipality.

On whether the government representatives relied on the internet to provide e-government services to the public GOVR1-Local Municipality responded that the local library used the internet to extend its services to the public and for ordering books. GOVR1-Local Municipality indicated that their website provided information on policies and gazettes which the public was also able to download and also had facilities for the public to rate the services of the local municipality. GOVR1-Local Municipality also indicated that the website enabled the public to buy bus coupons, view and download maps and they also used it as a vehicle to inform the public of events and happenings and warn the public about water and electricity disruption. GOVR2-Public school responded that they somewhat relied on the internet to provide e-government services. GOVR2-Public School indicated that although the Department of education website was a national website they did not rely on the website for many services but stated that the urban and more affluent schools did their registrations online and matric results were also available online for all matriculates. GOVR3-Government clinic responded that “in this rural clinic neither we nor the people have access to internet, so we don’t use any of the e-Government services” (GOVR3-Government clinic, interview dated 22nd August, 2012).

GOVR1-Local Municipality, GOVR2-Public school and GOVR3-Government clinic all agreed that having access to broadband services would be valuable to government and gave the following reasons. GOVR1-Local Municipality responded that constant technology change required them to stay up to date on a regular basis and indicated that research had proved that going digital saved on paper and ink. GOVR2-Public School responded that broadband services were valuable as they enabled one to keep abreast with technology both nationally and internationally. GOVR2-Public school stated that the internet was a search engine and a source of information which as an important tool that was required for education purposes and to enable the schools to operate optimally. GOVR3-Government clinic responded that if they had access to internet, communication with head office would be instant as they currently relied on post and physical deliveries for communication from the head office.

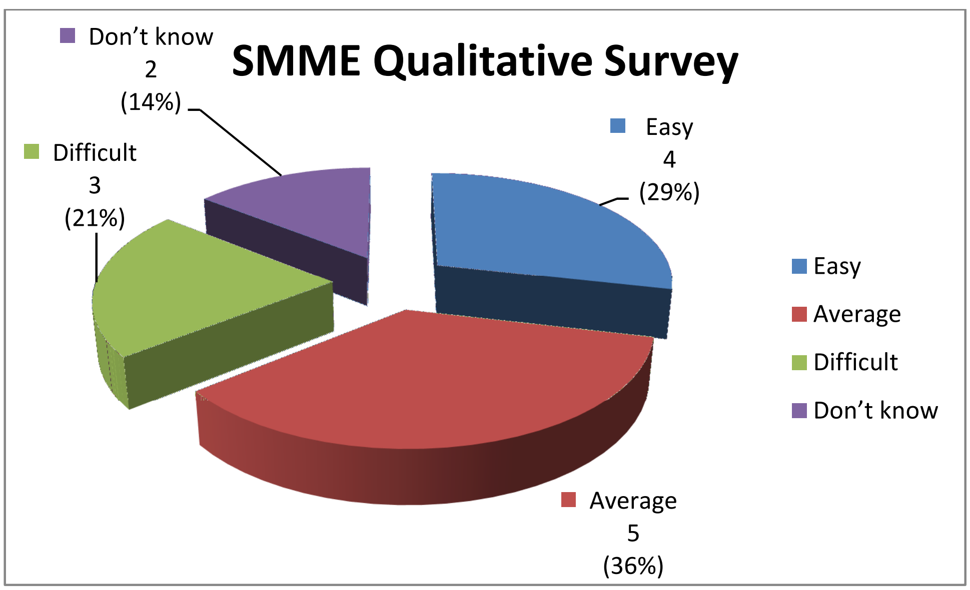
Figure 35: Household qualitative survey on the ease of access to broadband services in Metsweding municipality



***Source*:** Macharia, 2012

On the ease of accessing broadband services in Metsweding municipality as indicated in figure 35 above, 44% (7) of the households indicated that it was difficult to access broadband services, 37% (6) of the households indicated it was easy to access broadband services and 19% (3) indicated it was average to access broadband services in Metsweding municipality as illustrated in figure 35 above. Those that indicated that getting access to broadband services in Metsweding municipality was difficult highlighted the challenges as follows; HH4 indicated that frequent electricity blackouts prevented them from getting access to the internet, HH6 responded that internet access was rare to find in Metsweding, HH7 responded that the lack of access to an internet café was a challenge, HH9 highlighted that there was no access to the internet in the schools, HH10 and HH12 indicated that they only had one internet café in the area, HH13 indicated that there were few internet cafes in Metsweding and those that were available were expensive and HH14 indicated they were only able to access the internet through the cellphone as there were no internet cafes in their area.

Figure 36: SMME Qualitative survey on the ease of access to broadband services in Metsweding municipality



Source: *Macharia, 2012*

On the ease of accessing broadband services in Metsweding municipality as highlighted in figure 36 above, 21% (3) of the SMMEs indicated that it was difficult to access broadband services, 29% (4) of the SMMEs indicated it was easy to access broadband services in Metsweding municipality, 36% (5) indicated it was average to access broadband services in Metsweding municipality and 14% (2) indicated that they didn't know. The SMMEs that indicated that it was difficult to access broadband services in Metsweding gave the following reasons; SMME2 responded that there was only one internet café in their area which was always busy and sometimes they were unable to go in because of this, SMME3 responded that there was a lack of infrastructure in their area and felt that many things in Bronkospruit was only exposed to the white people. SMME5 responded that "because of lack of facilities most of our black community they not well informed with getting access to broadband" (SMME5, interview dated 20th August, 2012). The SMMEs that responded I don't know gave the following reasons; SMME9 responded that "I hear people say there is limited coverage and they cannot get connected" (SMME9, interview dated 20th August, 2012). SMME12 responded that he was a farmer and his expertise was on farming, SMME12 responded that the internet was used by his children and when he needed something from the internet he asked his kids to help him out as he was "too old to know how to browse or use broadband" (SMME12, interview dated 20th August, 2012).

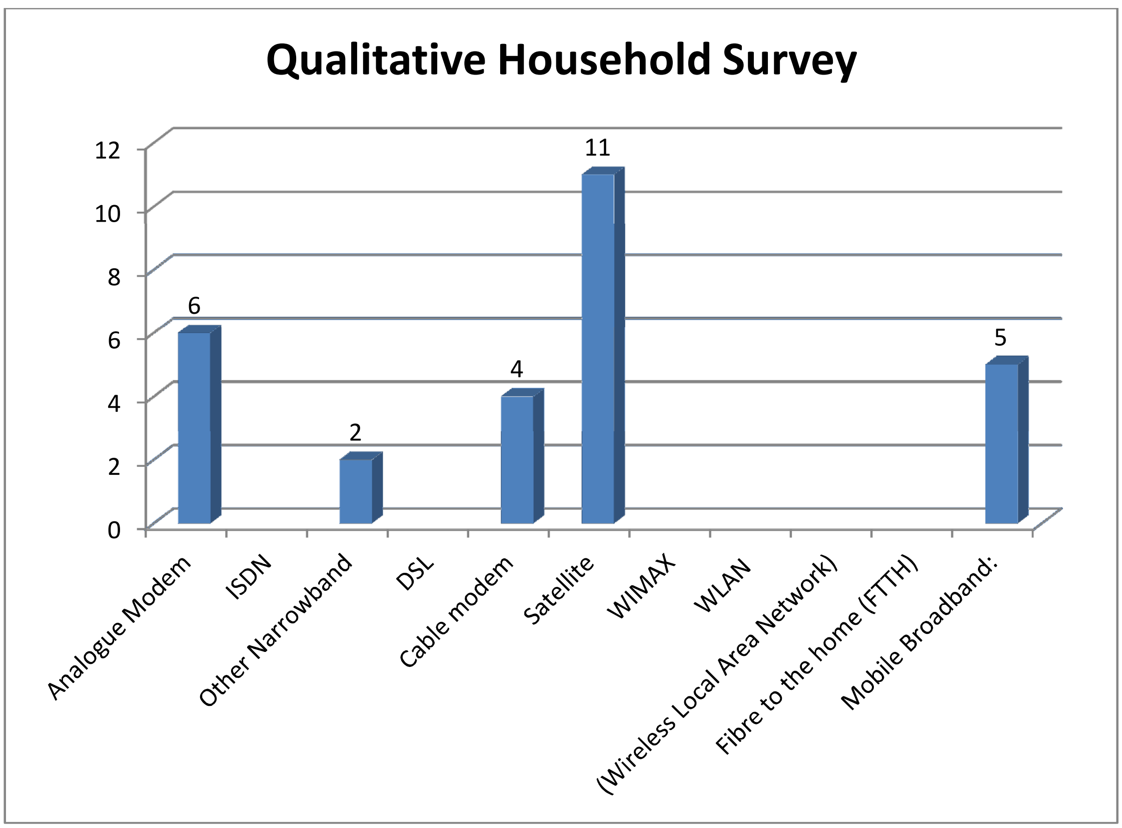
Figure 37: Government Qualitative survey on the ease of access to broadband services in Metsweding Municipality

	Local Municipality (IT Manager) - (GOVR1-Local Municipality)	**Public School (school principal) – (GOVR2-Public School)**	**Government Clinic (principal nurse) – (GOVR3-Government clinic)**
Would you describe accessing broadband services in your areas as easy / average / difficult?	average	average	don't know never used it

Source: *Macharia, 2012*

On the ease of accessing broadband services in Metsweding Municipality as highlighted in figure 37 above, GOVR1-Local Municipality responded that the ease of accessing broadband services was average and highlighted that they did not use broadband regularly as they often used access via the server. GOVR2-Public school responded that the ease of accessing broadband services was average and highlighted that he used his own personal 3G connection which worked and other times did not especially during cloudy and rainy days. GOVR3-Government clinic responded that they didn't know as they had never used broadband services and considered themselves as born before technology.

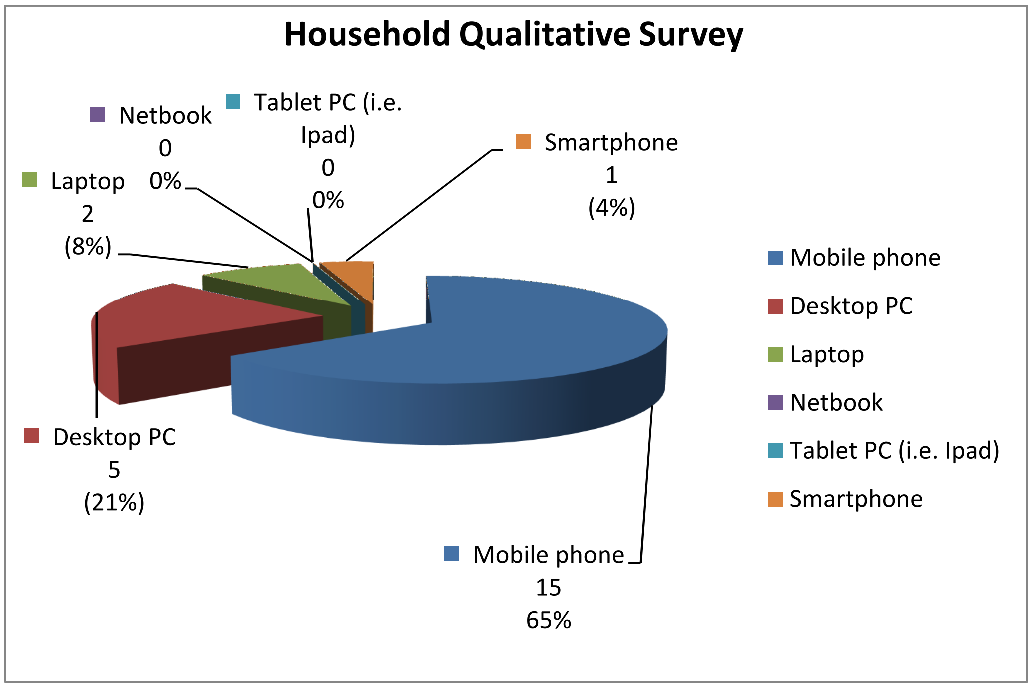
Figure 38: Type of broadband access used by households in Metsweding municipality



Source: *Macharia, 2012*

The most popular form of broadband access by households in Metsweding as highlighted in figure 38 above was through satellite connectivity followed by mobile broadband which was either through connectivity via a laptop or desktop PC or the mobile phone for those that did not have any broadband access to the home. Other forms of broadband access were through analogue or cable modem.

Figure 39: Qualitative Household Survey on the type of devices used to access broadband services in Metsweding Municipality

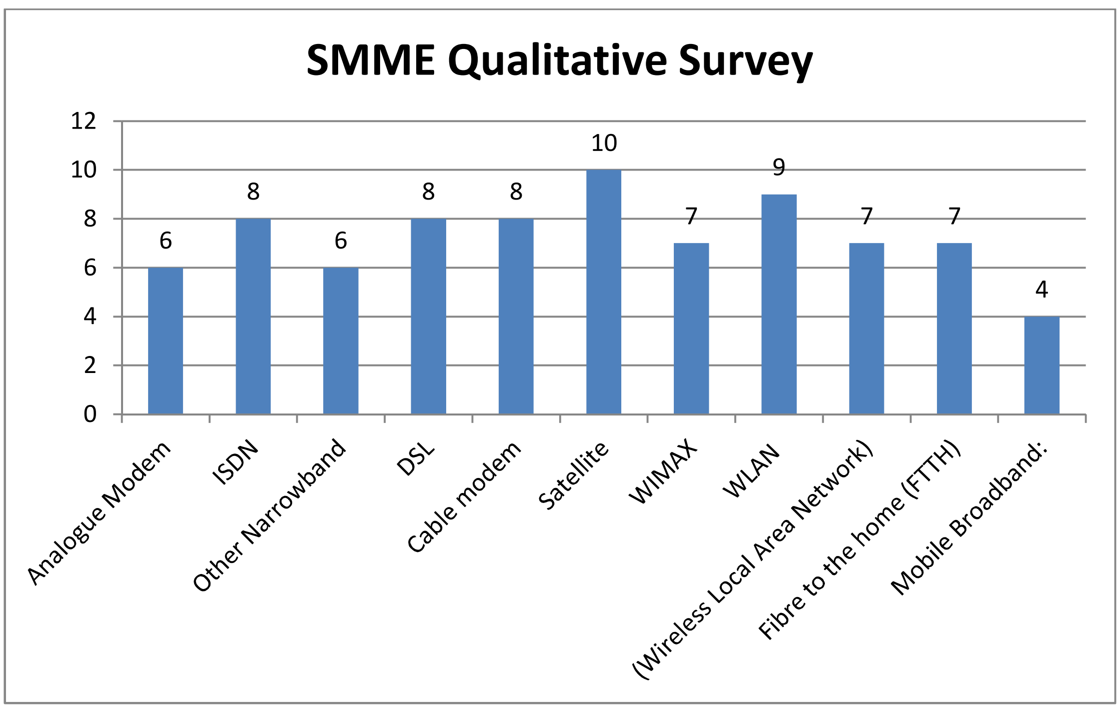


Source: *Macharia, 2012*

With regards to the type of device used to access broadband services by households in Metsweding Municipality as highlighted in figure 39 above, 94% (15) households responded that they used mobile phones as the primary device to access broadband services in the home and 6% (1) household indicated they did not use their mobile phone. Some of the households indicated that they had secondary devices or additional devices that they used to access broadband services in the home Of these 8% (2) of the household responded that they used a laptop as a secondary device to access broadband services in the home, 21% (5) households responded that they had an additional secondary device in the form of a desktop PC to access broadband services in the home and 4% (1) responded they had a smartphone as a secondary device to access broadband services in the home.

On Broadband access available in the home, 4 of the households indicated that they did not have any physical broadband access to the home and all accessed broadband services either through the mobile phone and in addition 3 of these households indicated they accessed broadband services at the community internet access facility and 1 household accessed broadband services from work. It is important to note that the user experience of a subscriber using internet connectivity on a cellphone was not as great as a subscriber using a laptop, smartphone or desktop PC to connect to the internet and laptops, smartphones, desktop PC's or tablets provided a better user experience for broadband use.

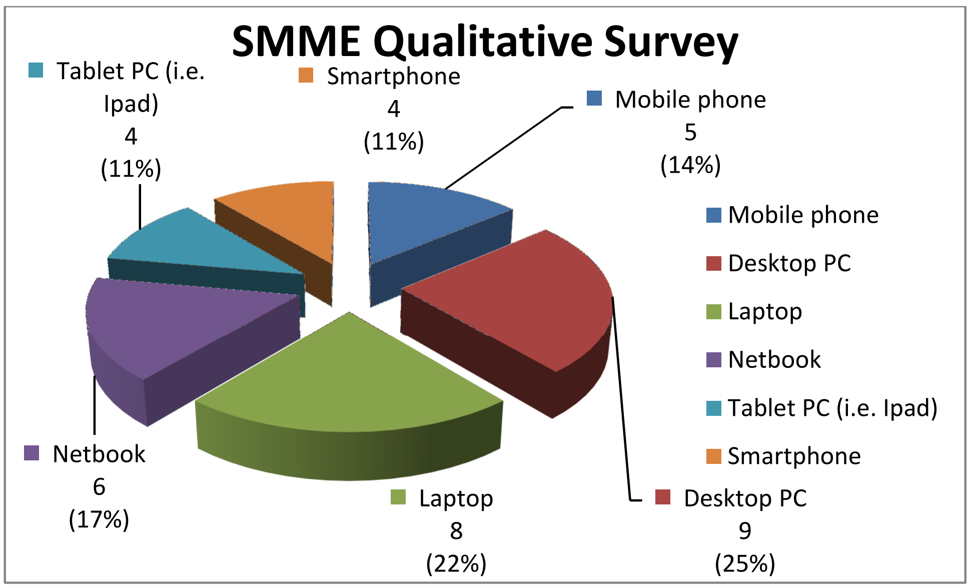
Figure 40: Type of Broadband Access used by SMMEs in Metsweding Municipality



Source: *Macharia, 2012*

As highlighted in figure 40 above, 71% (10) SMMEs indicated that the primary mode of broadband access in the business premises was by satellite connectivity. The rest were optional secondary modes of broadband access that the businesses used for broadband connectivity which varied from WLAN, DSL, ISDN, mobile broadband and analogue modem.

Figure 41: Qualitative SMME survey on the type of devices used to access broadband services in Metsweding Municipality



Source: *Macharia, 2012*

With regards to the type of devices used to access broadband services by SMME at the business premises in Metsweding Municipality as highlighted in figure 41 above, 64% (9) SMMEs responded that they used Desktop PCs as the primary device to access broadband services at the business premises and 36% (5) SMMEs indicated they did not use broadband services in the businesses. Some of the SMMEs indicated that they had secondary devices or additional devices that they used to access broadband services of these 22% (8) of the SMMEs responded that they used a laptop as a secondary device to access broadband services at the business premises, 17% (6) SMMEs responded that they had an additional secondary device in the form of a netbook to access broadband services at the business premises, 11% (4) SMMEs responded that they had an additional secondary device in the form of a tablet to access broadband services at the business premises and 14% (5) responded they used a smartphone as a secondary device to access broadband services at the business premises.

Figure 42: Government qualitative survey on type of broadband access and devices used to access the internet

	Local Municipality (IT Manager) - GOVR1-Local Municipality	**Public School (school principal) - GOVR2-Public school**	**Government Clinic (principal nurse) - GOVR3 - Government clinic**
What type of broadband access do you use?	Intranet, extranet, ISDN, DSL, Satellite, WLAN, FTTH, Mobile Broadband,	None	None
Which device do you use to access the internet?	Mobile phone, desktop PC, laptop, netbook, Tablet PC (i.e. iPad), smartphone	None	None

Source: *Macharia, 2012*

As highlighted in figure 42 above GOVR2-Public school and GOVR3-Government clinic responded that they did not have any form of broadband access in the public school and government clinic respectively and did not have any form of devices to enable connectivity to the internet in these locations. GOVR1-Local municipality responded that they had various forms of broadband access that they had at the local municipality which was via the intranet, extranet, ISDN, DSL, satellite, WLAN and mobile broadband. GOVR1-Local Municipality indicated that they used a number of devices for connectivity to the internet and highlighted these as mobile phone, desktop PC, laptops, netbooks, tablet and smartphones.

4.2.2 Viability of Content and Applications in local languages

This section outlines the data findings with regards to content and applications from the primary study in the form of document analysis of existing policy and regulation documents, semi-structured in-depth interviews, secondary study in the form of qualitative surveys conducted with households, SMME and Government and content analysis findings.

The findings from document analysis of existing policies and regulation documents revealed the following. The Electronic Government the Digital Future 2001 document highlights 3 areas that the electronic government initiative focuses on which are; e-Governance where IT is applied to “intra-governmental operations” and includes central, provincial and local government interacting together through messaging, the use of an electronic document management system, integrated finance, human resource systems, conferencing, real time collaboration and project management systems (RSA, 2001, p.4). E-government’s success is focused on ensuring interoperability of the IT systems in government which includes “networks, platforms, applications and data” communicating with each other and enabling the “automatic sharing and exchange of electronic messages and document, collaborative applications, distributed data processing and report generation, seamless transaction services, whole of government search and queries and integrated IT systems management” (RSA, 2001, p.8). E-Business is another area of focus for the electronic government initiative where IT is applied to “business to business transactions” such as the use of e-procurement systems used by government to procure goods and services and electronic payment. E-Services is another area of focus for the electronic government initiative where IT is applied to deliver online services to the public such as telemedicine, information regarding health, culture and education. Government is also able to use these systems to interact with the public on matters relating to policy, service delivery and corruption system (RSA, 2001, p.4).). The Electronic Communications Transaction act which was subsequently published in August 2002 makes provision in the policy for the Minister to develop a national e-strategy and the implementation thereafter as a national priority. The envisioned national e-strategy takes into consideration "all matters involving e-government services" (RSA, 2002, p.18). The Electronic Communications Transaction Act 2002 identifies the objectives of the act as "to enable and facilitate electronic communications and transactions for the public" (RSA, 2002, p.16) which amongst others includes the promotion of e-government services to enable electronic communication between the public, institutions and government, the removal of barriers to "electronic communications and transactions" attract investments in respect to electronic transactions and "the development of electronic transactions services which are responsive to the needs of users and consumers" with a focus on "the special needs of particular communities and, areas and the disabled" (RSA, 2002, p.16). The National Information Society and Development Plan (ISAD) which was subsequently published in 2005 highlights one of government's challenges as being able to provide equitable, cost effective access to quality health care to all citizens (PNC, 2005). The National Information Society and Development Plan (ISAD) 2005 highlights ICT as an effective tool that could be used to provide health care effectively to the health sector. The National Information Society and Development Plan (ISAD) 2005 propose that ICT usage "can provide medical expertise and technical support to primary rural health care communities in different parts of South Africa" (PNC, 2005, p.6). The National Information Society and Development Plan (ISAD) 2005 also highlights several initiatives which are geared at addressing ICT skills training, one being the e-Education policy published by the Department of Education "that sets out a framework for the implementation of a strategy that aims to expand the use of ICTs and improve the quality of teaching and learning" (PNC, 2005, p.5). The National Information Society and Development Plan (ISAD) 2005 also highlights the NEPAD e-schools initiative of which South

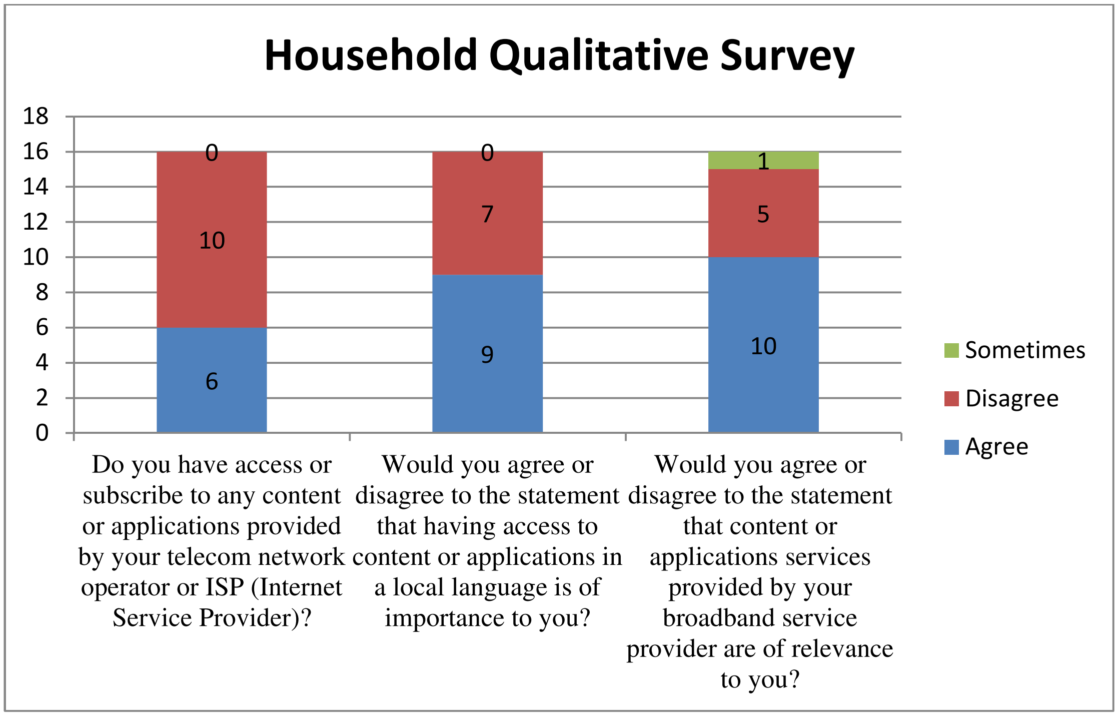
Africa is one of the co-initiating countries that is aimed at enabling ICTs as a tool that supports “distance and lifelong learning, e-learning as well as the elimination of illiteracy” (PNC, 2005, p.6). The National Information Society and Development Plan (ISAD) 2005 in conjunction with the Department of Education highlights initiatives that it will support that are aimed at designing and implementing funding models for the e-Education policy and NEPAD e-schools, the provision of funding and human resources required to develop and implement learning, e-learning and skills development and the provision of relevant and affordable “ICT infrastructure, applications and services to meet the teaching, learning and administration needs” (PNC, 2005, p.6) of the above programmes. The National Information Society and Development Plan (ISAD) 2005 highlights e-Awareness as a critical element in the development of a knowledge society. The National Information Society and Development Plan (ISAD) 2005 highlights that e-Awareness improves and increases the utilization of ICT and the creation of e-awareness methods that increase awareness on the “benefits of ICT adoption and use” and drive awareness on the various initiatives that are promoting ICT as a tool for development and service delivery (PNC, 2005, p.40). The National Information Society and Development Plan (ISAD) 2005 highlights e-Administration which entails using ICT to drive improvement around communication and administration of schools which are linked to “district and provincial offices” as a key focus area (PNC, 2005). The National Information Society and Development Plan (ISAD) 2005 highlights an initiative by Meraka institute and Department of Education which is part of the e-administration initiative that is currently working on developing a hybrid model in rural areas that uses the existing EduNet infrastructure that connects institutions with each other, telecommunication technologies and broadcasting with the aim of providing equitable access to broadband for all (PNC, 2005, p.56).). The National Information Society and Development Plan (ISAD) 2005 highlights that provisions for the development of an education network (EduNet) have been made in the Telecommunications Act of 1999 and the amendment act of 2001 (PNC, 2005). Initiatives made to drive e-Administration includes the education network (EduNet) which is driving initiatives that involve connecting schools and institutions to each other and the department of education and Meraka institute who are developing a hybrid model that aims at providing equitable broadband access (PNC, 2005, p.56). The National Information Society and Development Plan (ISAD) 2005 also highlights e-Documentation as a key application that enables "ICT applications such as track and trace, integrated electronic document management system, e-passport with a view to efficiently process enabling documents" (PNC, 2005, p.83). However the exchange of documents between government departments is an area highlighted where government needs to improve in order "to support the processing of public service applications and delivery of services" (PNC, 2005, p.83). The National Information Society and Development Plan (ISAD) 2005 highlights that an enabling environment already exists through provision of e-Documentation in the Electronic Communication and Transaction Act of 2002 and the Electronic Government document 2001. The National Information Society and Development Plan (ISAD) 2005 proposes an "interoperable, integrated e-Documentation system" for government that will enable the management of public service documents electronically, enable the interoperability and "seamless exchange of citizen documents" and enable a secure environment for the secure exchange of documents between government, businesses, citizens and institutions (PNC, 2005, p.84). E-government is another area which according to The National Information Society and Development Plan (ISAD) 2005 that requires a lot of improvement. The National Information Society and Development Plan (ISAD) 2005 propose strategies that focus on the use of ICT by government for the sole purpose of delivering "customer focused services" (PNC, 2005, p.69). The National Information Society and Development Plan (ISAD) 2005 highlights that provision for a policy framework for e-Government exists in the Electronic Government the Digital Future document of 2001. The National Information Society and Development Plan (ISAD) 2005 highlights the use of e-health systems for the efficient provision of health care services equitably to its citizens as facing a lot of challenges despite the fact that provisions have been made in existing policies and legislatures for the delivery of health care using ICTs (PNC, 2005). The National Information Society and Development Plan (ISAD) 2005 indicate that provisions have been made in the National Health Act of 2003 and the Electronic Communication Transaction Act 2002 (PNC, 2005, p.59 – p.60). The Broadband Policy document which was published in July 2010 states that "all public and private institutions, as well as civil society, must have access to broadband services" (DoC, 2010, p.13) aimed at enabling the demand and uptake in government departments and specifically in health and education. The Broadband Policy 2010 document goes further to stipulate that "content from departments will be used for both information services as well as e-government service delivery to citizens" (DoC, 2010, p.13). The development of content is stipulated as a policy objective in the Broadband Policy 2010 document aimed at increasing the broadband usage and uptake in "education, health and e-Government" (DoC, 2010, p.8). The development of content in the local languages is highlighted as another policy objective by The Broadband Policy 2010 document aimed at enabling government services electronically for citizens to interact with government with the aim of stimulating broadband usage (DoC, 2010, p.8). One of the key priority areas highlighted by The Broadband Policy 2010 document is awareness, The Broadband Policy 2010 document calls for the three spheres of government to form "partnerships with other stakeholders" aimed at increasing the public's broadband awareness (DoC, 2010, p.15). The focus must be on the "communications ability and opportunities that broadband can offer to all citizens in both urban and rural areas" through content and applications aimed at increasing broadband uptake and usage (DoC, 2010, p.15). ANC policy discussion document which was published in March 2012 further proposes that e-Skills in all public schools become a mandatory subject aimed at promoting an "e-literate society". This protects students in rural areas from being abused by none legit training institutions (ANC, 2012, p.10). The main purpose of the e-Education white paper which was adopted in 2004 as outlined by the ICT Policy Colloquium discussion document 2012 was to ensure that all learners in school were "ICT competent by 2013" (DoC, 2012, p.79). Other initiatives driven by policy that are highlighted in the ICT Policy

Colloquium discussion document 2012 were the e-Rate policy and establishment of the Educational Network which are aimed at enabling affordable internet connectivity to schools for education purposes. Other initiatives that have been launched by the DoC to address e-Skills highlighted in the ICT Policy Colloquium discussion document 2012 include the national e-Skills dialogue initiative launched in 2009 with the aim of facilitating dialogue between government and industry role players with the aim of ensuring that there is alignment between the demand and supply of skills (DoC, 2012, p.81).). The ICT Policy Colloquium discussion document 2012 further highlights that the green paper on e-commerce published by the DoC in 2000 outlined “a framework for the development of e-Government initiatives” (DoC, 2012, p.73) whose focus was on the development of ICT literate public servants and the adoption of modern systems. However despite the provision for an e-Government framework the implementation of the strategy is still not visible to date (DoC, 2012, p.74).

Feedback from the semi-structured in-depth interviews was as follows; MNOR1-8ta response was that it was important that internet content was presented in a language that the user understood. MNOR1-8ta highlighted tools that were currently available such as Google translate that enabled one to translate pages to a language that one understood however MNOR1-8ta highlighted that one required education to understand how to use the applications. MNOR1-8ta view was that in some areas language was not so important but rather visual mechanisms for representing data were of importance and gave an example of a weather report where an icon showing sunshine or rain was sufficient enough to communicate the message. MNOR1-8ta further highlighted that “it depends on its purpose and its need so I would say if it’s for education or viewing a web page, reading news then it has to be in a language that people can read. If it’s more for updates then to have an application on the phone is a great example to have a sun or moon or rain that’s got a number and tells you the temperature is all I need. Some people use applications more for information but people are using more data in for example farmers. A lot of networks are deploying devices that communicate with the main network for example you've got automated water reading, automated power consumption, these are things you can pick up on your phone. Now to be honest with you, you don't have to read it to me I just need to see a number, so language is less irrelevant in that application. But that's a growing market so what I'm saying is that today if its specifically for education or keeping up to date with news or local information then you have to keep it in the text that's specific for that persons reading" (MNOR1-8ta, interview date 17th August, 2012). FNOR1-Telkom responded that he wasn't convinced that there was a need for content and applications in a local language in rural areas as there were no studies to substantiate this. FNOR1-Telkom view on applications was that "that education must be the starting point. It's just the most obvious application of broadband and other forms is information to tablets". FNOR1-Telkom also highlighted that education around the application of broadband and its benefits to the user was critical in driving its development and stated that "you've got to show it's not about the device and the network this is the application of broadband and this is how it's going to help you in your daily life. It's going to help you with job finding, it's going to help you with home affairs, court roles, police cases, find a document. I think you have to actually first build the application first then you educate second. You can't build a broadband for broadband sake sort of campaign" (FNOR1-Telkom, Telephonic interview date 17th August, 2012). MNOR1-MTN views on the availability of relevant content and applications in rural areas were that this was an area that should be driven by government as mobile operators were more of enablers. MNOR1-Vodacom view on the availability of relevant content in rural areas was that content was "more in the domain of end users so if you look at your social networks its user generated content and that's very big so that's wide spread so when people go to Facebook, twitter they would generally speak or write in their language that they are comfortable with" (MNOR1-Vodacom, Interview dated 28th August, 2012). On the availability of applications in local languages MNOR1-Vodacom responded that it was "just an issue of software programming so if you look at things like Microsoft office and others, they cater for local languages so it's up to you to determine which language you want to write in they are there they cater for it so they have the spelling tools and such things in the different languages you just have to make the choice. It's a basic software package its available you just choose what language you want to interact in". FCR1-FTTH Councils view was that the availability of content and applications in a local language was not practical as operators had to focus on growing the broadband penetration first, "I think it's important just to have some successes than to try and tackle some content that is not easily even available in many different languages. So you just end-up doing a substandard job and I think you'd rather do one great job in a relatively global language then trying to tackle realistically" (FCR-FTTH, interview date 23rd August 2012). MNOR1-CellC responded that their primary focus as an operator was to build infrastructure and provide airtime and developing applications as a value add would require them to form partnerships with third party partners. MNOR1-CellC highlighted that as one of their licence conditions they were required to provide their services in 2 or 3 local languages which they were already providing through their call centres. ISPR1-Internet Solutions response was that "secondary challenges would be lack of ICT skills required to create local content in local languages" (ISPR1-Internet Solutions, Written response 23rd August, 2012).

The findings from the qualitative surveys conducted in Metsweding municipality with households, SMMEs and government departments revealed the following.

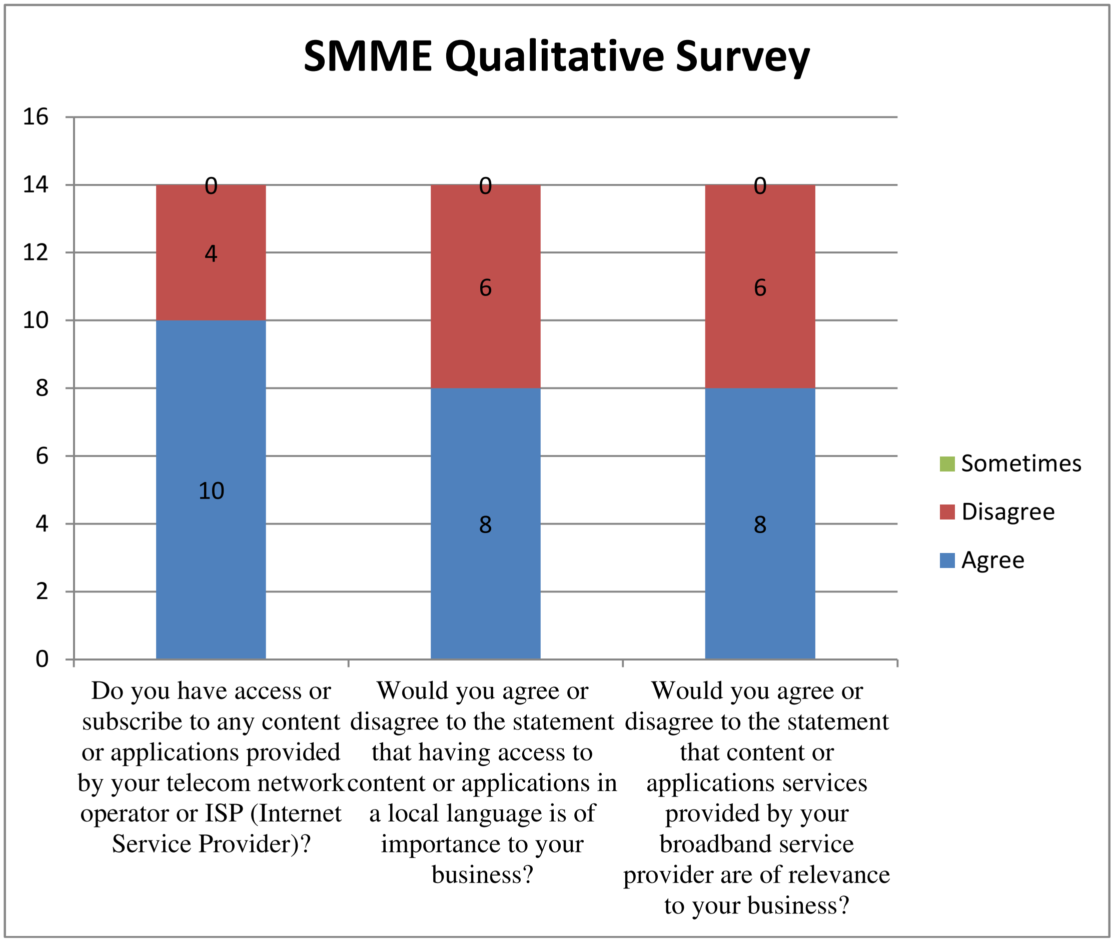
Figure 43: Household qualitative survey on availability of relevant content and applications in a local language in Metsweding municipality



Source: *Macharia, 2012*

On whether the household had access or subscribed to content and applications provided by a telecom network operator or ISP as highlighted in figure 43 above, 62.5% (10) of the households indicated that they did not and 37.5% (6) of the households indicated that they did subscriber to content and applications. On whether having access to content or applications was of importance to them 56% (9) of the households indicated that they agreed it was of importance to them and 44% (7) of the households disagreed it was of importance. The households that agreed that having access to content or applications in a local language was of importance gave the following reasons; HH1 responded that some of the people were unable to read in English and didn’t understand it, HH6 and HH7 both responded that it would enable illiterate people to adapt to the internet faster, HH9 responded that it would enable faster job searches and all the other households agreed that it would enable none English speaking people to access the internet in a language that they understood. On whether the content and applications provided the broadband service provider was of relevance to them 63% (10) of the households agreed that it was of relevance and 31% (5) of the households disagreed it was of relevance and 6% (1) of the household indicated that it was sometimes relevant. Those households that agreed that the content and applications provided were of relevance gave the following reasons; HH1 responded that it helped in his job searches as jobs were readily available online nowadays, HH2 indicated that it was a source of educational material, HH3 and HH5 both responded it was cost saving and saved them trips to the library as information was available online and the rest of the households responded that it was mainly used as a source of information.

Figure 44: SMME qualitative survey on availability of relevant content and applications in a local language in Metsweding Municipality



Source: *Macharia, 2012*

On whether the SMMEs had access or subscribed to content and applications provided by a telecom network operator or ISP as highlighted in figure 44 above, 71% (10) of the SMMEs indicated that they did and 29% (4) of the SMMEs indicated that they did not subscriber to content and applications. On whether having access to content or applications was of importance to their business 57% (8) of the SMMEs indicated that they agreed it was of importance to them and 43% (6) of the SMMEs disagreed it was of importance. The SMMEs that agreed that having access to content or applications in a local language was of importance gave the following reasons; SMME2 responded that some of the people did not understand English especially the older generation, SMME4 responded that being a rural area majority of the people although have assets never went to school and were illiterate therefore having access to content and applications in a local language was important, SMME6 responded that "because not all consumers can read or understand Afrikaans or English. We are based in a place where all languages dominate. Its therefore applications and content are more helpful for our customers and for us to keep the business running" (SMME6, interview dated 20th August, 2012), SMME7 responded that "because we now living in a democratic country so for our customers to be well informed we used to make sure that they are well informed so that they can understand clearly who we are and where are we based" (SMME7, interview dated 20th August, 2012) and SMME10 responded that "we have a client base of people who mostly speak African languages therefore the communication is much simpler when we use English as a major language" (SMME10, interview dated 20th August, 2012). On whether the content and applications provided by the broadband service provider was of relevance to their business 57% (8) of the SMMEs agreed that it was of relevance and 43% (6) of the SMMEs disagreed it was of relevance. Those SMMEs that agreed that the content and applications provided were of relevance to their businesses all responded that they were able to advertise and market their businesses.

Figure 45: Government qualitative survey on availability of relevant content and applications in a local language in Metsweding Municipality

	Local Municipality (IT Manager) - GOVR1-Local Municipality	**Public School (school principal) - GOVR2-Public school**	**Government Clinic (principal nurse) - GOVR3 - Government clinic**
Does government provide the public with access to content or e-government applications?	Yes	Yes	Don't know about content
Would you agree or disagree to the statement that being able to provide content to the public in a local language is of importance to government?	Yes	No	English is fine
Would you agree or disagree to the statement that content or e-government applications services provided by government is of importance to the public?	Yes	Yes	Have no idea

Source: *Macharia, 2012*

On whether the government provided the public with access to content or e-government applications as highlighted in figure 45 above, GOVR1-Local Municipality and GOVR2-Public school responded yes while GOVR3-Government clinic indicated that she did not know about content. On the importance of government being able to provide content to the public in a local language GOVR1-Local Municipality responded that it was of importance and highlighted that being able to provide content in a local language made information relevant and ruled out misunderstanding occurring. GOVR2-Public school responded that it was not of importance and highlighted that the Department of Education currently provided information in English and introducing content in other languages create difficulties and inaccuracies. GOVR3-Government clinic responded that English was fine as people who already used the internet had a certain level of literacy in the English language. Both GOVR1-Local Municipality and GOVR2-Public school agreed that content or e-government application services provided by the government were of importance to the public. GOVR1-Local Municipality responded that the government required “feedback and participation from the public so it’s important that public has knowledge of content” (GOVR1-Local Municipality, interview dated 22nd August, 2012) and GOVR2-Public school responded that “Matric results can be viewed. Curriculum changes are updated, learning programmes, policies and relevant education DoC are provided to the public. Vacancies are posted. The department also posts workshops, events, schedules, DoC on the website. As mentioned I have to use my personal 3G to access this information. Registration for workshops and seminars are also placed on the website. We in rural areas are often lose out on these opportunities, education and health department must be prioritised by National for broadband connection” (GOVR2-Public school, interview dated 22nd August, 2012). GOVR3-Government clinic responded that she did not know.

4.3 Absorptive Capacity

This section outlines the data findings from the absorptive capacity elements consisting of investment in broadband, quality of human capital, efficiency and productivity and governance structures. The data findings are from the primary study in the form of document analysis of existing policy and regulation documents and semi-structured in-depth interviews, secondary study in the form of qualitative surveys conducted with households, SMME and Government and content analysis findings.

Table 11 below summarises the Demand side data findings from the semi-structured in-depth interviews and qualitative surveys which are discussed in detail below in section 4.3.1, section 4.3.2, section 4.3.3 and section 4.3.2.

Table 11: Summary of Absorptive capacity Data findings

Absorptive Capacity			
Investment in Broadband	**Quality of Human Capital**	**Efficiency and Productivity**	**Governance Structures**
Policy for a management framework that directs investment to the development of a national broadband network does not exist	Knowledge of broadband in both the metros and rural areas was poor	Without people understanding the social economic benefits of broadband, relevant applications and availability of e-government services there would be no traction gained in broadband market development.	Existing policies on governance lack provisions for an institutional framework
Existing policy makes provision for the application of funds in the universal service and access fund to be utilised in the procurement of electronic communication services and access however this was only limited to public schools and training institutes that fell within underserviced areas.	Building broadband infrastructure alone was not sufficient and operators had to go the extra mile to educate the users on how broadband would benefit them for them to see the value	Existing policy enables efficiency and productivity through governments electronic government initiative and national e-strategy	Government's role was to give clear direction to the operators on strategies that related to areas where operators were looking to gain market share such as rural areas and certain mechanisms had to be in place that enabled that

Existing policy enables efficiency and productivity through governments electronic government initiative and national e-strategy	There was very little formal education on broadband coming out of areas like possibly government or academic institutions	what was lacking Is a framework from government that looked at the provision of e-government services	Challenges associated to the rental cost of manning a mast or site housing a base station was an issue that government could influence through concessions as the land in most instances belonged to the municipalities and airport companies which were all government owned
Existing policy enables efficiency and productivity through governments electronic government initiative and national e-strategy	There is a lack of skilled and experienced people in rural areas	e-Education was the starting point to drive broadband market development in rural areas	Although Sanral is a private company it is outsourced to government and no framework exists that highlights the input costs of operators that government could use as a basis to waiver the costs for operators and subsequently lower the end user price as currently all costs are borne by the end user
The biggest cost to broadband network rollout in rural areas was the financial cost	Giving the subscriber a broadband device was not sufficient and a strong education effort was required as well		Lack of clear policy direction was the reason why there hadn't been any progress with regards to broadband market development
Commercially driven businesses were not going to invest in building the rural infrastructure if no commercial gains	If one required expert training all the courses were offered in urban areas and none in the rural areas		Constant change of ministers over a short period of time has resulted in a certain level of complacency which has led to the department always playing catch up and losing momentum

Some form of incentives that government could offer the private sector is required which includes incentives in the form of tax breaks or co-funding or low cost financing that gets provided to third parties	Government could play the main role of facilitating skills to “eliminate bottlenecks rather than crowding out any small scale entrepreneurs. Such facilitation could be government funded business incubators or tax breaks and loans for small start up business		Government played a conflicting role of being a player and a policy maker
Partnerships or joint management between government and the private sector were not viable as they led to a lot of finger pointing and blame games	Literacy levels were poor and there was a lack of skilled and experienced people and highlighted that there was a need for policy to address the skills and training of people and also form some interventions with regards to literacy levels in the country.		The biggest role that government could play is to rollout fibre to the rural areas and using government buildings to do that so your schools, clinics, libraries, just put fibre to those buildings and then mobile operators or any other operators can tap off from those markets
			Barriers exist relating to governance problems between municipalities and provinces where one finds municipalities and provinces building their own independent networks
			The challenge faced by operators was that it took 18 months and more to get a permit for rapid deployment

			There was a need for a special interconnect framework for rural that could accelerate infrastructure rollout.
			Policies that were being developed displayed a lack of knowledge of the industry and technical knowledge

Source: *Macharia, 2013*

4.3.1 Investment in broadband networks

This section outlines the data findings with regards to investment in broadband networks from the primary study in the form of document analysis of existing policy and regulation documents, semi-structured in-depth interviews, secondary study in the form of qualitative surveys conducted with households, SMME and Government and content analysis findings.

The researcher reviewed existing policy discussion documents to establish whether they enabled the investment in broadband. The policy discussion documents reviewed that had data that enabled investment in broadband networks included the National Information Society and Development Plan (ISAD) 2005 (PNC, 2005), Electronic Communication Act 2005 (RSA, 2005), ANC policy discussion document 2012 (ANC, 2012), and The ICT Policy Colloquium discussion document 2012 (DoC, 2012).

The Electronic Communication Act which was published in July 2005 makes provision for Ministerial policies and policy directions in matters pertaining to guidelines on licence fees, award of licences and incentives associated with individual licences where a binding commitment is made by an applicant "to construct electronic communications networks and provide electronic communications services in rural and underserviced areas" (RSA, 2005, p.12). The Electronic Communication Act 2005 further makes provision for the application of funds in the Universal Service and Access Fund "to electronic communications network service licensee for the purpose of financing the construction or extension of electronic communications networks in underserviced areas as prescribed" (RSA, 2005, p.55). The National Information Society and Development Plan (ISAD) which was also published in 2005 highlights that governments in most instances does not have sufficient funding to rollout ICT infrastructure due to the large investment requirements and this challenge is often exuberated by the fact that underserviced areas are most often considered not commercially viable by operators as they are occupied by poor people. Due to the return on investment in these areas being low the private sector is not willing to make investments. State intervention is required in these communities and innovative ways to fund ICT infrastructure rollout in these areas is required (PNC, 2005). The National Information Society and Development Plan (ISAD) 2005 recommends universal service obligations as one model to fund ICT infrastructure rollout through the imposition of obligations for operators to rollout ICT infrastructure to areas that are considered not commercially viable. Public Private Partnerships (PPP) is promoted as another viable financing model that can be adopted to finance "Information Society Projects" (PNC, 2005, p.48). The National Information Society and Development Plan (ISAD) 2005 calls on government and operators in telecommunications to subsidise investments in infrastructure in rural areas with the aim of achieving universal access. This is due to the fact that network investments in rural areas would require a huge amount of capital outlay (PNC, 2005, p.27). The Broadband Policy document which was published in July 2010 further highlights that communication increases the attractiveness of rural areas as "investment destinations" and highlights that the investment in broadband networks in rural areas will go further in alleviating the need for people in rural areas to migrate to urban areas (DoC, 2010, p.11). The ANC Policy discussion document which was published in March 2012 proposes that Government provides capital in the form of financial support to start-up greenfield operators in underserviced areas for the provision of services and also proposes that Government enables preferential interconnect rates as a mandatory requirement for start-up greenfield operators in underserviced areas (ANC, 2012, p.14). The ANC Policy discussion document 2012 proposes that national priority should be given to setting aside public finance specifically for broadband rollout “through the fiscus and the developmental finance institutions (DFIs)” (ANC, 2012, p.15). The ICT Policy Colloquium discussion document which was subsequently published in April 2012 acknowledges the role that governments globally are playing in investing in building broadband networks through increased public funding and recognising broadband as a “national economic investment” (DoC, 2012, p. 24). The ICT Policy Colloquium discussion document 2012 goes further to state that policy makers must view broadband “as a long term economic investment which is intrinsically linked to the overall progress and growth of a nation” (DoC, 2012, p.24). The ICT Policy Colloquium discussion document 2012 highlights that the regulator and the universal service funds were established as mechanisms that would address the challenges of providing access to these areas (DoC, 2012, p.39 & p.40). The ICT Policy Colloquium discussion document 2012 highlights that the Electronic Communications Act 2005 made provision for the Universal Service and Access Agency of South Africa through a fund to develop electronic communications networks in rural and under serviced areas (DoC, 2012, p.43). The ICT Policy Colloquium discussion document 2012 highlights that the provision of universal broadband access will enable a reduction in the spatial inequalities that currently exists in South Africa with regards to access. The ICT Policy Colloquium discussion document 2012 highlights future policy directions which include investment initiatives in “the delivery of basic and enhanced capability infrastructure” (DoC, p.95, 2012) and Sentech estimates this cost of rolling out a national broadband network at R 1.5 billion. The ICT Policy Colloquium discussion document 2012 highlights “the development of a management framework to direct investment” (DoC, 2012, p.74) as a critical requirement and the investment in a national broadband network and the convergence of broadband is highlighted as a targeted area for investment in South Africa. The ICT Policy Colloquium discussion document 2012 further highlights broadband as “the next major area of investment requiring public private partnering, inter-governmental partnering and addressing consolidation of government mandate and assets" (DoC, 2012, p.50). The ICT Policy Colloquium discussion document 2012 also proposes as part of the national integrated ICT policy consideration for tax incentives (DoC, p.95, 2012).

Based on the feedback from the semi-structured in-depth interviews the following information was obtained. MNOR1-Vodacom in his response on the barriers to broadband market development in rural areas suggested that government could kick start the process to address the problem of lack of infrastructure in rural areas by "putting fibre in rural areas, putting fibre to every rural schools, to every clinic, every hospital and then based on that operators can then take it further by wireless" (MNOR1-Vodacom, interview date 28th August, 2012). MNOR1-Vodacom provided examples of countries such as New Zealand, Australia and Qatar where government had taken the initiative to rollout the fibre network. On the same question FCR1-FTTH Council response was that the biggest cost to broadband network rollout in rural areas was the financial cost and the targets could be achieved by piggy backing off the existing mobile operator's networks which already provided good voice coverage nationally and could be upgraded to support broadband. However FCR1-FTTH Council felt that someone had to pay for the upgrade and it would ultimately be the end-user. FCR1-FTTH Council view was that "there is a big price that people are willing to pay which shouldn't be underestimated and even the poorest people based on the utility value of having a telecommunication link versus getting in a taxi and going to buy stuff" (FCR1-FTTH Council, interview date, 23rd August 2012). FCR1-FTTH Council opinion was that commercially driven businesses were not going to invest in building the rural infrastructure if no commercial gains and argued that this had to be a government driven initiative. FCR1-FTTH Council provided examples of countries such as Scandinavian, Australia and some Asian countries where the infrastructure rollout was through "massive state sponsored initiatives" (FCR1-FTTH Council, Interview date, 23rd August 2012). FCR1-FTTH Council argued that billions had been wasted through state owned corporations such as Sentech, Broadband Infraco, Telkom, the universal access funds and local government initiatives with no successes to show for these initiatives. To get the private sector involved FCR1-FTTH Council suggested some form of incentives that government could offer the private sector "incentives in the form of tax breaks or co-funding or low cost financing that gets provided to third parties and its success gets based on come collect your money" (FCR1-FTTH Council, interview date, 23rd August 2012). FCR1-FTTH Council views on partnerships or joint management between government and the private sector was that they were not viable as they led to a lot of finger pointing and blame games. Funding the business model was a big challenge highlighted by FCR1-FTTH Council as well as mundane municipal processes riddled with red tape which led to investor uncertainty and investor capital being tied up for unreasonable periods of time. On whether lack of finance was a barrier to rolling out infrastructure to rural areas MNOR2-CellC view was that this was not a barrier and if given finance the operator would rollout the infrastructure. MNOR2-CellC highlighted that there was budget available that was reserved for the Digital terrestrial migration and the broadband process however MNOR2-CellC felt there was a need to build on the broadband policy through "coming up with a proper framework and also making the funds available, driving the roadmap to that 2020. You can either use a property arrangement or government can do it on its own or give it to the private sector to do it" (MNOR2-CellC, interview date 30th August, 2012). On whether existing policies and regulation enabled the investment in broadband networks RR1-ICASA responded that "current legislation provides all individual network service licensees with the right to deploy networks in any geographic region. Furthermore, the unlicensed spectrum band provides for opportunities for small ISPs to provide internet connectivity in rural areas where there is unlikely to be significant spectrum interference" (RR1-ICASA, written response 25th September, 2012). On the current state of the broadband ecosystem in rural areas MNOR2-MTN responded that the broadband services were not sufficient in rural areas and the cost of investing was prohibitive for operators. MNOR2-MTN highlighted that with access to spectrum in the lower bands operators would require less investment due to the wider land mass that the spectrum was able to cover. ISPR1-Internet Solution response was to address the challenge of providing services to areas that were uneconomical to rollout broadband infrastructure government could look at a Public Private Partnership (PPP) between government and a "wholesale open access company".

4.3.2 Quality of Human Capital

This section outlines the data findings with regards to quality of human capital from the primary study in the form of document analysis of existing policy and regulation documents, semi-structured in-depth interviews, secondary study in the form of qualitative surveys conducted with households, SMME and Government and content analysis findings.

The researcher reviewed existing policy, policy discussion documents and regulation to establish whether they enabled the quality of human capital in broadband. The policy discussion documents and regulation reviewed that enabled the quality of human capital in broadband were Telecommunications White Paper 1996 (RSA, 1996), the Electronic Government the Digital Future 2001 (RSA, 2001), Electronic Communication Transaction Act 2002 (RSA, 2002), the National Information Society and Development Plan (ISAD) 2005 (PNC, 2005), Electronic Communication Act 2005 (RSA, 2005), ANC policy discussion document 2012 (ANC, 2012) and the ICT Policy Colloquium discussion document 2012 (DoC, 2012). The Telecommunications White Paper published in 1996 proposes the support of human resource development in the Telecommunication sector and the scope includes the training of workers, artisans and technicians, undergraduate and postgraduate training and the promotion of technology interest amongst school children (RSA, 1996, p.5). The Telecommunications White Paper 1996 acknowledges the importance of having a nation with skilled and knowledgeable human resources in telecommunications and makes provision for the availability of funds that will be utilised to enhance human resources in the sector and the management of the funds will be for the sole responsibility of the regulator (RSA, 1996, p.23). The funds will focus on supporting telecommunications applications and includes the training of workers, artisans and technicians, undergraduate and postgraduate training and the promotion of technology interest amongst school children (RSA, 1996, p.23). The Telecommunications White Paper 1996 proposes that the sector should also contribute to the human resource development and also makes provision for the ministry to avail funds for the human resource development in the sector through the retention of "a portion of the licence fee paid by" operators through the regulator (RSA, 1996, p.23). The Telecommunications White Paper 1996 proposes an increase in the number Telecommunications based courses in "universities and technikons by making funds available for additional staff, equipment or running expenses" (RSA, 1996, p.24). The Telecommunications White Paper 1996 proposes that universities and Technikons expand the scope of their programmes to include telecommunications engineering and management and telecommunications oriented courses (RSA, 1996, p.24). The Electronic Government the Digital Future document which was subsequently published in February 2001 highlights that the success of e-Government critically depends on skills development. The current IT skills development process is done in a manner "that is not beneficial to service delivery initiatives" by government (RSA, 2001, p.11). Some of the policy recommendations made include the development of IT skills by the education system, IT education must form part of the primary education curriculum in underserved areas, skills transfer in the development and maintenance of IT infrastructure must be a requirement that forms part of government contracts with IT providers and vendors and the accreditation of such IT skills must be done through the education system (RSA, 2001, p.11). The Electronic Communication Transaction Act 2002 makes provision for the Minister to "provide for ways of promoting development of human resources" (RSA, 2002, p.22) while in the process of developing a national e-strategy. Provision is also made for the Minister to consult with the Minister for Labour and Education "on existing facilities, programmes and structures for education, training and human resource development in the information technology sector" (RSA, 2002, p.22). The Electronic Communications act which was published in July 2005 further makes provision for the application of funds in the Universal Service and Access Fund to public schools and training institutions “for the procurement of electronic communications services and access to electronic communications networks” (RSA, 2005, p.55). The National Information Society and Development Plan (ISAD) which was subsequently published in 2005 calls for the education curriculum to be restructured for the requirements of the knowledge economy and developing skills that are critical in the sustainability of the technology and ICT sector (PNC, 2005, p.4). The National Information Society and Development Plan (ISAD) 2005 highlights an initiative by Meraka institute and Department of Education which is part of the e-administration initiative that is currently working on developing a hybrid model in rural areas that uses the existing EduNet infrastructure that connects institutions with each other, telecommunication technologies and broadcasting with the aim of providing equitable access to broadband for all (PNC, 2005, p.56). The National Information Society and Development Plan (ISAD) 2005 highlights several other initiatives which are geared at addressing ICT skills training, one being the e-Education policy published by the Department of Education “that sets out a framework for the implementation of a strategy that aims to expand the use of ICTs and improve the quality of teaching and learning” (PNC, 2005, p.5). The National Information Society and Development Plan (ISAD) 2005 also highlights the NEPAD e-schools initiative of which South Africa is one of the co-initiating countries that is aimed at enabling ICTs as a tool that supports “distance and lifelong learning, e-learning as well as the elimination of illiteracy” (PNC, 2005, p.6). The National Information Society and Development Plan (ISAD) 2005 in conjunction with the Department of Education highlights initiatives that it will support that are aimed at designing and implementing funding models for the e-Education policy and NEPAD e-schools, the provision of funding and human resources required to develop and implement learning, e-learning and skills development and the provision of relevant and affordable “ICT infrastructure, applications and services to meet the teaching, learning and administration needs” (PNC, 2005, p.6) of the above programmes. The

National Information Society and Development Plan (ISAD) 2005 highlights e-Awareness as a critical element in the development of a knowledge society. The National Information Society and Development Plan (ISAD) 2005 highlights that e-awareness improves and increases the utilization of ICT and the creation of e-awareness methods that increase awareness on the "benefits of ICT adoption and use" and drive awareness on the various initiatives that are promoting ICT as a tool for development and service delivery (PNC, 2005, p.40). As part of its policy proposal the ANC policy discussion document which was published in March 2012 proposes that e-skills is made "a compulsory subject in public schools" with the aim of promoting "an e-literate society" (ANC, 2012, p.10). ANC policy discussion document 2012 acknowledges the important role that industry plays in skills development and proposes for industry to be incentivised "to create opportunities for young people to receive experiential training" (ANC, 2012, p.11). ANC policy discussion document 2012 goes further with calls for government to introduce "a comprehensive e-skills development plan" which also incorporates incentives for the mobile industry. ANC policy discussion document 2012 also proposes the option of converting one of the existing universities into a specialised ICT institution offering ICT education aimed at producing "highly skilled ICT professionals and experts" (ANC, 2012, p.11). The main purpose of the e-Education white paper which was adopted in 2004 as outlined by the ICT Policy Colloquium discussion document which was subsequently published in April 2012 was to ensure that all learners in school were "ICT competent by 2013" (DoC, 2012, p.79). Other initiatives driven by policy as highlighted in the ICT Policy Colloquium discussion document 2012 were the e-Rate policy and establishment of the Educational Network which are aimed at enabling affordable internet connectivity to schools for education purposes. In addition the ICT Policy Colloquium discussion document 2012 proposed availing funds for the purpose of capacity building which would be managed by ICASA (DoC, 2012, p.80). The funds are meant for use in the areas of training of human resources, artisans and technicians, growth and development of undergraduate and postgraduate education and "promotion of interest in technology among schoolchildren" (DoC, 2012, p.80). Other initiatives that have been launched by the DoC to address e-Skills include the national e-Skills dialogue initiative launched in 2009 with the aim of facilitating dialogue between government and industry role players with the aim of ensuring that there is alignment between the demand and supply of skills (DoC, 2012, p.81). An e-Skills institute is another DoC initiative launched with the aim of creating a new approach to "ICT education and training" (DoC, 2012, p.81). The ANC policy discussion document 2012 proposes the creation of a "dedicated funding plan" that would enable universities and colleges in rural areas to prioritise ICT skills development (ANC, 2012, p.11). The ANC policy discussion document 2012 further proposes that e-Skills in all public schools become a mandatory subject aimed at promoting an "e-literate society". This protects students in rural areas from being abused by none legit training institutions (ANC, 2012, p.10).

The semi-structured in-depth interviews generated the following feedback on the knowledge of skills development in rural areas. MNOR1-8ta opinion was that knowledge of broadband in both the metros and rural areas was poor. MNOR1-8ta argued that if in the urban market people already struggled with understanding broadband because of its complexities this was definitely going to be a barrier to uptake for people in the rural areas as well. MNOR1-8ta view was that giving the subscriber a broadband device was not sufficient and felt that "a strong education effort" was required. Operators had to ask whether the market understood what to do with broadband services, whether the right devices to enable broadband connectivity were available, whether the market was aware that broadband existed and whether it was literate enough with regards to broadband services according to MNOR1-8ta. MNOR1-8ta indicated that an operator had to go a step further and ask whether the user was literate enough to know how to use the broadband device and whether the operator provided education around broadband to the market. With regards to enabling access to broadband services operators had to take baby steps according to MNOR1-8ta.The market had to be educated on how to use the devices as broadband was complicated to understand and according to MNOR1-8ta this training takes a number of years and different forms hence it is important for operators to have a clear voice and data strategy. FNOR1-Telkom opinion was that building broadband infrastructure alone was not sufficient and operators had to go the extra mile to educate the users on how broadband would benefit them for them to see the value. MNOR1-Vodacom opinion was that broadband training was currently mainly gained through experience by using social networking sites such as twitter and Facebook where users "just see someone else using it they get online and use it" (MNOR1-Vodacom, interview date 28th August, 2012). MNOR1-Vodacom highlighted that if one required expert training all the courses were offered in urban areas and none in the rural areas. MNOR1-Vodacom suggested that these cooperatives in rural areas could offer the training courses through train the trainer sessions and there after these trainers could offer training to various groups of people in rural areas. FCR1-FTTH Council response was that there was a natural adoption related to the use of broadband when looking at its use from an informal sense however from a formal basis FCR1-FTTH Council felt that "there was very little formal education coming out of areas like possibly government or academic institutions" (FCR1-FTTH Council, interview date, 2012). FCR1-FTTH Council felt that education and skill knowledge on broadband was mainly limited to the metro areas however he felt that "possibly if you take it in a more informal basis you look at the way people use cellphones and increasingly smartphones you know, I think the sort of commercial and personal value that people get out of it, I think possibly we underestimate what skill levels are in terms of users of technology. I think the sort of applications you see the African market generally has, has been one of the most versatile and innovative users of this technology" (FCR1-FTTH Council, interview date, 2012). MNOR1-CellC highlighted that no formal structures existed to provide formal training on broadband to rural areas. MNOR1-CellC highlighted that one of the objectives when the universal service agency was formed was for them "to setup public access centres and telecentres" through which training would be offered to the rural communities however to date no success stories had been experienced from these centres. MNOR1-CellC view was that it was high time that the department of education filtered “some kind of relevant curriculum into our programme because the very same students that are studying in rural when they graduate matric they need to come to the university in the city” (MNOR1-CellC, Interview date 30th August, 2012). MNOR1-CellC highlighted that as part of their Corporate Social Investment initiatives and as part of the education drive were talking about broadband issues to these communities. MNOR1-CellC also suggested other initiatives such as partnering with universities that run outreach programmes or “using the south African communication forums” (MNOR1-CellC, Interview date 30th August, 2012). ISPR1-Internet Solutions opinion was that “skills is obviously a key issue but as can be seen by other African countries experiences (Kenya, Ghana, Nigeria, Tanzania) skills transfer can happen at a relatively rapid pace” (ISPR1-Internet Solutions, Written response 23rd August, 2012). ISPR1-Internet solution recommendation was that schools and clinics could serve as broadband hubs as a vehicle of expanding broadband access. ISPR1-Internet Solution also recommended that government could play the main role of facilitating skills to “eliminate bottlenecks rather than crowding out any small scale entrepreneurs. Such facilitation could be government funded business incubators or tax breaks and loans for small start up business” (ISPR1-Internet Solutions, Written response 23rd August, 2012). RR1-ICASA response was that “wider socio-economic matters of poor education and low employment levels also significantly affect the actual consumption of devices” (RR1-ICASA, Written response 25th September, 2012). MNOR2-MTN response was that literacy levels were poor and there was a lack of skilled and experienced people and highlighted that there was a need for policy to address the skills and training of people and also form some interventions with regards to literacy levels in the country. MNOR2-MTN opinion was that ICASA and the DoC were “limited by the lack of knowledge and expertise of their staff and policy makers and they are limited by incorrect concerns about politics and competition” (MNOR2-MTN, Telephonic Interview dated 28th August, 2012). MNOR2-MTN expanded on his response by arguing that decisions were made that were not “efficient or correct” and gave an example where tenders were issued irregularly on limited government funding to small companies that had limited skills and resources and were unable to rollout broadband services as the barrier to entry was high and suggested that the government funding could be better utilised in the building of schools as opposed to developing small rural businesses.

The findings from the qualitative surveys conducted in Metsweding municipality with households, SMMEs and government departments revealed the following.

Figure 46: Household, SMME and Government Qualitative Survey on the existence of educational institutions offering courses in digital literacy

Would you describe the existence of educational institutions in Metsweding offering training courses on digital literacy as being existent / non-existent?	**Existent**	**Non-existent**	**Don't know**
Household Qualitative Survey	in some areas (HH11)	12	1
	in some areas (HH7)		
	but they are far from the area (HH13)		
SMME Qualitative Survey	10	3	1

Government Qualitative Survey	BEE does offer internship however only selected people have access to training, not for everyone (GOVR1-Local municipality)	I've never attended any training or never heard of anyone going for internet training (GOVR3-Government clinic)	1 (GOVR2-Public School)

Source: *Macharia, 2012*

On whether educational institutions existed in Metsweding offering training courses on digital literacy as highlighted in figure 46 above, 12 households responded that they were non-existent, 1 household responded that they did not know, HH7 and HH11 responded that it was existent and HH13 indicated that they were existent but far from the area. On the other hand 10 SMMEs responded that it was existent, 3 SMMEs responded that it was non-existent and 1 SMME responded that they didn't know. GOVR1-Local Municipality responded that "BEE does offer internships however only selected people have access to training, not everyone" (GOVR1-Local Municipality, Interview dated 22nd August, 2012). GOVR3-Government clinic responded that "we've never attended any training or never heard of anyone going for internet training" (GOVR1-Government clinic, Interview dated 22nd August, 2012). GOVR2-Public school responded that it was non-existent. Further feedback from the qualitative surveys generated the following responses on quality of human capital; Both HH1, HH4, HH5 and HH8 further responded that help was required with building internet cafes at the community centres to enable accessibility to kids for the purpose of learning and education. HH4 further stated that formal training on digital literacy was required by the community. HH2 and HH3 both responded that libraries required internet connectivity. HH2 further stated that schools required computer labs to enable internet learning for kids. HH11, HH13 and HH15 all responded that schools were required that provided training on internet and computer use. HH16 responded that digital literacy was required “because people around them don’t know anything about internet” (HH16, Interview dated 2nd September, 2012). SMME1 responded that all businesses required access to training institutions that provided training on broadband. SMME3 responded that there was a “need to open a computer centre where people can get training for free and they will pay as soon as they are employed because for some of us it’s difficult to raise money from our own pockets” (SMME3, interview dated 20th August, 2012). SMME4 responded that they currently learnt on a trial and error basis and government had to build more training institutions provided knowledge on broadband services. SMME5 and SMME6 both responded that more educational facilities were required. SMME7 responded that “more facilities need to be introduced to the community and not only in town but in rural area as well. More educational course need to be introduced as quickly as possible. We not living in the ancient years whereby only internet issues need to be known by certain individuals” (SMME7, interview dated 20th August, 2012).

4.3.3 Efficiency and Productivity

This section outlines the data findings with regards to efficiency and productivity from the primary study in the form of document analysis of existing policy and regulation documents, semi-structured in-depth interviews, secondary study in the form of qualitative surveys conducted with households, SMME and Government and content analysis findings. The researcher reviewed existing policy, policy discussion documents and regulation to establish whether they enabled efficiency and productivity through broadband. The policy, policy discussion documents and regulation reviewed that enabled efficiency and productivity through broadband were the Electronic Government the Digital Future 2001 (RSA, 2001), Electronic Communication Transaction Act 2002 (RSA, 2002), National Information Society and Development Plan (ISAD) 2005 (PNC, 2005), Broadband policy 2010 (DoC, 2010), ANC policy discussion document 2012 (ANC, 2012), The ICT Policy

Colloquium discussion document 2012 (DoC, 2012) and the Electronic Communication Act Amendment bill 2012 (DoC, 2012). .

Efficiency and productivity refers to the ability of citizens “to create and use broadband enabled services and applications to improve their welfare” (Kelly & Rossoto, 2011, p.27) and the ability of government and institutions to use broadband enabled services and applications to provide services to the public “efficiently and transparently” (Kelly & Rossoto, 2011, p.27) and the ability for businesses to develop and use broadband enabled services aimed at making their processes “productive and efficient” (Kelly & Rossoto, 2011, p.27). The Electronic Government the Digital Future document which was published in February 2001 highlights 3 areas that the electronic government initiative focuses on which are e-Governance where IT is applied to “intra-governmental operations” and includes central, provincial and local government interacting together through messaging, the use of an electronic document management system, integrated finance, human resource systems, conferencing, real time collaboration and project management systems (RSA, 2001, p.4). E-government’s success is focused on ensuring interoperability of the IT systems in government which includes “networks, platforms, applications and data” communicating with each other and enabling the “automatic sharing and exchange of electronic messages and documents, collaborative applications, distributed data processing and report generation, seamless transaction services, whole of government search and queries and integrated IT systems management” (RSA, 2001, p.8). E-Business is another area of focus for the electronic government initiative where IT is applied to “business to business transactions” such as the use of e-procurement systems used by government to procure goods and services and electronic payment. E-Services is another area of focus for the electronic government initiative where IT is applied to deliver online services to the public such as telemedicine, information regarding health, culture and education. Government is also able to use these systems to interact with the public on matters relating to policy, service delivery and corruption system (RSA, 2001, p.4).

The Electronic Communication Transaction Act which was subsequently published in August 2002 makes provision in the policy for the Minister to develop a national e-strategy and the implementation thereafter as a national priority. The envisioned national e-strategy takes into consideration "all matters involving e-government services" (RSA, 2002, p.18). The Electronic Communication Transaction Act 2002 identifies the objectives of the act "are to enable and facilitate electronic communications and transactions for the public" (RSA, 2002, p.16) which amongst others includes the promotion of e-government services to enable electronic communication between the public, institutions and government, the removal of barriers to "electronic communications and transactions" (RSA, 2002, p.16) attract investments in respect to electronic transactions and "the development of electronic transactions services which are responsive to the needs of users and consumers" (RSA, 2002, p.16) with a focus on "the special needs of particular communities and, areas and the disabled" (RSA, 2002, p.16). The National Information Society and Development Plan (ISAD) which was published in 2005 highlights e-Administration which entails using ICT to drive improvement around communication and administration of schools which are linked to "district and provincial offices" as a key focus area. The National Information Society and Development Plan (ISAD) 2005 highlights that provisions for the development of an education network (EduNet) have been made in the Telecommunications Act of 1999 and the amendment act of 2001 (PNC, 2005). Initiatives made to drive e-Administration includes the education network (EduNet) which is driving initiatives that involve connecting schools and institutions to each other and the department of education and Meraka institute who are developing a hybrid model that aims at providing equitable broadband access (PNC, 2005, p.56). The National Information Society and Development Plan (ISAD) 2005 also highlights e-Documentation as a key application that enables "ICT applications such as track and trace, integrated electronic document management system, e-passport with a view to efficiently process enabling documents" (PNC, 2005, p.83). However the exchange of documents between government departments is an area where government needs to improve in order "to support the processing of public service applications and delivery of services" (PNC, 2005, p.83). The National Information Society and Development Plan (ISAD) 2005 highlights that an enabling environment already exists through provision of e-Documentation in the Electronic Communication and Transaction Act of 2002 and the Electronic Government document 2001. The National Information Society and Development Plan (ISAD) 2005 proposes an "interoperable, integrated e-Documentation system" (PNC, 2005, p.84) for government that will enable the management of public service documents electronically, enable the interoperability and "seamless exchange of citizen documents" (PNC, 2005, p.84) and enable a secure environment for the secure exchange of documents between government, businesses, citizens and institutions (PNC, 2005, p.84). E-government is another area which according to The National Information Society and Development Plan (ISAD) 2005 requires a lot of improvement. The National Information Society and Development Plan (ISAD) 2005 proposes strategies that focus on the use of ICT by government for the sole purpose of delivering "customer focused services" (PNC, 2005, p.69). The National Information Society and Development Plan (ISAD) 2005 highlights that provision for a policy framework for e-Government exists in the Electronic Government the Digital Future document of 2001. The National Information Society and Development Plan (ISAD) 2005 highlights the use of e-health systems for the efficient provision of health care services equitably to its citizens as facing a lot of challenges despite the fact that provisions have been made in existing policies and legislatures for the delivery of health care using ICTs. The National Information Society and Development Plan (ISAD) 2005 indicates that provisions have been made in the National Health Act of 2003 and the Electronic Communication Transaction Act 2002 (PNC, 2005, p.59 – p.60). The Broadband Policy document which was published in July 2010 highlights universal access of broadband to "all public and private institutions" (DoC, 2010, p.13) and civil society as a key priority area of focus. This is aimed at enabling access to broadband and driving increased demand and uptake of ICT "across government departments especially in education and health" (DoC, 2010, p.13). "Content from departments will be used for both information services as well as e-government service delivery to citizens" (DoC, 2010, p.13). One of the key priority areas highlighted by the Broadband Policy 2010 document is awareness. The Broadband Policy 2010 document calls for the three spheres of government to form "partnerships with other stakeholders" aimed at increasing the public's broadband awareness (DoC, 2010, p.15). The focus must be on the "communications ability and opportunities that broadband can offer to all citizens in both urban and rural areas" (DoC, 2010, p.15) through content and applications aimed at increasing broadband uptake and usage (DoC, 2010, p.15). As part of its policy proposal the ANC policy discussion document published in March 2012 outlines its focus on developing and strengthening "its capacity to stimulate demand to increase broadband usage and uptake by generating relevant content" (ANC, 2012, p.29) targeting its various communication mediums and audiences which includes its "online presence". The ANC policy discussion document 2012 also proposes developing the writing skills of its "cadres and leaders" in relation to website and social media which all speak to enabling efficiency and productivity through broadband use. ANC policy discussion document 2012 further proposes the need for the ANC to develop the capacity to manage its internal IT systems. A political champion from IT would be responsible for driving the ICT policy and strategy for the ANC which will include "to develop ICT platforms, manage membership system, including managing all conference registrations" (ANC, 2012, p.29). ANC policy discussion document 2012 proposes "the development of indigenous knowledge systems and the revival of the local content industry" (ANC, 2012, p.9). The DoC (2012) makes provision as part of the E-rate initiative for service providers supplying internet services to public schools and training institutions to do so at minimum a 50% discount rate. "The discount is applicable to the total levied" and includes internet connectivity charges, support calls made to the service provider and equipment required to enable internet connectivity (DoC, 2012, p.38). The ICT Policy Colloquium discussion document which was subsequently published in April 2012 highlights the lack of policy focus on the matter regarding the deployment of broadband infrastructure specifically within government structures for the purpose of providing the public with access to government. The ICT Policy Colloquium discussion document 2012 highlights that provision was made in the Broadband policy document 2010 (DoC, 2010) for an implementation plan that ensures the involvement of national government in enabling "the connection of government and its entities through broadband services" and "enabling e-government services" (DoC, 2012, p.67). The ICT Policy Colloquium discussion document 2012 further highlights that the green paper on e-commerce published by the DoC in 2000 outlined "a framework for the development of e-Government initiatives" (DoC, 2012, p.73) and focus was on the development of ICT literate public servants and the adoption of modern systems. However despite the provision for an e-Government framework the implementation of the strategy is still not visible to date (DoC, 2012, p.74).

The semi-structured in-depth interviews generated the following feedback on the Efficiency and productivity. FNOR1-Telkom view was that without people understanding the social economic benefits of broadband, relevant applications and availability of e-government services there would be no traction gained in broadband market development. Understanding what to use broadband service for was an important component of utilizing broadband services; however what was lacking according to FNOR1-Telkom was a framework from government that looked at the provision of e-government services. FNOR1-Telkom view on applications was that e-Education was the starting point to drive broadband market development in rural areas and stated "that education must be the starting point. It's just the most obvious application of broadband and other forms is information to tablets… then you can start doing video broadcasting, video conferencing and those sort of things" (FNOR1-Telkom, Telephonic interview date 17th August, 2012). FNOR1-Telkom also highlighted that education around the application of broadband and its benefits to the user was critical in driving its development and stated that "you've got to show it's not about the device and the network this is the application of broadband and this is how it's going to help you in your daily life. It's going to help you with job finding, it's going to help you with home affairs, court roles, police cases, find a document. I think you have to actually first build the application first then you educate second. You can't build a broadband for broadband sake sort of campaign" (FNOR1-Telkom, Telephonic interview date 17th August, 2012).

4.3.4 Governance Structure

This section outlines the data findings with regards to governance structures from the primary study in the form of document analysis of existing policy and regulation documents, semi-structured in-depth interviews, secondary study in the form of qualitative surveys conducted with households, SMME and Government and content analysis findings. The researcher reviewed existing policy, policy discussion documents and regulation to establish whether they enabled governance structures that spoke to broadband evolution and market development. The policy, policy discussion documents and regulation analysed that enabled governance structures were the Electronic Government the Digital Future 2001 (RSA, 2001), National Information Society and Development Plan (ISAD) 2005 (PNC, 2005), draft spectrum assignment plan for the combined licensing of the 800MHz and 2.6GHz bands 2011 (DoC, 2011), ANC policy discussion document 2012 (ANC, 2012), The ICT Policy Colloquium discussion document 2012 (DoC, 2012) and the Electronic Communication Act Amendment bill 2012 (DoC, 2012)..

"The governance structure determines the degree to which businesses and citizens are permitted to share and access information openly as well as to share broadband-based ideas and innovations. Additionally, governance addresses the security of investment and the cost of creating new broadband-enabled business, services, and products. Governance that promotes the absorptive capacity of broadband generally requires free, open access to information and abidance by the rule of law to protect investments" (Kelly & Rossoto, 2011, p.28).

The National Information Society and Development Plan (ISAD) which was published in 2005, highlights that having existing ICT policies and infrastructure is not a guarantee that this will enable positive outcomes. The National Information Society and Development Plan (ISAD) 2005 proposes for the implementation of institutional mechanisms that are well designed and aligned to government structures with access to the highest office which facilitates decision making across government and "coordinated development of an inclusive information society" (PNC, 2005, p.8). As part of the strategic imperative of establishing an "investor friendly, progressive and enabling policy and regulatory environment" (PNC, 2005, p.25) PNC (2005) is tasked with the strategic action of "ensuring that all policies and regulation support information sharing and dissemination for development" (PNC, 2005, p.25). The draft spectrum assignment plan for the combined licensing of the 800MHz and 2.6GHz bands which were published in December 2011 highlights that ICASA is "mandated to establish obligations on priority stages for network roll out on the basis of a number of inhabitants per area" (DoC, 2011, p.7). ANC policy discussion document which was published in March 2012 proposes for policies that "provide for an institutional framework that enhances collaboration, effective planning and oversight" as part of the proposed coordinated national ICT policy framework and strategy (ANC, 2012, p.9). One of ANC policy discussion document 2012 objectives that forms part of its National ICT policy is to "inform regulatory interventions" that will enable a digital infrastructure that will drive connectivity between households and business sectors across the country and including those in rural areas (ANC, 2012, p.9). ANC policy discussion document 2012 highlights that the government institutional framework has been a "barrier to the emergence of a coherent government strategic thinking, effective planning and deployment infrastructure and services" (ANC, 2012, p.9). ANC policy discussion document 2012 proposes that government needs to shift its thinking on delivery of services timeously to the public using resources that are available to it. ANC policy discussion document 2012 further proposes that government should retain its function of policy development. ANC (2012) further calls for the transformation of the DoC into the "Department of Information and communication technologies and postal services" (ANC, 2012, p.9) with the overall function of formulating and overseeing the implementation of government ICT policies (ANC, 2012, p.9). ANC policy discussion document 2012 also proposes the creation of "a National ICT forum" (ANC, 2012, p.9) that involves the engagement of and participation of government, industry and civil society in critical issues (ANC, 2012, p.9). In order to remove the "overlaps, duplication and undue competition" that currently exists within government institutions ANC policy discussion document 2012 calls for the government institutions to be rationalised. Some of these entities include Broadband Infraco, Sentech, Universal Service and Access Agency of South Africa and the Presidential National Commission on ICT (ANC, 2012, p.10). ANC policy discussion document 2012 further highlights its policy support for converged services and technologies, however highlights that regulation that address convergence in the ICT space should not lead to the creation of monopolies and abuse by dominant operators. ANC policy discussion document 2012 calls for the prioritisation of competition rules and regulation that will open up the market to competition (ANC, 2012, p.12). The ICT Policy Colloquium discussion document which was subsequently published in April 2012 highlights the shift in policy focus with cabinet approving the Cyber security policy in 2012 whose objective is to establish a secure environment for citizens that would "enable secure transaction environments" and increase their "confidence and trust" in using ICT's (DoC, 2012, p.70).

The semi-structured in-depth interviews generated the following feedback on the governance structure. MNOR1-8ta view was that government's role was to give clear direction to the operators on strategies that related to areas where operators were looking to gain market share such as rural areas and argued that certain mechanisms had to be in place that enabled that. MNOR1-8ta gave examples of the UK regulator OFCOM that had clear strategies in place that addressed the digital migration and clear broadband intentions which was in contradiction to the South

Africa where no clear direction was in place with regards to spectrum and the digital migration. FNOR1-Telkom responded that the challenges associated to the rental cost of manning a mast or site housing a base station was an issue that government could influence through concessions as the land in most instances belonged to the municipalities and airport companies which were all government owned. FNOR1-Telkom highlights the administrative process of getting rights of way from Sanral as another challenge that is faced by operators, as building networks requires operators to trench an area in order to get to a base station. FNOR1-Telkom argues that although Sanral is a private company it is outsourced to government and no framework exists that highlights the input costs of operators that government could use as a basis to waiver the costs for operators and subsequently lower the end user price as currently all costs are borne by the end user. MNOR1-MTN response on government's role in addressing the barriers faced by operators responded that the lack of clear policy direction was the reason why there hadn't been any progress with regards to broadband market development. MNOR1-MTN also highlighted the constant change of ministers over a short period of time has resulted in a certain level of complacency which has led to the department always playing catch up and losing momentum. MNOR1-MTN personal views on how government could address these challenges felt that government played a conflicting role of being a player and a policy maker and gave examples of government's shareholding in Telkom and broadband Infraco. MNOR1-MTN also gave an example of Sentech that was sitting on valuable spectrum which was not being utilised and his personal opinion was that this spectrum should be auctioned off to the highest bidder as they would be best placed to maximise the use of this spectrum. MNOR1-Vodacom response was that the biggest role that government could play was to rollout fibre to the rural areas "and using government buildings to do that so your schools, clinics, libraries, just put fibre to those buildings and then mobile operators or any other operators can tap off from those markets" (MNOR1-Vodacom, Interview dated 28th August, 2012). MNOR1-Vodacom highlighted that no plan existed that addressed the problem of lack of infrastructure and his view was that government had to get involved and drive the initiative of rolling out fixed fibre infrastructure to rural areas. FCR1-FTTH Council opinion was that commercially driven businesses were not going to invest in building the rural infrastructure if no commercial gains and argued that this had to be a government driven initiative. FCR1-FTTH Council provided examples of countries such as Scandinavian, Australia and some Asian countries where the infrastructure rollout was through “massive state sponsored initiatives” (FCR1-FTTH Council, Interview date, 2012). FCR1-FTTH Council argued that billions had been wasted through state owned corporations such as Sentech, Broadband Infraco, Telkom, the universal access funds and local government initiatives with no successes to show for these initiatives. To get the private sector involved FCR1-FTTH Council suggested some form of incentives that government could offer the private sector “incentives in the form of tax breaks or co-funding or low cost financing that gets provided to third parties and its success gets based on come collect your money” (FCR1-FTTH Council, interview date, 2012). FCR1-FTTH Council views on partnerships or joint management between government and the private sector was that they were not viable as they led to a lot of finger pointing and blame games. Funding the business model was a big challenge highlighted by FCR1-FTTH Council as well as mundane municipal processes riddled with red tape which led to investor uncertainty and investor capital being tied up for unreasonable periods of time. MNOR2-CellC highlighted that vision 2020 had identified what had to be done with regards to broadband rollout in rural areas however identifying how to get there was a challenge that was being addressed at a “piece meal approach”. MNOR2-CellC highlighted that there was no collaboration between the various ministries. MNOR2-CellC highlighted that there was budget available that was reserved for the Digital terrestrial migration and the broadband process however MNOR2-CellC felt there was a need to build on the broadband policy through “coming up with a proper framework and also making the funds available, driving the roadmap to that 2020. You can either use a property arrangement or government can do it on its own or give it to the private sector to do it” (MNOR2-CellC, interview date 30th August, 2012). MNOR2-CellC personal view was that government should be taking the lead role of coordinating and effecting broadband access in rural areas and highlighted that current barriers exist relating to governance problems between municipalities and provinces where one finds municipalities and provinces building their own networks. MNOR2-CellC felt that government had been addressing the issue of broadband rollout through Broadband Infraco in 2005 with the decision to rollout fibre, city to city however the whole concept failed as it was put together in a silo and there were major loop holes with the concept. One of the reasons why the whole process failed according to MNOR2-CellC was that government failed to identify the platform that would be used to rollout broadband to rural areas "will you go through fibre? Or is it wireless and if it is wireless, is it GSM or satellite or is it going to be copper through ADSL?" (MNOR2-CellC, interview date 30th August, 2012). So it wasn't clear which access technology Broadband Infraco was going to use to rollout the broadband network. The other attempt made by government to address rural broadband access rollout was through Sentech according to MNOR2-CellC where the plan was for Sentech to be a satellite based company over and above being a broadband signal distributor however the whole Sky wave business model failed as they were using satellite which was expensive to rollout to the rural areas. Other attempts made to address rural broadband access according to MNOR2-CellC were the G-link initiative where other provinces including Gauteng came up with the initiative to link Gauteng to other provinces through a wide area network. Limpopo, Mpumalanga and Western Cape all spoke of building their own wide area network which highlighted the gap that existed between government and the private sector. MNOR2-CellC highlighted that government invited the industry players to discuss the vision 2020 DoC however the issue of rapid deployment was not addressed which the industry players felt was the best way to approach the rural broadband rollout. However according to MNOR2-CellC the challenge faced by operators was that it took 18 months and more to get a permit for rapid deployment. MNOR2-CellC highlighted that there was some progress being made with rules and public processes being rolled out at municipality level. Secondly MNOR2-CellC felt that there was a need for a special interconnect framework for rural that could accelerate infrastructure rollout. MNOR2-MTN opinion was that ICASA and the DoC were "limited by the lack of knowledge and expertise of their staff and policy makers and they are limited by incorrect concerns about politics and competition" (MNOR2-MTN, Telephonic Interview dated 28th August, 2012). MNOR2-MTN expanded on his response by arguing that decisions were made that were not "efficient or correct" and gave an example where tenders were issued irregularly on limited government funding to small companies that had limited skills and resources and were unable to rollout broadband services as the barrier to entry was high and suggested that the government funding could be better utilised in the building of schools as opposed to developing small rural businesses. MNOR2-MTN view was that the DoC and ICASA had the incorrect view regarding competition; MNOR2-MTN argued that "just because there are more players does not mean that there is more competition. Sometimes this just wastes resources and can ultimately lead to destruction in the industry" (MNOR2-MTN, Telephonic Interview dated 28th August, 2012). MNOR2-MTN further argued that "the current policy directives that are coming out is that they want more businesses and more people involved in the industry. This makes no sense. The objective of government should be to get broadband out as fast and a cheaply as possible. It should not be about developing rural small businesses and getting tenders for friends" (MNOR2-MTN, Telephonic Interview dated 28th August, 2012). MNOR2-MTN further view was that the policies that were being developed displayed a lack of knowledge of the industry and technical knowledge. MNOR2-MTN indicated that decisions made regarding policy and policy directives had not been thought out nor tested.

Feedback from the SMME qualitative survey on government's role was as follows; SMME8 responded that he was not interested in anything related to government. SMME10 responded that "the government has to build more of the broadband service companies and get more cheaper ISPs as the ones available are more or less the same" (SMME10, interview dated 20th August, 2012). SMME11 view was that the government did not care about such issues. SMME14 responded that the government was doing fine but required government to provide small businesses with access to more operators and ISPs. GOVR1-Local Municipality responded that ISP had to invest in rural areas to provide advanced technologies however GOVR1-Local Municipality highlighted that security was a huge problem as infrastructure was continually stolen and vandalised posing a huge challenge. GOVR1-Local Municipality highlighted that although e-Government services were offered to the public majority of the rural population were unable to access the services and only 20% of the population used these services. GOVR2-Public school responded that priority should be given to rural areas during broadband rollout and suggested that more towers and satellite access was required. GOVR2-Public school further stated that all rural schools in Metsweding should be considered for internet connectivity now that Metsweding was part of Tshwane Metropolitan. GOVR3-Government clinic responded that "I think government must take the initiative to capacitate all services especially us in rural areas with internet. We feel left out get information days later and yet we are not so far away from Tshwane. All our administration work is being done manually; our medication stock is also done manually. We have to fill out manual requisitions, which are delivered by a driver. I'm sure clinics in urban areas use internet to order" (GOV3-Government clinic, interview dated 22nd August, 2012).

CHAPTER 5: UNSYSTEMATIC APPROACH TO POLICY AND REGULATION FOR THE BROADBAND ECOSYSTEM

5. Introduction

This chapter will provide an analysis that aims to provide some understanding as to why the level of the broadband ecosystem development in urban areas is developed while in rural areas it remains underdeveloped. The analysis points to the unsystematic approach to policy and regulation for the broadband ecosystem in general that does not even begin to address the broadband ecosystem development requirements in rural areas. Existing policies and regulation have been too generic and are more suited for urban areas and do not address the specific challenges and needs for rural areas. A dedicated broadband strategy for rural areas is required that will focus on enabling the various elements of the broadband ecosystem to drive the broadband market development in rural areas.

This chapter details the process followed by the researcher in analysing primary data findings from the semi structured in-depth interviews with the telecommunication operators and the analysis of data findings from existing policy and regulation documents. Analysis of the data findings from secondary data was in the form of findings from the qualitative survey with the Households, SMME and Government carried out in four areas of Metsweding municipality within Cullinan and Bronkhorstspruit. The analysis of the data findings will be detailed in this chapter and are aimed at providing answers to the four research sub questions which are outlined in chapter 3 and which are as follows:

1. How do the supply side factors affect broadband evolution in rural areas?
2. How do demand side factors influence policy for broadband in rural areas?
3. To what extent does existing policy enable the investment in and absorptive capacity of broadband?

4. To what extent does existing policy and regulation enable broadband evolution and ecosystem development in rural areas?

5.1 How do the supply side factors affect broadband evolution in rural areas?

This section provides an analysis of the data findings of the supply side of the broadband ecosystem which includes data findings from the infrastructure and spectrum elements.

5.1.1 Operators definition of rural areas differ from that of the DoC

Observations from the analysis reveal that operators have a different view and definition of rural areas which differ from that of the DoC who view rural areas as those areas that fall in remote locations and/or underserviced areas. The observations reveal that operator’s definition of rural is based on the commercial viability of the area and is referred to as any area that falls outside the metros. The analysis further reveals that the earning potential of a specific area is used by operators to determine the potential of a specific area for broadband network rollout and not the number of people in the specific area.

5.1.2 Universal Service and Access obligations

Observations from the analysis reveal that the initial Universal Service and Access obligations mainly catered for voice and internet connectivity with no focus on the rollout of broadband infrastructure and broadband access. Further observations revealed that provision for funding through the universal service fund to address the challenges of providing communication access to rural areas exists in current policy and regulation documents, however the provisions to support the rollout of broadband network remains out of the scope of these provisions. Although the second round of obligations imposed on Neotel and Sentech included the rollout of 2500 and 500 internet labs in rural areas respectively (Hodge, 2004) the initial scope for universal service and access obligations mainly catered for voice services and not broadband or internet access. The analysis further revealed that considerations to include broadband infrastructure funding as part of the scope of the Universal Access and Service obligations is only being reviewed now by USAASA. It is only recently where the importance of providing broadband infrastructure to rural and underserved areas as a solution to addressing the digital divide gap and the inclusion thereof is being considered.

5.1.3 Roll out of broadband networks in rural areas uneconomical

Observations from the analysis reveal that rolling out broadband networks into rural areas was uneconomical for telecoms operators. Observations highlight that the concentration of the broadband network rollouts to date has mainly been in the metro areas with very little focus in rural areas. Some of the challenges facing operators identified from the analysis that have been a barrier to the roll out of broadband networks in rural areas include the lack of the earning potential of specific areas, the low density of the area and the lack of the income earning potential of the people that fall in these areas. It was further observed from the analysis that the building of a broadband network was capital intensive and the low return on investment in rural areas was perceived as unattractive by operators and not suitable for investment.

5.1.4 Rural termination rate currently does not exist for broadband

Observations from the analysis reveal that rural termination rate currently did not exist for broadband. This was mainly attributed to the fact that the economics of broadband differed from that of voice as the operator was unable to cross subsidise the cost of the broadband connection as broadband technology did not support two way conversations. With voice technology operators are able to cross subsidise the costs of the voice service for the rural user from the flow of traffic from urban areas to rural areas through services being generated such as please call me back. The analysis revealed that with broadband the rural user bears the full cost of the broadband connection.

5.1.5 The economics of broadband differ from the economics of voice

Observations from the analysis reveal that the economics of broadband differ from the economics of voice. Observations of the analysis highlight one of the challenges facing operators while rolling out rural broadband networks is the additional backhaul capacity required to support broadband networks. The analysis further revealed that even in the scenario where the operator already has an existing voice network and wants to build the broadband network on top, additional backhaul capacity is required to support the broadband service and this comes at additional costs. Additionally the operator is required to carry out additional radio frequency spectrum planning as well however broadband differs from voice technology in that there is no two way conversation taking place like in voice where the operator is in a position to cross subsidise the cost of maintaining the base station as money is flowing effectively from the urban rich user to the rural base station due to services such as please call me back. It is therefore the rural user that ultimately bears the full cost of the broadband connection.

5.1.6 No studies exist to determine the coverage zones the different areas fall into

Observations from the analysis revealed that there were areas that fell within the operator's coverage zones by default due to overlapping coverage and not as a result of planning. The analysis revealed that some of these areas that fell within the overlapping coverage zones did fall within rural areas. White zones were identified from the analysis as areas with no coverage, the grey zones were identified as areas that were essentially covered by more than one operator and the black zones were areas that essentially fell within the coverage zone due to the overlap of coverage and not from planning. Observations from the data analysis highlight that no economic studies have been carried out to establish the zones that the different areas fell into. The analysis revealed further that the problem of providing broadband network access to rural areas therefore still needed to be quantified in order to identify solutions.

5.1.7 No framework exists to direct investment to the development of a broadband network in rural areas

Observations from the analysis revealed that no framework exists to direct investment to the development of a broadband network in rural areas. Further analysis revealed that the operators shared the common view that a lot of funding had been wasted by government through various initiatives with state owned corporations such as Sentech, Broadband Infraco, Telkom, the universal access funds and local government initiatives with no successes to show for these initiatives. Although current regulation provides an enabling environment for the investment of communication access networks, the data analysis highlights that funding the business model for the rollout of broadband infrastructure to rural area is a challenge as operators were unwilling to invest in rural areas as they were deemed as not being commercially viable and the mundane municipal processes which are riddled with red tape led to investor uncertainty and investor capital being tied up for unreasonable periods of time. The data analysis also highlights that joint partnerships between government and the private sector were not successful as they led to a lot of finger pointing and blame games. Observations from the analysis highlight that some form of incentives is required from government in the form of co-funding or tax breaks in order to get the private sectors involved. These challenges in the analysis highlight the need for a proper funding framework and the rollout initiative either being led by government or the private sector.

5.1.8 It costs an operator more to maintain a base station in rural areas than in the metropolitan area

Observations of the analysis revealed that it costs an operator more to maintain a base station in rural areas than in metropolitan areas. The observations revealed that operators faced various challenges in rural areas such as the availability of electricity, air conditioner and backup services which made it more costly for the operator to maintain the base station in the rural area. Other challenges that were observed from the analysis highlight the rental costs of manning a mast site or a site housing a base station as being high for operators in rural areas. Operators in Cape Town for example that co-located on a site were required to pay individual site rental costs instead of one site rental cost which made the cost of the service more expensive. The analysis further revealed that the site rental costs were high despite the fact that the land in most instances belonged to the municipalities and airport companies which are all government owned.

5.1.9 Fibre backbone network rollout is not a priority for rural areas as its main priority is to connect the metro hubs

Observations from the analysis revealed that fibre backbone network rollout is not a priority for rural areas and the fibre backbone network currently being rolled out by operators has been prioritised mainly to connect the metro hubs aimed at creating traffic hubs to connect the major cities which are Cape Town, Johannesburg and Durban. Further to this it was identified from the analysis that a number of elements were required in place to connect a rural village to the fibre backbone network which required a huge capital outlay. The analysis highlight that only 10% of the cost incurred was attributed to the fibre backbone network rollout, a further 30% of the cost was incurred in the branching out of the fibre network between cities or provinces and the bulk of the cost lay in connecting the fibre backbone network to the last mile which was 60% of the cost incurred. Running a fibre backbone network through a rural area therefore had no impact on the broadband market development in rural areas

5.1.10 Administrative process for getting rights of way is problematic

Observations from the analysis revealed that the administrative process of getting rights of way from Sanral is problematic especially where trenching is required by an operator to get to a base station and to construct networks. This is despite the fact that Sanral is outsourced to government there is no framework to input operator costs for government consideration in waiving operator costs and subsequently lowering the end user price. The analysis reveals that various bottle necks exist in rural areas that leave them uncovered. The analysis highlights the challenges facing network operators as the failure to issue land use or rights of way approval by municipalities and the high site rental costs charged by municipalities for the base station sites.

5.1.11 Rapid rollout is problematic in rural areas

Observations from the analysis reveal that rapid rollout is problematic in rural areas. Some of the challenges revealed from the analysis that impact rapid rollout of networks in rural areas include the problem of provinces having different rules affecting the digging up of roads. Other challenges observed from the analysis highlight that municipalities had no set of national guidelines or rules related to digging that existed and that could be applied to both rural and urban areas. Another challenge highlighted from the analysis reveals that the process of obtaining a permit for rapid deployment took 18 months and more which caused huge delays with the rapid rollout process.

5.1.12 Governance framework and coordination between government and the private sector remains a challenge

Observations from the analysis revealed that the lack of a governance framework and the lack of coordination between government and the private sector remains a challenge in the rollout of broadband in rural areas. Analysis revealed that governance barriers exist between municipalities and provinces where municipalities and provinces were in the process of building their own individual networks with no coordinated joint efforts. Observations from the analysis further revealed that the initial objective of Broadband Infraco coming into being in 2005 was to address the rollout of broadband to rural areas however the whole initiative failed as government failed to identify the platform that would be used to rollout broadband to rural areas. The analysis revealed that it wasn't clear which access technology Broadband Infraco was going to use to rollout the rural broadband network and government chose to work as a silo in the whole process with no involvement of the private sector. The analysis further revealed that other attempts made by government to address rural broadband access rollout was through Sentech where the plan was for Sentech to be a satellite based company over and above being a broadband signal distributor however the whole Sky wave business model failed as they were using satellite which was expensive to rollout to the rural areas. Other attempts made to address rural broadband access were the G-link initiative where other provinces including Gauteng came up with the initiative to link Gauteng to other provinces through a wide area network. Limpopo, Mpumalanga and Western Cape all spoke of building their own wide area network which highlighted the gap that existed between government and the private sector.

5.1.13 3G coverage in rural areas is minimal

Observations from the analysis revealed that the 3G coverage in rural areas is minimal. The analysis of the findings revealed that mobile operators mainly supported GSM and 2G coverage in rural areas while 3G coverage in rural areas was not widespread.

5.1.14 Lack of spectrum in the lower frequency bands a challenge to broadband rollout in rural areas

Observations from the analysis revealed that operators are unable to rollout broadband to rural areas without access to radio frequency spectrum in the lower frequency bands which was mainly the 1GHz spectrum bands. A common observation from the analysis revealed the common shared challenge by all the operators on the lack of access to radio frequency spectrum in the lower frequency bands which was critical in enabling the rollout of broadband networks to rural areas. Lack of the lower frequency spectrum meant that operators were unable to target certain areas and specifically remote or rural areas. What emerged in the analysis was that using higher frequency spectrum was uneconomical for operators in enabling broadband coverage to wide areas as this would require more base stations and proof more expensive. Further analysis revealed that spectrum that fell below the 1GHz spectrum bands specifically the 1000MHz, 900MHz, 800MHz and 700MHz frequency spectrum band afforded operators the advantage of being able to roll out less base stations while at the same time being able to cover a wider area cost effectively. Another challenge that emerged from the analysis that operators faced was the length that it took to apply for spectrum from ICASA which was a lengthy process which could extend up to between six months to 1 year. This challenge was the case currently being faced by operators that apply for spectrum for microwave in the lower spectrum bands which was appropriate for rural broadband network rollout and base stations could stand idle for over six months as operators were unable to get backhaul due to the lack of spectrum. Another challenge that emerged from the analysis revealed that ducts in the rural areas were a challenge for operators especially if they did not have fibre, cable or links to pull backhaul to a base station. Another observation from the analysis revealed that wireless spectrum was the preferred form of connecting the last mile of the fibre backbone in comparison to copper or fixed line infrastructure which was more expensive, however without the spectrum in the lower frequency bands operators were unable to achieve the required broadband network rollout to rural areas. The analysis also revealed that CellC was the only operator with access to the 900MHz frequency spectrum however the spectrum was being used to support its GSM services and although CellC was busy re-farming the spectrum for LTE services it was not sufficient to support the demands for both GSM services and broadband services.

5.1.15 Spectrum administrative and annual fees a prohibition

Observations from the analysis revealed that spectrum administrative and annual fees were a prohibition to operators rolling out affordable broadband services. Observations from the analysis further revealed that in instances where an operator had to extend their network out of town, microwave "point to point backhaul spectrum" was still required in the various bands. In instances where the spectrum was readily available the analysis revealed that operators were still required to pay administrative and annual fees to the regulator. This was despite the fact that the government had the powers to issue the spectrum for free to operators as the operator still had to utilize their own radio backhaul link to extend the network outside their coverage areas. The analysis further revealed that additional fees compounded on the costs of the broadband services being provided by the operators and the end user ultimately bore the full costs.

5.1.16 Operators are being forced to re-farm existing spectrum due to lack of access to the 800MHz and 2.6GHz spectrum

Observations from the analysis revealed that the challenge facing operators currently with no access to the 800MHz spectrum was that they were being forced to re-farm their existing spectrum which was a challenge as the existing spectrum was allocated for services on the 2G and GSM technologies. Observations from the analysis revealed that re-farming and re-using existing spectrum to cater for LTE services or for providing rural broadband coverage was a major challenge for operators as it caused spectrum shortage and it meant that operators were unable to acquire new customers on their existing voice services due to insufficient spectrum. The analysis also revealed that CellC was the only operator with access to the 900MHz frequency spectrum however the spectrum was being used to support its GSM services and although CellC was busy re-farming the spectrum for LTE services it was not sufficient to support the demands for both GSM services and broadband services. This had implications in that operators were forced to limit the markets that they could reach or serve because of limited spectrum frequency capacity.

5.1.17 Flawed Digital migration process a barrier to the provision of broadband access to rural areas

Observations from the analysis revealed that the digital migration process was flawed and had been dragging on for a while with no resolution in place. The analysis revealed that this ultimately caused a delay with the freeing up of the digital dividend spectrum which was critical for the provision of broadband access to rural areas. Observations from the analysis revealed that in-order to achieve the 100% broadband target by 2030 set by the DoC the 800MHZ and the 2.6GHz spectrum were key in realising these targets. Further observations from the analysis revealed that the 790MHz to 860MHz spectrum bands constituted the digital dividend frequency spectrum which was currently occupied by the broadcasting sector and provided operators the benefit of being able to rollout less base stations to a wider area and was ideal for the rural deployment of broadband. Further observations from the analysis also revealed that the 2.6GHz which was complementary to the 800MHz frequency spectrum was also occupied by the broadcasting sector and provided operators the benefit of more capacity especially in high density areas. Observations from the analysis further revealed that although the digital migration process had taken place in other countries South Africa had still not implemented the process which continued to drag on with no resolution in place. Further observations revealed that some of the challenges that faced the digital migration process was the constant change of ministers and the process was also hampered by a lot of procrastination around spectrum matters. Further observations revealed that there was a migration plan to migrate the broadcasters from the 800MHz spectrum however the process had been dragging on for years and a similar view shared by the operators was that the process of issuing spectrum was flawed and that the department lacked the technological knowledge to manage it.

5.1.18 Government played conflicting roles which has hampered its capability to address the spectrum challenge

Observations from the analysis revealed that government played conflicting roles of being a policy maker and also being a player in the telecommunication market through its shareholding in Telkom and Broadband Infraco. The analysis revealed that this compromised its capability to address the challenges of valuable spectrum. It was further revealed from the analysis that government was too fixated on Telkom and the incumbent mobile operators to develop the broadband market in rural areas. Further observations from the analysis revealed that Sentech was currently sitting on valuable spectrum in the 2.6GHz spectrum frequency bands which wasn't being utilised. Observations from the analysis further revealed that government played conflicting roles whereby government wanted to be a wholesaler while on the other hand government wanted to rollout broadband infrastructure and at the same time was pushing for Sentech to play a part in the LTE roll out yet government lacked the critical skills required to achieve all this and without the right mechanisms being in place the 2030 goal was unachievable. It was further revealed from the analysis that in order to resolve the problem of scarce spectrum for rural broadband access a clear set of policies to expedite the digital migration process was required from the DoC which incorporated clear targets and deadlines

5.1.19 Spectrum is currently being used inefficiently

Observations from the analysis revealed that the main challenge faced by the industry was that spectrum was currently being used inefficiently. Observations from the analysis revealed that Sentech was currently sitting on valuable spectrum in the 2.6GHz spectrum frequency bands which wasn't being utilised. Further observations from the analysis revealed that another challenge facing the industry was that some of the existing spectrum holders were holding onto their allocations as a means to keep the competitors away. Further observations from the analysis revealed that some of the recommended solutions favoured to resolve the issue of spectrum was for the digital dividend spectrum to be issued on a wholesale open access model in order to address the eminent problem of duplicated infrastructure, scarce spectrum resources and enable the effective and efficient use thereof. Another solution that seemed to be favoured by the regulator was to assign the digital dividend spectrum through a beauty contest which was also tied to coverage obligations or an auction of the digital spectrum. Another solution proposed by the operators as a solution to the scarce frequency spectrum was for ICASA to adopt the French model which provided mobile operators with incentives to adopt "mobile virtual network operator" that would focus on prioritising the broadband network deployment into rural areas and at the same time achieving government's objectives.

5.2 How do demand side factors influence policy for broadband in rural areas?

This section provides an analysis of the data findings of the demand side of the broadband ecosystem which presents data analysis from the services, content and applications elements.

5.2.1 Affordability of broadband services in rural areas is a problem

Observations from the analysis revealed that the affordability of broadband services in rural areas was a problem. Observations from the analysis revealed that some of the elements that contributed to broadband being unaffordable in rural areas included elements such as income, population density, markets and class. Other elements were the willingness to spend on broadband services which was low and the broadband costs which were higher in rural areas.

5.2.2 Broadband is categorised as a secondary need in rural areas

It was observed from the analysis that broadband is categorised as a secondary requirement in the hierarchy of needs by consumers in rural areas. It was further observed that consumers were not willing to view broadband as an independent purchase.

5.2.3 There is no business case for broadband as a standalone service in rural areas

Observations from the analysis revealed that there was no business case for broadband being offered as a standalone service in rural areas as it would have a zero effect on broadband adoption which was critical for the broadband evolution in rural areas. It was further revealed from the analysis that for broadband to be successful in rural areas it had to be offered together with voice or applications such as e-Education and e-Health but not as an isolated service which would drive higher broadband adoption and usage in rural areas.

5.2.4 Affordable devices for broadband use such as netbooks, tablets, laptops, PC's, Ipads and smartphones are key to rural broadband adoption

Observations from the analysis revealed that devices for broadband use such as netbooks, tablets, laptops, PC's, Ipads and smartphones were much more expensive than voice devices making them unaffordable for people living in the rural areas. It was further revealed from the analysis that the culture of people handing down devices that was currently common with voice services was not the case with broadband services as people were not willing to hand down devices like tablets or smartphones as this were much more expensive and required longer payback periods if taken out on a contract. It was further observed that some form of government subsidy or tax incentives was required on devices for broadband use such as netbooks, tablets, laptops, PC's, Ipads and smartphones being supplied to rural areas as this currently was not catered for in existing policies and regulation. It was further observed from that analysis that the majority of the subscribers in rural areas were prepaid subscribers and were not credit worthy which had an impact on their ability to purchase expensive devices. It was further observed from the analysis that subscribers in rural areas could not afford the devices for broadband use such as netbooks, tablets, laptops, PC's, Ipads and smartphones and therefore was unwilling to spend. It was also revealed that currently with voice services subscribers were able to get cellphone devices which cost $10 or R 100 while with broadband services this was not the case as smartphones or tablets would on average cost $389 or R 2500 in comparison to cellphones. Low cost devices such as tablets that come at a cost of $30 or R 300 were critical in driving the uptake of broadband in rural areas. It was revealed from the analysis that since broadband was still a relatively new technology the device costs were still very high as the economy of scale and bulk purchasing power was currently lacking and the scale could only be realised once countries with large buying powers like Brazil and China started pushing for smaller devices for broadband use such as netbooks, tablets, laptops, PC's, Ipads and smartphones. Some form of government subsidisation was therefore required in the short term to enable affordability of these devices specifically for rural areas as the handset layer presented the biggest barrier to the broadband evolution in rural areas.

5.2.5 Education on the benefits of broadband key in broadband market development in rural areas

Observations from the analysis revealed that there was a gap in rural areas as people did not understand the benefits of broadband or its applications or how it would add value to the businesses and this was evident especially with some of the SMMEs that were interviewed in the qualitative survey. It was further revealed that the market required education on how to use the devices for broadband use as they were complicated to understand to an average consumer. Further analysis revealed that the operators had to go a step further than just providing broadband services but also had to go further by providing education around broadband benefits and its applications to the market. Further analysis revealed that there was a need for the market to be educated on the benefits of broadband, its application and what purpose broadband services could serve as this was key in driving the broadband market development in rural areas and was currently lacking. Analysis revealed that some form of government intervention was required in prioritising ICT education and training in rural institutions to drive knowledge around broadband.

5.2.6 Broadband is a sophisticated technology that requires some form of literacy

Observations from the analysis revealed that literacy played a big role in the uptake of broadband services. Further analysis revealed that broadband was a sophisticated technology unlike voice service that required the user to have some level of literacy in order to understand how to use the service. It was further revealed in the analysis that people in the urban areas already struggled to understand broadband because of its complexities and this was ultimately the same challenge facing subscribers in rural areas and training was key in addressing the challenge. The analysis revealed that some form of government intervention was required in prioritising ICT education and training in rural institutions aimed at driving knowledge around broadband.

5.2.7 There was a gap in Metsweding municipality with regards to the population having access to broadband services and infrastructure

Observations from the analysis of existing policy and regulation documents revealed that existing policy and regulation does enable network operators to rollout networks in rural and underserviced areas through the award of licences with associated incentives however no provisions had been made to date that catered the rollout of broadband networks to rural areas. Observations from the analysis of the qualitative surveys with Households, SMME and Government revealed that there was a gap in Metsweding municipality with regards to the population having access to broadband services. Further analysis revealed some of the challenges faced by the population in rural areas as frequent electricity blackouts, internet cafes were few in the area and those that were available were too expensive. It was also revealed that majority of the rural dwellers that accessed the internet did so via the cellphones as there were no internet cafes in the area.

5.2.8 Government departments in Metsweding Municipality were lacking an online presence

Observations from the analysis of policy documents revealed that a lack of policy focus exists with regards to the implementation of broadband infrastructure specifically within government structures for the purpose of providing the public with access to e-Government services. Further analysis of policy documents revealed that provisions for the development and implementation of an e-strategy were enabled by government and the e-strategy developed which included e-Government however to date there has been no progress made to implement the strategy despite these provisions being made in 2001. This gap was further evident in the analysis of the qualitative survey which revealed that government departments in Metsweding municipality were lacking an online presence that would enable them to provide the public with interactive e-Government services in Metsweding. Further analysis revealed that the government departments relied on the national website at a departmental level which still did not facilitate electronic transactions to the public and the rural government departments had no influence over the content of the department's national website.

5.2.9 e-Health and e-Education applications are lacking in Metsweding Municipality

Observations from the analysis of policy and legislature documents revealed that provisions were in place that enabled the development and use of e-Health and e-Education systems for the provision of health care and education services to people living in rural and underserviced areas. Further analysis of the data from the qualitative survey with the government clinic and government school revealed that these applications were not available in Metsweding Municipality and this was mainly a challenge as both the government school and clinic did not have any access to broadband within the school and clinic respectively. The analysis revealed that although policy has made provisions that enable e-Health and e-Education in rural areas there has been no further progress made for the implementation thereof in rural areas and broadband access remains the key for enabling these applications in rural areas.

5.2.10 The provision of content and applications in a local language does not exist in Metsweding Municipality

Observations from the analysis revealed that a lot of the content generated online and especially on social networking sites such as Facebook and twitter was user generated and the user had influence over the language that they wished to communicate in on these sites. Further observations from the analysis also revealed that there were already tools that existed online for example Google translate that could translate content to specific languages one of which was Afrikaans. It was further revealed from the analysis that Microsoft office already catered for local languages and it was up to the user to select the software package in their preferred local language. Further analysis also revealed that CellC already provided customer support through their call centres in 3 local languages. However analysis of the qualitative survey findings done in Metsweding Municipality revealed that language was a major barrier to communication as the first language for the majority was not English. It was further observed from the analysis that majority of the content and applications provided by the operators were mainly in English and not in the local languages. It was further revealed from the analysis that some of the challenges that people in Metsweding municipality faced was English literacy which was low and majority did not know how to read or write in English. It was further revealed that to address the problem of English literacy and drive broadband usage, content and applications had to be provided in a local language. It was observed from the analysis of the policy and regulation that provisions had been made for the development of content in local languages however policy was required to drive the further implementation of content in local languages through e-government services. Analysis also revealed that operators had to take responsibility to educate the users on the availability of the online tools that subscribers could use to translate online content to a preferred language.

5.3 To what extent does existing policy enable the investment in and absorptive capacity of broadband?

This section provides an analysis of the data findings of existing policies and feedback from the In-depth interviews with the operators which includes analysis of the data findings from the investment and absorptive capacity elements.

5.3.1 Policy for a management framework that directs investment to the development of a national broadband network does not exist

Observations from the analysis of existing policy revealed that existing policy makes provision for funding to support the rollout of communication network in underserviced and rural areas however policy that makes provision for a management framework to direct investment to the development of a national broadband network does not exist. Further observations revealed that provision for funding through the universal service fund to address the challenges of providing communication access to rural areas exists in current policy and regulation documents however the provision of funding to support the rollout of broadband networks remains out of the scope of these provisions. Further observations of the analysis revealed that existing policy only makes recommendations for funding models that can be applied to fund the rollout of broadband networks in rural areas one of which is the use of public finance but no model has been identified in existing policy that could address the requirement for investment model to fund the rollout of broadband networks.

5.3.2 Existing policy provisions for the application of funds in the universal service and access fund

Observations from the analysis of existing policy revealed that existing policy makes provision for the application of funds in the universal service and access fund to be utilised in the procurement of electronic communication services and access however this was only limited to public schools and training institutes that fell within underserviced areas. The scope of the electronic services that the fund supported included internet connectivity. Further observations of the analysis revealed that existing policy and regulation does make provision for the universal service and access fund to be utilised to subsidise the cost of electronic communication services for needy people. Further analysis however revealed that no definitions existed that identified the category of people that fell under needy people.

5.3.3 Existing policy makes provision for educational institutions to prioritise training programs on information technology and communication sector

Observations from the analysis of existing policy reveals that existing policy makes provision for educational institutions to prioritise training programs on information technology and communication sector. Further analysis revealed that there are initiatives such as e-Skills which have already been launched by the DoC.

5.3.4 Existing policy enables efficiency and productivity through governments electronic government initiative and national e-strategy

Observations from the analysis of existing policy revealed that existing policy enables efficiency and productivity through government's electronic government initiative and national e-strategy. It was further revealed that electronic government initiative made provisions for e-governance, e-business and e-services which were all initiatives geared towards enabling efficiency and productivity in terms of interaction between government departments, between government and businesses and between government and the public. It was further observed from the analysis of policies that the national e-strategy made provisions for e-government, e-administration, e-passport and e-documentation geared towards facilitating efficiency and productivity by promoting electronic interaction between the government and the public, improving the communication and administration of schools with the provincial offices and district offices and enable the efficient tracking and tracing of electronic documentation. It was further observed from the analysis of policies that provisions for an e-commerce framework exists and that an implementation plans exists that enables government to connect with its entities through broadband connectivity and e-government services.

5.3.5 Existing policies on governance lack provisions for an institutional framework

Observations from the analysis of existing policy revealed that existing policies on governance lack provisions for an institutional framework that promotes a coherent plan for the coordination, planning and deployment of broadband networks. Further analysis of existing policies revealed that undue competition, overlaps and duplications existed within government institutions this was mainly the case with existing government entities such as Broadband Infraco, Sentech, USAASA and PNC. Further analysis of existing policies revealed that the prioritisation of competition rules and regulation was necessary in-order to open up the market to competition however no provisions have been made to address this and specifically local loop unbundling remains major barrier to enabling competition in the broadband market. What was further revealed from the analysis of existing policies was that the current government institutional framework provided challenges that prevented government from applying coherent strategic thinking planning and implementation of infrastructure and services this was specifically the case with the high turnover of ministers in the Communications department.

5.4 To what extent does existing policy and regulation enable broadband evolution and ecosystem development in rural areas?

This section provides an analysis of the data findings of existing policy and regulation which includes data findings from the infrastructure, spectrum and applications and absorptive capacity, services, content elements.

5.4.1 Policy and regulation: Network rollout to rural and underserviced areas

Observations from the analysis of existing policy and regulation revealed that existing policy and regulation does enable network operators to rollout networks in rural and underserviced areas through the award of licences with associated incentives however no provisions have been made to date to incentivise operators for the rollout of broadband networks. It was further revealed in the analysis that unlicensed spectrum bands provided small ISPs the opportunities to enable internet connectivity in the rural areas.

5.4.2 Policy and regulation: Funds for extending networks

Observations from the analysis of existing policy and regulation revealed that existing policy and regulation makes provision for the application of funds in the Universal Service and Access fund for the purpose of financing the construction and extension of electronic communications networks in underserviced areas however provisions for funding the construction of broadband networks remains out of the scope of the funds provisions.

5.4.3 Policy and regulation: Digital dividend for the provision of wireless broadband technologies in underserviced areas and rural areas

Observations from the analysis of existing policy and regulation revealed that policy and regulation did promote the use of the digital dividend for the provision of wireless broadband technologies in underserviced areas and rural areas. Further analysis revealed that spectrum frequency for rural broadband market development was only addressed in 2010 and 2011 respectively however the ITA on the digital dividend spectrum were subsequently withdrawn and to date there has been no progress made to address the requirement for the digital dividend spectrum.

5.4.4 Policy and regulation: Provision for the development of content in the local languages

Observations from the analysis of existing policy and regulation revealed that existing policy and regulation makes provision for the development of content in the local languages. Further observations of the analysis revealed that to date there has been no further progress made on the implementation of content in the local languages in rural areas and this was evident from the analysis of the qualitative survey feedback from the interviews with the households, SMME and government departments in Metsweding Municipality.

5.4.5 Policy and regulation: Provision for reduced customs duty on raw material for manufacturing ICT related equipment and tax incentives

Observations from the analysis of existing policy and regulation revealed that existing policy and regulation makes provision for reduced customs duty on raw material for manufacturing ICT related equipment and tax incentives however no existing policy speaks to subsidies or tax incentives schemes for devices for broadband use such as netbooks, tablets, laptops, PC's, Ipads and smartphones being supplied to rural areas.

CHAPTER 6: CONCLUSION AND RECOMMENDATIONS: POLICY, STRATEGY AND REGULATION FOR RURAL BROADBAND

6. Introduction

Broadband has been identified as a growth area and is evolving rapidly and considerations need to be made to include rural areas in the broadband development. To conclude on the main research question “how has policy and regulation affected the evolution of the broadband ecosystem in rural area of Metsweding Municipality?” this research has identified that existing policies and regulation are too generic and are more suited for urban areas and not rural areas. Existing policies and regulation have made minimal provisions for the development of the broadband ecosystem in rural areas which have had no effect on the broadband market development in rural areas. The Broadband Policy Discussion document was only enacted in July 2010 and as such did not make considerations for the specific needs required for the evolution of the broadband ecosystem in rural areas. A dedicated broadband strategy for rural areas is required that will focus on enabling the various elements of the broadband ecosystem to drive the broadband market development in rural areas. However considerations need to be made on how the rural broadband strategy will be integrated into the overall National Broadband strategy.

Chapter 4 above provides detailed feedback on the data findings which was structured around the conceptual framework. Chapter 5 above provides an analysis of the data findings based on the research sub questions that were outlined in chapter 3 above. Based on the analysis this chapter will provide a summary to the barriers identified in the study that have affected the evolution of the broadband ecosystem in rural areas and will also provide a conclusion and recommendation.

6.1 Summary

From a policy and regulation perspective the study highlights that current policy and regulation makes provisions that enable network operators to rollout network infrastructure to rural and underserviced areas through the award of licences and incentives. Provisions for the application of funds from the universal service and access fund to finance the construction and extension of electronic communication networks into underserviced areas also exists. However this study identifies gaps that exist within current policies and regulation as they do not specifically address and make provision for broadband as part of the scope of the rollout of network infrastructure and for the allocation of funds from the universal service and access fund for the purpose of financing broadband network rollout. The study also identifies that a flawed process exists within the digital migration process, which has resulted in numerous delays in the freeing up of the digital dividend spectrum. The study identifies the digital dividend spectrum as being critical in addressing the development of the broadband market in rural areas. A gap was also identified in the study within existing policies and regulation which have failed to make provisions for subsidies and tax incentive schemes specifically for devices for broadband use such as netbooks, tablets, laptops, PC's, Ipads and smartphones that are supplied to rural areas as the total cost of ownership of these devices for broadband use such as netbooks, tablets, laptops, PC's, Ipads and smartphones remains relatively high. The study also reveals that policy has no existing provisions that enable a management framework to direct investment towards the development of a national broadband network. The study also reveals that provisions for an institutional framework that promotes a coherent plan for the coordination, planning and deployment of broadband networks in rural areas is lacking from a policy perspective that addresses the governance of broadband. A gap was also identified in the lack of policy that enables a framework for the implementation of electronic services to rural areas. E-Government was identified in the study as critical in driving the utilization of broadband services but without a framework for the implementation of electronic services to rural areas the development of the broadband market in rural areas cannot be achieved. The study also reveals the lack of policy that makes provision for a funding model that will enable educational institutions in rural areas to prioritise ICT training. Although the Broadband Policy 2010 makes some proposals that address the rollout of broadband to rural areas, they only address a portion of the broadband ecosystem and not in its entirety.

A number of barriers were identified in the study in relation to the supply side of the broadband ecosystem. The study identifies that operators are unwilling to rollout broadband infrastructure to rural areas due to the huge capital financial outlay required and the low return on investment that rural areas attract. The study reveals that the lack of a management framework to direct investment to the development of a broadband network in rural areas and the lack of incentives to drive investments in broadband market development that make rural areas unattractive to investors. The lack of sufficient spectrum resources, access to the lower frequency bands the study established and the current inefficient use of existing spectrum remains one of the main barriers to the broadband market development in rural areas. The lack of governance structures and lack of coordination between government and the private sector in the roll out of a broadband network is identified in the study as another barrier to the broadband market development of rural areas. Administrative processes and the rapid rollout of broadband in rural areas are identified in the study as being problematic. The study also reveals that the rollout of the fibre backbone to rural areas is not a priority and the urban areas remain the focus for the rollout of a fibre backbone. The operating costs of base stations in rural areas remains relatively higher than urban areas for operators the study further identifies. The study also identifies that 3G coverage in rural areas is minimal compared to urban areas.

The study identifies on the demand side of the broadband ecosystem that access to broadband services and infrastructure remains a challenge for the rural population of Metsweding municipality. The study also reveals that the majority of the rural population in Metsweding municipality did not understand the benefits of broadband. The study further reveals that e-Government and e-health services are lacking in Metsweding municipality which are crucial in driving broadband usage in rural areas. The study also identified that the provision of content and applications in a local language in Metsweding municipality was non-existent. The study further reveals that no subsidies or tax incentives currently exist for devices for broadband use such as netbooks, tablets, laptops, PC's, Ipads and smartphones that are being supplied to rural areas. Affordability of broadband services is rural areas is also identified as a barrier to the uptake of broadband services. The study also reveals that there is no business case for broadband being positioned as a standalone service in rural areas and has to be offered together with voice as a major component or with applications such as e-Education or e-Health.

This study concludes that a classic case of market failure exists in the rural area of Metsweding Municipality in relation to the broadband market development. The lack of a governance framework, investment management framework, universal access funding model, lack of spectrum resources, policies and regulation that specifically address the development of the broadband market in rural areas are non-existent.

6.2 Recommendations

With the appointment of the ICT policy review panel by the minister of communication this study could add value to the deliberations of the ICT policy review panel. The following are recommendations that can be applied to address the barriers identified in this study that prohibit the broadband market development in rural areas.

6.2.1 Formulation of a rural broadband strategy

This study identifies that although policies and regulation exist that address the provision of communication network access and services to rural areas, these policies and regulation do not make inclusions for broadband and the development of the broadband ecosystem in rural areas. Although the Broadband Policy 2010 does make some proposals that address the rollout of broadband to rural areas to a certain extent, however a gap exists as it only addresses portions of the broadband ecosystem and does not provide considerations for the complete broadband ecosystem. The researcher therefore recommends the formulation of a rural broadband strategy that focuses on the development of a broadband ecosystem framework that will promote the broadband market development in rural areas. The elements of the broadband ecosystem cannot be viewed in isolation and will have to be considered collectively as each element impacts the other in enabling development. The researcher proposes that the policies and regulation formulated should address the three elements of the broadband ecosystem in rural areas namely the supply, demand and absorptive capacity elements.

6.2.2 The rollout of broadband networks should form part of the scope of the Universal Access and Service Fund

The study revealed that provisions for the application of funds from the universal service and access fund to finance the construction and extension of electronic communication networks into underserviced areas exists. However this study identifies gaps that exist within current policies and regulation as they do not specifically address and make provision for broadband being part of the scope of the rollout of network infrastructure. The study also identifies that existing policies and regulation do not make provisions for the allocation of funds from the universal service and access fund for the purpose of financing broadband network rollout. The researcher therefore recommends that considerations are made for a Universal Access and Service Fund model with a specific focus on a funding model that would support the development of broadband networks in rural areas; the model should include broadband network rollout as part of the funding models scope. The researcher also recommends that funding from the universal service and access fund should be used to subsidise the cost of broadband services and devices for broadband use such as tablets and laptops for needy people living in rural areas.

6.2.3 The licencing obligations for the Digital Dividend Frequency Spectrum should be tied to rural broadband network rollout targets

A number of barriers were identified in the study in relation to the supply side of the broadband ecosystem. The lack of sufficient spectrum resources, access to the lower frequency bands the study established and the current inefficient use of existing spectrum remains one of the main barriers to the broadband market development in rural areas. The findings from the study revealed that the 2.6GHz Frequency spectrum would specifically enable operators to address the capacity issue that currently exists in urban areas thus providing no guarantee that operators will utilize the spectrum for rural broadband network rollout. To ensure that operators specifically utilise the 2.6GHz and 800MHz spectrum for rural broadband network rollout the researcher recommends that the licencing obligations for the digital dividend spectrum are tied to rural broadband network rollout targets. The researcher also recommends that the regulator considers heavy penalties that will be applied to any licence holder that does not adhere to the licencing requirements.

6.2.4 Apply a Municipal based infrastructure development finance model for the rollout of the broadband network in rural areas

This study revealed a number of challenges that hampered the development of a broadband backbone network in rural areas. Some of the main challenges that were identified in this study include the lack of a governance framework that enabled municipalities and provinces to coordinate the rollout of a broadband network in rural areas. The study also identifies that operators are unwilling to rollout broadband infrastructure to rural areas due to the huge capital financial outlay required and the low return on investment that rural areas attract. The study also reveals that the lack of a management framework to direct investment to the development of a broadband network in rural areas and the lack of incentives to drive broadband market development make rural areas unattractive to investors. Due to the huge capital outlay required and rural areas being viewed as unattractive by investors the researcher recommends that the development and rollout of a broadband backbone network in rural areas has to be a government driven initiative, that utilizes a municipality based infrastructure development finance model to fund broadband infrastructure development in rural areas. However for this model to be successful a governance framework first needs to be in place that will facilitate for rural municipalities and provinces to coordinate their efforts in rolling out a broadband backbone network that not only enables broadband access to rural areas but also ensures that backbone networks are connected between municipalities and provinces. The Development Bank of South Africa (DBSA) which focuses on infrastructure development financing with a particular focus on municipalities in underdeveloped areas was funded in 1983 by the South African government and provides municipal based infrastructure development financing (KwaZulu-Natal Top Business, 2013). The DBSA's role is to provide funding towards infrastructure development mainly to local government and "low capacity municipalities" at the same time providing technical skills, project management and systems (DBSA, Date Unknown). The ICT Policy Colloquium discussion document 2012 states that "policy makers should therefore not only play in typical domain of licencing, market liberalisation and facilitating access to spectrum but rather take a leadership role in defining and implementing a National Broadband Plan the same as for ownership of roads and rail infrastructure and services as provided by the Ministry of Transport" (DoC, 2012, p.25). The researcher therefore recommends that a municipal based infrastructure development finance model is used to fund a broadband network rollout in rural areas.

6.2.5 Implement an Open Access Wholesale Network model for the 800 MHz and 2.6GHz Spectrum

Scarce spectrum resources were identified in this study as another barrier to the rollout of broadband networks to rural areas. Due to spectrum scarcity the researcher recommends that the DoC develops a policy framework that will facilitate access to the 800 MHz also known as the digital dividend and the 2.6GHz spectrum on an open access wholesale model where a wholesale structure will be implemented to enable open access by multiple operators at competitive interconnect rates. The open access wholesale model will provide huge cost savings and eliminate the duplication of infrastructure in rural areas. This model will also open up the broadband market to competition as not only operators but ISPs as will have the opportunity to provide broadband networks to rural areas. In parallel to this the researcher recommends that the regulator develops licencing conditions that will ensure that the 800MHz and

2.6GHz spectrum is used mainly to rollout coverage to rural areas as the main priority. Spectrum frequency for rural broadband market development was only addressed in 2010 and 2011 respectively in draft regulations however the ITA on the digital dividend spectrum were subsequently withdrawn and to date there has been no progress made to address the requirement for the digital dividend spectrum since December 2011.

6.2.6 Development of an interconnect model for operators rolling out a rural broadband network

The requirement to implement an open access wholesale network model will also require the regulator to ensure that competitive interconnect rates are enforced for operators that connect to the open access network. The study revealed that affordability of broadband in rural areas was an existing problem and the researcher recommends the development of a competitive interconnect framework which will go a long way in addressing the need for affordable broadband services in rural areas.

6.2.7 Enable the availability of e-Government, e-Education and e-Health services to rural areas as a driver for broadband usage in rural areas

The study reveals that there is no business case for broadband being positioned as a standalone service in rural areas and broadband has to be offered together with voice as a major component or with applications such as e-Education or e-Health. The researcher recommends that e-Education, e-Government and e-Health services are offered particularly in rural areas as the main drivers for demand of broadband services. The researcher also recommends that government departments extend the reach of e-Government services to rural areas as these have been identified as crucial in driving broadband usage in rural areas and enabling public interaction with the government. This interaction ultimately has the impact of driving digital literacy among the public which also goes a long way in driving demand for broadband.

6.2.8 Implementation of reduced import tax duty on devices for broadband use

The study reveals that the total cost of ownership of devices for broadband use remains relatively high. Existing policies and regulation have failed to make provisions for subsidies and tax incentive schemes specifically for devices for broadband use such as netbooks, tablets, laptops, PC's, Ipads and smartphones that are supplied to rural areas aimed at reducing the costs for the rural user. The researcher recommends the implementation of a reduced import tax duty on devices for broadband use that are specifically being supplied to rural areas. The researcher also recommends some form of tax incentives on devices for broadband use. This will ultimately have the effect of lowering the total cost of ownership of broadband services in rural areas and is aimed at enabling affordability as well. Considerations must be made with regards to the subsidisation of devices for broadband use as the life span for these devices on average falls between 2 to 3 years and provisions for the replacement of these devices when technology goes end of life must be made. This would call for repeat subsidisation of devices for one users and plans to counter such scenarios must be put into consideration. The ICT Policy Colloquium discussion document 2012 also proposes as part of its national integrated policy for the implementation of a reduced customs duty on raw material imported for the purpose of manufacturing ICT related equipment and products as well as tax incentives however this does not directly address the need for rural areas.

6.3 Recommendations on areas for further future research focus

This study was conducted as a baseline study as the broadband ecosystem is a broad topic for research with room for further research. The researcher recommends the following areas for further future research focus:

1. A research that focuses on various models that could be adopted to develop a management framework to direct investment to broadband network development in rural areas;

2. A research that focuses on a Universal Access fund model with a specific focus on funding models that would support the development of broadband networks in rural areas;
3. A research that will investigate broadband ecosystem frameworks for rural broadband ecosystem development that have been implemented globally and that could be adopted in South Africa;

In conclusion a rural specific broadband strategy that focuses on the development of a rural broadband ecosystem framework aimed at promoting the broadband market development in rural areas is key in driving this development. Government cannot depend on the private sector to take the initiative to drive the rollout of broadband network infrastructure to rural areas. The rollout has to be a government driven initiative with a focus on municipal infrastructure development finance as the model for funding broadband infrastructure development in rural areas. Although the barriers and gaps identified in this study are known to the industry this research study goes further to corroborate from an academic perspective the existence of these barriers that are affecting the broadband market development of rural areas.

References

Abrams, L. (2010). Sampling 'Hard to Reach' Populations in Qualitative Research: The Case of Incarcerated Youth, (p.538), Qualitative Social Work, Published by Sage publications. Retrieved online from http://0-qsw.sagepub.com.innopac.wits.ac.za/content/9/4/536.full.pdf+html on 18th April 2012.

Abrahams, L. & Goldstuck, A. (2010). The state of e-development in South Africa: a view from the end of the first document of the 21st century, (P. 17), LINK Public Policy Paper Series No.11, LINK Centre, Graduate School of Public and Development Management, University of the Witwatersrand, Johannesburg.

Abusabha, R. & Woelfel, M. (2003). Qualitative Vs quantitative methods: Two opposites that make a perfect match, (P. 566), Journal of American Dietetic Association, Volume 103, (Number 5).

Africantelecomsnew. (Date Unknown). Major African Mobile Markets: South Africa, Retrieved online from http://www.africantelecomsnews.com/resources/AfricaOpp_South_Africa.shtml on 03rd March 2013.

ANC. (2012). Building an inclusive society through information and communication technology, (p. 6 - p.16 & p.29), Communications Policy Discussion Document.

Analysys Mason. (2010). Overview of Broadband services in South Africa: Demand Side, (P. 11), Assessment of economic impact of wireless broadband in South Africa, Report for GSMA.

ArcGIS. (2010). ArcGIS version 10, GIS lab, School of Geography, Archaeology and environmental studies, Bernard Price Building, University of Witwatersrand, Johannesburg, South Africa.

Babbie, E. & Mouton, J. (2001). The Practice of Social Research. (P. 270, P. 279, P. 281, P. 289). Oxford University Press, Cape Town.

Broadband Infraco. (2011). Annual Report 2011, (P. 6 and P. 40), Retrieved online from www.infraco.co.za/Broadband_Infraco_Annual_Report_2011.pdf on 06th April 2012.

Budde, P. (2010). A 2010 Leadership Imperative: The Future Built On Broadband, (P. 6 – P. 35), A Report By The Broadband Commission For Digital Development. ITU and UNESCO, New York.

BuddeComm, (2010). South Africa – Mobile Market – Overview, Statistics and Forecasts, (P. 9 – P. 25), Paul Budde Communications Pty Ltd, Australia.

Budde, P. (2011). Broadband A Platform For Progress, (P. 1, P. 6 and P. 31). A Report By The Broadband Commission For Digital Development, ITU and UNESCO, New York.

Burger, D. (2000). The Integrated Sustainable Rural Development Strategy, (P. 2 – P. 7), Pretoria. Retrieved online from http://www.info.gov.za on 10 July 2011.

Buttkerelt, S. Enriquez, L. Grijpink, F. Moraje, S. Torfs, W. & Delmulle, V. T. (2009). Mobile Broadband For The Masses: Regulatory Levers To Make It Happen, (P. 7 – P. 13), McKinsey & Company.

Bridges.org. (2001). Spanning the Digital Divide: Understanding and Tackling the Issues, (P. 25), Spanning the International Digital Divide.

Calandro, E. Gilwald, A. Moyo, M. & Stork, C. (2010). Comparative Sector Performance Review 2009/2010: Towards Evidence-based ICT Policy and Regulation, (P. 9), Research ICT Africa, Volume Two, (Policy Paper 5).

Carrega, C. (2009). Should Universal Service be extended to Broadband? (P. 15 – P. 40).

Cohen, N. & Arieli, T. (2011). Field research in conflict environments: Methodological challenges and snowball sampling, (p. 426 and p. 427), Journal of Peace Research, published by Sage publications. Retrieved online from http://0-jpr.sagepub.com.innopac.wits.ac.za/content/48/4/423.full.pdf+html on 18th April 2012.

Collingridge, D. & Gantt, E. (2008). The Quality of Qualitative Research, (p. 391), American Journal of Medical Quality, published by Sage publications. Retrieved online from http://0-ajm.sagepub.com.innopac.wits.ac.za/content/23/5/389.full.pdf+html on 18th April 2012.

Coyle, D. & Williams, H. (2011). Making Broadband Accessible to All: Overview, (P. 3), The Policy Paper Series, Number 12, Vodafone Group PLC

DBSA. (Date unknown). Development Bank of Southern Africa at a glance, (p.10), Headway Hill, Midrand, South Africa. Retrieved online from http://www.dbsa.org/Confr/DBSA%20COP%2017%20Related%20Documents/Development%20Bank%20of%20Southern%20Africa%20at%20a%20glance.pdf on 3rd February 2013.

Diphoko, T. (2012). Mapping of Metsweding Municipality, GIS Lab, School of Geography; Archaeology and Environmental studies, University of Witwatersrand campus.

DoC. (2008). Discussion Document: Definitions of Universal Service, Universal Access, and Underserviced Areas and Determinations in respect of needy persons, Government Gazette number 31333, Vol 518, Notice 987 of 2008.

DoC. (2010). Broadband Policy for South Africa, Policies and policy directions drafted in terms of Section 3(1) of the Electronic Communications Act, 2005 (Act No. 36 of 2005), Government Gazette No. 33377, Government Printing Works.

DoC. (2010). Determination issued under the Electronic Communications Act 2005, with regard to Universal Access to and The universal provision of Electronic Communications Services and Electronic Communications Networks Services, (P. 4), Electronic Communications Act, 2005 (Act No. 36 of 2005), Government Gazette No. 32939.

DoC. (2010). Radio Frequency Spectrum Policy for South Africa, Policy directions drafted in terms of section 3(1) of the Electronic Communications Act, 2005 (Act No. 36 of 2005), Government Gazette No. 33119, Notice 306 of 2010.

DoC. (2011). Discussion Paper: Towards An Information and Communications Technologies (ICT) Rural Development Strategic Framework.

DoC. (2011). Draft Policy Directions For Electronic Communications Services in High Demand Spectrum, Policy directions drafted in terms of section 3(2) of the Electronic Communications Act, 2005 (Act No. 36 of 2005), Government Gazette No. 34848, Notice 898 of 2011.

DoC. (2011). Draft Policy Directions For Electronic Communications Services in Draft Spectrum assignment plan for the combined licensing of the 800MHz and 2.6GHz bands. Policy directions drafted in terms of section 3(2) of the Electronic Communications Act, 2005 (Act No. 36 of 2005), Government Gazette No. 34872, Notice 911 of 2011.

DoC. (2011). eBarometer: Measuring the impact of ICTs on Development in South Africa.

DoC. (2012). ICT Policy Colloquium discussion document, Government Gazette No. 35255, Notice No. 308 of 2012.

DoC. (2012). Electronic Communications Amendment Bill, Government notice 572 of 2012, Vol 565, Gazette No. 35525, Pretoria.

Domas, M. (2003). The Public Interest Theory of Regulation: Non-Existence or Misinterpretation, (P. 166), European Journal of Law and Economics, Kluwer Academic Publishers, The Netherlands.

Dooley, L. (2002). Case Study Research and Theory Building, (p. 336), Advances in Developing Human Resources, published by Sage publishers. Retrieved online from http://0-adh.sagepub.com.innopac.wits.ac.za/content/4/3/335.full.pdf+html on 21st April 2012.

Dymond, A. & Oestmann, S. (2003). Chapter 3: The Role of Sector Reform in Achieving Universal Access, (P. 58 and P. 59), Trends in Telecommunication Reform 2003: Promoting Universal Access to ICTs, Practical Tools for Regulators, International Telecommunication Union.

El- Darwiche, B. Friedrich, R. Sabbagh, K. & Singh, M. (2011). Building Communities Around Digital Highways, (P. 11 – P. 15), Booz & Co.

Elo, S. & Kyngas, H. (2008). The qualitative content analysis process, (p.111), Journal of Advanced Nursing 62 (1), Department of Nursing and Health, Administration, University of Oulu, Finland.

Esselaar, S. Gillwald, A. Moyo, M. & Naidoo, K. (2010). South Africa ICT Sector Performance Review 2009/2010, (P. 16 and P. 27), Towards Evidence Based ICT Policy and Regulation, Volume Two, Policy Paper 6.

Flick, U. (2007). Designing Qualitative Research, (P. 27), The Sage Qualitative Research Kit, The Cromwell Press Ltd, Wiltshire, Great Britain.

Frost & Sullivan. (2010). Economic 360 for South Africa: Growth Prospects and Emerging Opportunities in the ICT Industry, (P. 74 and P. 78), London.

Gauteng Provincial Government. (2010). Comprehensive Rural Development Strategy, (P. 10 – P. 11), Gauteng Department of Agriculture and Rural Development.

GCRO. (2009). GeoTerraImage 10m urban land cover dataset, Gauteng City-Region Observatory, Braamfontein, South Africa.

Gillwald, A. (2005). Good Intentions, poor outcomes: Telecommunications Reform in South Africa, (P. 469), Telecommunications Policy 29, Link Centre, Graduate School of Public and Development Management, Witwatersrand University, South Africa. Available online on www.sciencedirect.com.

Gillwald, A. (2007). Between Two Stools: Broadband Policy in South Africa, (P. 53 – P. 66), The Southern African Journal of Information and Communication Issue 8, Link Centre, Graduate School of Public and Development Management, Witwatersrand University, South Africa.

Goldstuck, A. (2012). 'Mobile Driving SA Internet Growth', Techcentral, Johannesburg, 10th May 2012, available online at http://www.techcentral.co.za/mobile-driving-sa-internet-growth/31718/.

Goldstuck, A. (2012). Internet Matters: The Quiet Engine of the South African Economy, (p.1), For World Wide Worx, commissioned by Google South Africa

Hancock, B. Hammersley, V. & East, L. (1998). Trent Focus for Research and Development in Primary Health Care: Health Needs Assessment in Primary Care, (p. 2 and p. 25), Trent Focus.

Hancock, B. Windridge, K. & Ockleford, E. (2009). An Introduction to Qualitative Research, (P. 4, P. 7, P. 19, p. 22, P. 24 and P. 27), The NIHR RDS EM / YH.

Hernandez, J. Leza, D. & Lena, K. (2010). GSR 2010 Discussion Paper: ICT Regulation in the Digital Economy, (P. 1 – P. 11), International Telecommunication Union, 10th Global Symposium for Regulators, Dakar, Senegal.

Hodge, J. Lipschitz, R. Sheik, F. & Aproskie, J. (2008). South African 15-year Telecommunications Policy Review, (P. 4 – P. 70), Conference 2008: The Regulatory Environment and its impact on the nature and level of Economic growth and Development in South Africa, Genesis Analytics (Pty) Ltd, Johannesburg, South Africa.

Hodge, J. (2004). 'Universal service through roll-out targets and licence conditions: lessons from telecommunications in South Africa', Development Southern Africa, Vol 21, No 1, March 2004, Routledge, London.

Horton, B. (2011). GSR 2011 Discussion Paper: Setting National Broadband Policies, strategies and Plans, (P. 3 – P. 5), International Telecommunication Union.

Hsieh, H. & Shannon, S. (2005). Three Approaches to Qualitative Content Analysis, (p.1278, 1281, 1282 & 1283), published by Sage publishers. Retrieved online from http://0-adh.sagepub.com.innopac.wits.ac.za/content/15/9/1277.full.pdf+html on 14th May 2012.

ICASA. (2012). Discussion Document on the Review of Universal Service and Access Obligations Framework (USAOs), (p. 9 & p.14), Government Gazette No. 33467, Vol. 542, Notice 807 of 2010.

ICASA. (2012). Draft Invitation to Apply for Radio Frequency Spectrum Licence: To Provide Mobile Broadband Wireless Access Service for Urban and Rural Areas using the complimentary bands, 800MHz and 2.6GHz, Government Gazette No. 34961, Notice 44 of 2012.

Intven, H. & McCarthy, T. (2000). Module 6: Universal Service, (P. 6-1), Telecommunications Regulation Handbook, The World Bank, Washington DC, USA.

IT-Online, (2012), 'First step in fibre to the home', IT-Online, Johannesburg, 04th April 2012, available online at http://www.it-online.co.za/2012/03/29/first-step-in-fibre-to-the-home/.

Kathuria, R. & Kedia-Jaju, M. (2011). India: The Impact of Internet, (P. 9), Department of Information Technology, Ministry of Communications & Information Technology, Government of India.

Katz, R. (2010). GSR 2010 Discussion Paper: The Impact of Broadband on the Economy: Research to date and Policy Issues, International Telecommunication Union, 10th Global Symposium for Regulators, Dakar, Senegal.

Kelly, T. & Rossotto, C. (2011). Broadband Strategies Handbook, (P. 17 – P. 174), The World Bank and Information for Development Program, Washington DC.

Kholod, A. & Lewis, J. (2010). The Digital Dividend: Opportunities and Challenges, (P. 27 – P. 29), International Telecommunication Union News.

Kim, Y. Kelly, T. & Raja, S. (2010). Building Broadband, Strategies and Policies for the Developing World, (P. x – P. 47), The World Bank, Washington, DC.

Kwazulu-Natal Top Business. (2013). Top-business-sector: The-Development-Bank-of-Southern-Africa (DBSA), (p.275). Retrieved online from http://kzntopbusiness.co.za/site/top-business-sector/The-Development-Bank-of-Southern-Africa-(DBSA)/page/275 on 3rd February 2013.

Lange, P. (2006). Africa Overview Telecoms, Mobile and Broadband Markets, (P. 45 – P. 148), A Buddecomm Report, 5th Edition, Paul Budde Communication Pty Ltd, Australia.

Lange, P. (2010). African Fixed Line and Fibre Telecoms Markets and Infrastructure, (P. 229 – P. 240), A Buddecomm Report, 5th Edition, Paul Budde Communication Pty Ltd, Australia.

Leedy, P. & Ormrod, J. (2005). Practical Research: Planning and Design, (P. 134 – P. 145), Pearson Educational International and Prentice Hall, New Jersey.

Macharia, C. (2012). Barriers to broadband market development in rural areas in South Africa, Graduate School of Public and Development Management, Witwatersrand University, South Africa.

Mail & Guardian online. (2009). 'Nyanda decries broadband penetration in SA', Mail & Guardian online, Johannesburg, 19th November 2009, available online at http://mg.co.za/article/2009-11-19-nyanda-decries-broadband-penetration-in-sa.

Mashinini, F. & Neilson, B. (2012). SA Wireless Access and Broadband Market, (p. 23, p. 73 & p. 79), BMI-Techknowledge Group (Pty).

May, I. & Pal, L. (1999). Good Fences Make Good Neighbours: Policy Evaluation and Policy Analysis – Exploring the Differences, (p. 261 & p. 264), published by Sage publishers on behalf of The Tavistock Institute. Retrieved online from http://0-mmr.sagepub.com.innopac.wits.ac.za/content/5/3/259.full.pdf+html on 25th July 2012.

Melody, W. (1996). Toward a framework for designing information society policies, (P. 244, P. 253, P. 255), Telecommunications Policy, Vol. 20, No. 4, Elsevier Science Ltd, Great Britain.

Metsweding District Municipality. (2008). Annual Report 2007/2008, (P. 19 and P. 22), Metsweding District Municipality. Retrieved online from http://mfma.treasury.gov.za on 11 July 2011.

Metsweding District Municipality. (2010). IDP Review 2009/2010, (p. 110), Metsweding District Municipality. Retrieved online from http://www.metsweding.com on 11 July 2011.

Metsweding District Municipality. (2011). IDP Review 2010/2011, (P. 10 – P. 42), Metsweding
District Municipality. Retrieved online from http://www.metsweding.com on 11 July 2011,

Monson, C. Ros, A. Tardiff, T. Banerjee, A. Briceno, A. Frieden, R. Kalba, K. Ehrhardt, D. Gale, S. McKinlay, A. & Sethi, P. (2004). Module 2: Competition and Price Regulation, (P. 20), Information for Development Programme and International Telecommunication Union Regulatory Tool Kit. Retrieved online from www.ictregulationtoolkit.org on 19th September 2011.

Msimang, M. (2003). Chapter 2: Universal Access and Universal Service: An Overview, (P. 30 and P. 29), Trends in Telecommunication Reform 2003: Promoting Universal Access to ICTs, Practical Tools for Regulators, International Telecommunication Union.

MTN Group Limited. (2010). Integrated Business report, (P. 48), For the year ended 31 December 2010. Retrieved online from www.mtn-investor.com/mtn_ar2010/go_about.php on 27th March 2012.

MTN. (2010). 'Connecting Communities, saving the environment through a sustainable network', MTN, Johannesburg, 27th March 2012, available online at http://www.mtn.co.za/AboutMTN/Press%20Room/ArchivedPressRelease/2010/September2010/Pages/Connectingcommunities,savingtheenvironmentthroughasustainablenetwork.aspx.

Muller, R. (2009). 'Broadband in SA: another scathing report', Mybroadband, Johannesburg, 1st November 2009, available online at http://mybroadband.co.za/news/broadband/10274-broadband-in-sa-another-scathing-report.html.

Muller, R. (2012). 'How much money can you make on YouTube?' Mybroadband, Johannesburg, 18th March 2012, available online at http://mybroadband.co.za/news/business/45680-how-much-money-can-you-make-on-youtube.html.

Muller, R. (2012). 'New, affordable broadband service for rural SA', Mybroadband, Johannesburg, 06th April 2012, available online at http://mybroadband.co.za/news/telecoms/45902-new-affordable-broadband-service-for-rural-sa.html.

Mybroadband Staff Writer. (2005). 'Y'ello 3G', Mybroadband, Johannesburg, 22nd June 2005, available online at http://mybroadband.co.za/nephp/403.html.

Mybroadband Staff Writer. (2012). 'ICASA strikes back after broadband spectrum article', Mybroadband, Johannesburg, 14th August 2012, available online at http:// http://mybroadband.co.za/news/wireless/57291-icasa-strikes-back-after-broadband-spectrum-article.html

Mybroadband Staff Writer. (2012). 'The State of Broadband in South Africa', Mybroadband, Johannesburg, 02nd October 2012, available online at http://mybroadband.co.za/news/broadband/61094-the-state-of-broadband-in-south-africa.html.

Neale, P. Thapa, S. & Boyce, C. (2006). Preparing a Case Study: A Guide for Designing and Conducting a Case Study for Evaluation Input, (P. 3), Monitoring and Evaluation – 1, Pathfinder International Tool Series.

Neilson, B. Falconer, C. & Mashinini, F. (2012). SA Telecommunications Services Changing Landscape, (p.38), BMI-TechKnowledge Group.

Odendaal, N. (2012). 'Communications Minister unveils new policy plans', Engineering News, Johannesburg, 19th April, 2012, available online at http://www.engineeringnews.co.za/article/communications-minister-unveils-new-policy-plans-2012-04-19.

OECD. (1996). The Essential Facilities Concept, (P. 7), OCDE/GD(96)113, Organisation for Economic Co-operation and Development, Paris, France.

OECD. (1997). Regulatory Impact Analysis: Best Practices in OECD Countries, (p. 177), Organisation for Economic Co-operation and Development Paris, France.

Patel, Y. (2010). A Dynamic and Creative Economy in South Africa: Exploring Rural – Urban Linkages, (P. 5 – P. 6), Rural Development Conference, India.

Plessis, R. (2008). Peri-Urban Land Management Assessment and Strategy in Metsweding District Municipality, (P. 2), Urban Landmark, Hartfield, Pretoria.

Presidential National Commission. (2005). Towards an Inclusive Information Society for South Africa: A National Information Society and Development Plan, (P. 4 – p.8, p.25, p.27, p.40, p.48 & p.56 –p.84) Presidential National Commission on Information Society & Development, A Country Report to Government.

Preston, P. Cawley, A. and MetyKova, M. (2007). Broadband and rural areas in the EU: From technology to application and use, (P. 394 – P. 394), Telecommunications Policy 31 (2007) 389 – 400. Retrieved online from www.elsevierbusinessand management.com/locate/telpol on 28th May 2013.

Qiang, C. Rossotto, C. and Kimura, K. (2009). Chapter 3: Economic Impact of Broadband, (P. 37), 2009 Information and Communications for Development: Extending Reach and Increasing Impact, The World Bank Group, Washington DC, USA.

Qiang, C. (2010), Broadband Infrastructure Investment in Stimulus Packages: Relevance for Developing Countries, (P. 7), Vol. 12, Issue: 2, The World Bank Group, Washington DC, USA.

Rasmusen, E. & Zupen, M. (1990). Extending the economic theory of regulation to the form of policy', (P. 187 and P. 188), Kluwer Academic Publishers, Netherlands.

Rasool, F. (2011). 'CSIR extends Rural Broadband" ITWeb, Johannesburg, 06th April 2012, available online at http://www.itweb.co.za/index.php?option=com_content&view=article&id=48656%3Acsir-extends-rural-broadband&catid=147&Itemid=2354.

Renda, A. (2010). Competition-regulation interface in telecommunications: What's left of the essential facility Doctrine, (P. 32), Telecommunications Policy 34. Retrieved online from www.elsevierbusinessandmanagement.com/locate/telpol on 18th January 2010.

Roller, L. & Waverman, L. (2001). Telecommunications Infrastructure and Economic Development: A Simultaneous Approach, (P. 909, P. 910 and P. 921), The American Economic Review, Vol. 91, No. 4.

RSA. (1996). White paper on Telecommunication Policy, Republic of South Africa, Retrieved online from http://www.polity.org.za/html/govDoC/white_papers/telewp.html?

RSA. (2001). Electronic Government the Digital Future: A Public Service IT Policy Framework, Republic of South Africa, Published by the Department of Public Service and Administration.

RSA. (2002). Telecommunications Amendment Act, Republic of South Africa, Government Gazette, Vol. 437, No. 22889, Act No. 64 of 2001, Capetown.

RSA. (2002). Electronics Communications and Transactions Act, Republic of South Africa, Government Gazette, Vol. 446, No. 23708, Act No. 25 of 2002, Cape Town.

RSA. (2005). Electronics Communications Act, Republic of South Africa, Government Gazette, Vol 490, No. 28743, Act No. 36 of 2005, Cape Town.

Schmittlein, D. (1984). Assessing the validity and Test-retesting for "Pick K of N" Data, (p.23), Marketing Science, Vol. 3, No , Winter 1984. Retrieved online from http://0-www.jstor.org.innopac.wits.ac.za/stable/pdfplus/183971.pdf on 11th February 2013.

Song, S. (Date Unknown). African Undersea Cables. Retrieved online from http://manypossibilities.net/african-undersea-cables on 03rd March 2013.

Statistics South Africa. (2001). Statistics South Africa Census – 2001: Advanced Reporting Statistics Index. Retrieved online from http://mapserver2.statssa.gov.za on 11thJuly 2011.

Statistics South Africa. (2007). Community Survey 2007: by municipality, Internet access and population group of household. Retrieved online from http://www.statssa.gov.za/timeseriesdata/pxweb2006/Dialog/varval.asp?ma=Computer_Municipalities&ti=Community+Survey+2007+by+municipality%2C+computer+and+population+group+of+household+head&path=../Database/South%20Africa/Community%20Survey%202007/Households/Municipality/&lang=1 on 11th March 2012.

Statistics South Africa. (2007). Community Survey 2007: Percentage of Households with household goods in working order. Retrieved online from http://www.statssa.gov.za/community_new/content.asp?link=basicresults.asp on 06th April 2012.

Statistics South Africa. (2012). Census 2011 Statistical Release, (p.58), published by Statistics South Africa, Pretoria, South Africa.

Stigler, G. (1971). The Theory of Economic Regulation, (P. 3), The Bell Journal of Economics and Management Science, Vol. 2, No.1. Retrieved online from www.jstor.org/stable/3003160 on 14th April 2011.

Teddlie, C. & Yu, F. (2007). Mixed Methods Sampling: A Typology with Examples, (p. 77), Journal of Mixed Methods Research, Volume 1 Number 1, published by Sage publishers. Retrieved online from http://0-mmr.sagepub.com.innopac.wits.ac.za/content/1/1/77.full.pdf+html on 18th April 2012.

Telkom Group, (2011). Integrated Annual Report 2011, (P. 84 and P.88). Retrieved online from https://secure1.telkom.co.za/ir/financial/annual-reports-2011.html on 27th March 2012.

The World Bank. (2010). South Africa: Internet Users (per 100 people), World Development Indicators, International Telecommunication Union, World Telecommunication/ICT Development Report and database, and World Bank estimates. Retrieved online from http://data.worldbank.org/indicator/IT.NET.USER.P2/countries/1W-ZA?display=graph on 25th March 2012.

The World Bank. (2010). South Africa: Fixed Broadband Internet Subscribers (per 100 people), World Development Indicators, International Telecommunication Union, World Telecommunication/ICT Development Report and database, and World Bank estimates. Retrieved online from http://data.worldbank.org/indicator/IT.NET.BBND.P2/countries/ZA-1W?display=graph on 25th March 2012.

The World Bank. (2010). South Africa: Urban Population (% of total), World Development Indicators, United Nations, World Urbanization Prospects. Retrieved online from http://data.worldbank.org/indicator/SP.URB.TOTL.IN.ZS/countries/1W-ZA?display=graph on 25th March 2012.

Tullett, J. (2012). ‘SA national ICT policy on the brink’, ITWeb Business, Johannesburg, 17th April 2012, available online at http://www.itweb.co.za/index.php?option=com_content&view=article&id=53579:sa-national-ict-policy-on-the-brink&catid=69.

University of Pittsburgh & University of Massachusetts. (2007 -2010). Coding analysis toolkit, University Center for Social and Urban Research & College of Social and Behavioural Sciences. 17th August 2012, available online at http://cat.ucsur.pitt.edu/app/main.aspx.

USAASA. (2009). Corporate Plan 2009 to 2014, (P. 16), USAASA Corporate Plan. Retrieved from http://www.usaasa.org.za/export/sites/usaasa/resource-centre/download-centre/downloads/USAASA_Corporate_Plan_2009-2014.pdf on 29th March 2012.

USAASA. (2012). Strategic plan 2012 – 2015, (p. 20, p. 21 & p.43). Retrieved online from http://www.usaasa.org.za/export/sites/usaasa/resource-centre/download-centre/downloads/USAASA_Strategic_Plan_2012-2015-_FINAL.pdf on 24th February 2012).

Vermeulen, J. (2011). 'LTE trial networks in South Africa', Mybroadband, Johannesburg, 06th April, 2012, available online at http://mybroadband.co.za/news/broadband/29376-lte-trial-networks-in-south-africa.html.

Vermeulen, J. (2012). 'SA Internet Stats for 2011 revealed', Mybroadband, Johannesburg, 8th May, 2012, available online at http://mybroadband.co.za/news/internet/49533-sa-internet-stats-for-2011-revealed.html.

Vodacom Group. (2010). Group Annual Report, (P. 20 – P. 21), For the year ended 31st March 2010. Retrieved online from www.vodacom.com/pdf/annual_reports/ar_2010.pdf on 27th March 2012

Vodacom. (2010). 'Socio-economic impact of mobile Telecoms', Sustainable Development Report, Vodacom, Johannesburg, 27th March 2012, available online at http://vodacom.investoreports.com/vodacom_sdr_2010/access-to-communications/socio-economic-impact-of-mobile-telecoms/.

Voster, G. (2012). 'DoC minister calls for ICT policy overhaul', BusinessTech by Mybroadband, Johannesburg, 19th April 2012, available online at http://businesstech.co.za/news/government/10320/DoC-minister-calls-for-ict-policy-overhaul/.

Wernick, C. & Picot, A. (2007). The Role of Government in Broadband Access, (P. 663 and P. 664), Telecommunications Policy 31. Retrieved online from www.sciencedirect.com on 23rd November 2011.

Wikipedia. (Date Unknown). Internet in South Africa. Retrieved online from http://en.wikipedia.org/wiki/Internet_in_South_Africa on 03rd March 2013.

Williams, M. (2009). Chapter 4: Advancing the Development of Backbone Networks in Sub-Saharan Africa, (P. 7 – P. 12 and P. 52 – P. 53), 2009 Information and Communications for Development: Extending Reach and Increasing Impact, The World Bank Group, Washington DC, USA.

Wilson, C. (2011). 'How to take Broadband to everyone', TechCentral, Johannesburg, 29th March 2012, available online at http://www.techcentral.co.za/how-to-take-broadband-to-everyone/24015/.

Wilson, C. (2012). 'Solving SA's Rural Broadband Challenge', TechCentral, Johannesburg, 06th April 2012, available online at http://www.techcentral.co.za/solving-sas-rural-broadband-challenge/28344/.

Yin, R. (2009). Case Study Research: Design and Methods, (P. 3 and P. 26), Fourth Edition, Applied Social Research Methods, Sage Publications.

Zimri, P. (no date). Radio-frequency spectrum, the out-of-sight, out-of-mind national strategic resource, Unpublished Masters research report, Master of Management in ICT Policy and Regulation, University of the Witwatersrand

APPENDIX 1

RESEARCH PARTICIPANT INFORMATION AND CONSENT FORM

Masters Research Report: Barriers to broadband market development in rural areas in South Africa

You are being asked to participate in a research study investigating the **"Barriers to broadband market development in rural areas in South Africa"**. Before the interview can commence you are required to read the following information which has been provided as background information on the research and why it is being carried out.

Background of the study

This research study is being conducted by Caroline Macharia in partial fulfilment of the requirements for the Masters of Management in ICT Policy and Regulation, at the Graduate School of Public and Development Management, at the University of the Witwatersrand.

The research study investigates challenges affecting the supply and demand side factors of the broadband ecosystem that hinder the market development of broadband in rural areas in South Africa and how policy and regulation has affected the evolution of the broadband ecosystem in rural areas.

Although the elements of the broadband ecosystem are strong and well placed in urban areas, not all elements of the broadband ecosystem in rural areas are in place and equally strong. The relative strengths and weaknesses of the different elements of the broadband ecosystem in rural areas are unknown and demand and supply side factors are not understood. Hence the broadband policy may not be based on a full understanding of the complex ecosystem.

The researcher will draw on insights gained from interviews with the various industry players within the Telecommunication sector. The researcher will also draw information from the analysis of secondary data in the form of the existing broadband policy 2010 document, spectrum policy document, Integrated ICT policy document, The national information society and development plan (ISAD), Electronic Communication Act and the Communication Convergence Bill of 2001 with the aim of gaining insight into the strengths and weaknesses of the policies and regulations in addressing the evolution of the broadband ecosystem in rural areas.

Your right to participate

Participation in this research study will be completely voluntary. Should you change your mind and decide not to participate in this study you are free to withdraw without giving reason at any time. Should you agree to participate in this study you will be required to sign the consent form.

Confidentiality

Information collected from the interview will be kept confidential. The research findings will form part of the final research report and published in a public domain however your identity will not be disclosed. Respondents will have full access to the consolidated research findings if required. The information obtained during this research will be kept securely in paper and electronic format after the completion of the research project and may be used for further research and analysis. The audio recordings will be transcribed into written transcriptions and will solely be used to validate the notes made during the interview. The original recordings will be stored in a locked location by the researcher and should copies be made available to researchers elsewhere in future, similar conditions regarding the storage and use of recordings will apply.

I HAVE CAREFULLY STUDIED THE ABOVE INFORMATION AND UNDERSTAND ITS CONTENT. I FREELY CONSENT AND VOLUNTARILY AGREE TO PARTICIPATE IN THIS RESEARCH STUDY.

NAME (please print) --

SIGNATURE ---

Should you at any time have questions about the research and your rights as a research participant please contact the researcher's supervisor Luci Abrahams, see contact details below.

Contacts for further information:

Luci Abrahams
Director, LINK Centre
University of the Witwatersrand
Johannesburg, South Africa
Email: luciennesa@gmail.com
Cell: +27 82 569 7675

Caroline Macharia
Student, LINK Centre
University of
Witwatersrand
Johannesburg, South
Africa
Email:
caroline.macharia@gmail.com
Cell: +27 84 837 3797

APPENDIX 2

Faculty of Management
University of The Witwatersrand
Cell: +27 (0) 84 837 3797
Email: caroline.macharia@gmail.com

Date: 23rd July 2012

Senior Systems Analyst
Gauteng City-Region Observatory (GCRO)

Letter to request for Land cover data for Metsweding Municipality from the GCRO

Dear Sir

I am a registered Masters student at the Faculty of Management, at the University of the Witwatersrand currently working on my master's research report under the supervision of Lucienne Abrahams. My masters research report titled "**Barriers to broadband market development in rural areas in South Afric**a", aims to establish whether barriers exist in rural areas that pose a challenge to the broadband market development and the rural parts of Metsweding municipality will inform the basis of this research.

The research will be based on the qualitative research method. In order to identify the population sample, a mapping of Metsweding Municipality showing a representative layer indicating the rural, urban and peri-urban parts of the municipality, the various commercial activities located within the municipality which include mining, agriculture, tourism and the population will form part of the research design.

The requested data required is:

1. Representative layer indicating the rural, urban and peri-urban parts of Metsweding Municipality – GTI land cover2.
2. Representative layer indicating the various commercial activities located within the municipality which should include mining, agriculture and tourism – GTI land use per building or ESKOM SBC3.
3. Representative layer indicating where the population is located within the municipality – Lightstone Demprokey X.

The data is solely intended for use in my research report and no third parties will receive this information. The GCRO and other sources through the GDCRO will be adequately acknowledged. GeoTerraimage and Lightstone will be acknowledged. I will reference the GCRO and include their logo on all my presentations and final report.

Your assistance will be highly appreciated in this regards.

Yours Sincerely

Caroline Macharia

APPENDIX 3

Sample Interview Schedule: with the Telecom operators (Vodacom, MTN, CellC, Neotel, Telkom and FTTH Council)

1. What would be the value to the Telecom operators of the Digital Dividend or high demand spectrum (800MHz / 2.6GHz spectrum)? What are your views on the role that this spectrum would play in the broadband market development in rural areas? Please elaborate.

2. What would be the value to Telecoms Operators of providing broadband services to rural areas?

3. What are your views on the current state of the broadband ecosystem (availability of networks or infrastructure, availability of broadband Services, availability and relevance of content and applications in a local language, availability and affordability of devices which includes laptops, smartphones or tablets, awareness, knowledge and skills development in broadband and affordability of broadband services) in rural areas? Highlight any challenges faced in these areas if any that you feel may pose a barrier to the broadband market development in rural areas. Please specify how these challenges have affected the broadband evolution in rural areas.

4. What are your views on the role that government has played in addressing the barriers (if any) faced by Telecom Operators in developing the broadband market in rural areas? How can government address these challenges? Please elaborate

5. What are your views on the role that the regulator has played in addressing the barriers (if any) faced by Telecom Operators in developing the broadband market in rural areas? How can the regulator address these challenges? Please elaborate

6. As a Telecom Operator how are you enabling/driving broadband adoption in rural areas? Please elaborate.

APPENDIX 4

Sample Interview Schedule: with the ISPs (Internet Solutions)

1. What would be the value to ISPs of spectrum licenses or unlicensed spectrum? What are your views on the role that this spectrum would play in the broadband market development in rural areas? Please elaborate.

2. What would be the value to ISPs of providing broadband services to rural areas?

3. What are your views on the current state of the broadband ecosystem (availability of networks or infrastructure, availability of broadband Services, availability and relevance of content and applications in a local language, availability and affordability of devices which includes laptops, smartphones or tablets, awareness, knowledge and skills development in broadband and affordability of broadband services) in rural areas? Highlight any challenges faced in these areas if any that you feel may pose a barrier to the broadband market development in rural areas. Please specify how these challenges have affected the broadband evolution in rural areas.

4. What are your views on the role that government has played in addressing the barriers (if any) faced by ISPs in developing the broadband market in rural areas? How can government address these challenges? Please elaborate

5. What are your views on the role that the regulator has played in addressing the barriers (if any) faced by ISPs in developing the broadband market in rural areas? How can the regulator address these challenges? Please elaborate

6. As an ISP how are you enabling/driving broadband adoption in rural areas? Please elaborate.

APPENDIX 5

Sample Interview Schedule: with the Regulator (ICASA)

1. What is ICASA's view on the value of spectrum for the purpose of addressing the digital divide and the provision of broadband access to rural areas? How does ICASA plan on addressing the allocation of spectrum for the provision of broadband access to rural areas?

2. What is ICASA's view on the current state of the broadband ecosystem (availability of networks or infrastructure, availability of broadband Services, availability and relevance of content and applications in a local language, availability and affordability of devices which includes laptops, smartphones or tablets, awareness, knowledge and skills development in broadband and affordability of broadband services) in rural areas? Highlight any challenges faced in these areas if any that you feel may pose a barrier to the broadband market development in rural areas. Please specify how these challenges have affected the broadband evolution in rural areas.

3. How has the current state of the broadband ecosystem (Demand and Supply side factors which includes availability of networks or infrastructure, availability of broadband Services, availability and relevance of content and applications in a local language, availability and affordability of devices which includes laptops, smartphones or tablets, awareness, knowledge and skills development in broadband and affordability of broadband services) in rural areas influenced policy and regulation for broadband development in rural areas? Please specify.

4. In your view what is the value of broadband access in rural areas? What challenges do you feel Telecom network operators/ ISPs face with regards to the broadband market development in rural areas? How is ICASA addressing these challenges if any? Please specify

5. What is ICASA doing to ensure that the broadband market development in rural areas is addressed in the scope of the Universal Service and Access policy with the aim of achieving Universal Access to broadband in rural areas? In the meantime how is ICASA currently addressing the roll out of broadband services to under serviced and rural areas? Please elaborate.

6. To what extent does existing policy and regulation enable broadband evolution and broadband ecosystem development in rural areas? Please elaborate.

7. To what extent does existing policy enable the investment in and absorptive capacity of broadband?
8. How is ICASA enabling/driving broadband adoption in rural areas? Please elaborate.

APPENDIX 6

Sample Interview Schedule: Government Departments: Local municipality, School and Hospital

1. How many employees does your department employ in total? --------------------------------
2. How many of the people employed use computers? ---
3. Do you know what broadband or internet services are? Yes [ ] No [ ]
4. Do you currently use broadband services in government? Yes [ ] No [ ]

If you answered no please explain why? --

----

5. How many of the people employed that use a computer have access to internet? -----------
6. Does the government department have a website?

   Yes [ ] No [ ]
7. Does the government department rely on the internet to provide e-government services to the public?

   Yes [ ] No [ ]

If you answered yes please specify which e-government services are offered to the public? ---
----

----

8. Please indicate whether you agree or disagree to the statement that having access to broadband services is valuable to government? ---

8.1 If you agreed with the above statement please explain why?

----

9. Would you describe accessing broadband services in your areas as easy / average / difficult? ---

9.1 If you answered difficult to question 9 please provide reasons as to why you feel getting access to broadband in your area is difficult?

----

10. What type of broadband access do you use in government?

Intranet	Yes [ ]	No [ ]
Extranet	Yes [ ]	No [ ]
LAN (Local Area Network)	Yes [ ]	No [ ]
Narrowband:		
Analogue Modem	Yes [ ]	No [ ]
ISDN	Yes [ ]	No [ ]
Other Narrowband	Yes [ ]	No [ ]
Broadband:		
DSL	Yes [ ]	No [ ]
Cable modem	Yes [ ]	No [ ]
Satellite	Yes [ ]	No [ ]
WIMAX	Yes [ ]	No [ ]
WLAN	Yes [ ]	No [ ]
(Wireless Local Area Network)		

Fibre to the home (FTTH) Yes [ ] No [ ]

Mobile Broadband: Yes [ ] No [ ]

11. Which device does government use to access the internet?

    Mobile phone Yes [ ] No [ ]

    Desktop PC Yes [ ] No [ ]

    Laptop Yes [ ] No [ ]

    Netbook Yes [ ] No [ ]

    Tablet PC (i.e. Ipad) Yes [ ] No [ ]

    Smartphone Yes [ ] No [ ]

12. Do government employees have any formal training on digital literacy?

    Yes [ ] No [ ]

13. Would you describe the existence of educational institutions in Metsweding offering training courses on digital literacy as being existent / non-existent?

----

14. What factors influence government's decision making when subscribing to a broadband service?

Price / affordability Yes [ ] No [ ]

Awareness of broadband services offered Yes [ ] No [ ]

Device cost (laptop, desktop, data modem etc.) Yes [ ] No [ ]

Total cost of ownership (device + broadband service) Yes [ ] No [ ]

Quality of service offered Yes [ ] No [ ]

Access to relevant applications offered by service provider Yes [ ] No [ ]

Access to content and applications in local language Yes [ ] No [ ]

Innovative broadband services Yes [ ] No [ ]

Ease of access to broadband services Yes [ ] No [ ]

15. Content is any work produced by an author, whatever the medium of expression (text, pictures, music or musical performances, computer programs, and so on). Content on the Internet is information and experiences created by individuals, institutions and technology to benefit users in contexts that they value. Examples

of content include e-mail, search engines, news, maps, sales and marketing applications used by businesses, user-generated content and hundreds of thousands of more specialized uses. While applications is function-specific software that uses the data stream to deliver content to users. Examples include e-Government, social networking sites such as Facebook and tweeter which are being used as vehicles for advertising.

15.1 Does government provide the public with access to content or e-government applications?

Yes [ ] No [ ]

15.2 If you answered yes to question 13.1 what language is the content or e-government applications provided in? -- -------------------------

15.3 Would you agree or disagree to the statement that being able to provide content to the public in a local language is of importance to government? ------------------ ----------------

Please elaborate if you agree -- --- --- ---------------------------

15.4 Would you agree or disagree to the statement that content or e-government applications services provided by government is of importance to the public? ---- -------------------------

Please elaborate if you agree --- --- --- -------------------------

15.5 In your view what content or application services do you feel would be of relevance to government? Please specify --- ---

----

----

16. For each of the following statements please state whether you strongly agree, agree, neither agree or disagree, disagree or strongly disagree:

    1. Broadband infrastructure is available in Metsweding

    Strongly agree [] agree [] neither agree or disagree [] disagree [] strongly disagree []

    2. Broadband services are available in Metsweding

    Strongly agree [] agree [] neither agree or disagree [] disagree [] strongly disagree []

    3. Broadband services are affordable in Metsweding

    Strongly agree [] agree [] neither agree or disagree [] disagree [] strongly disagree []

    4. Content and applications are available in Metsweding

    Strongly agree [] agree [] neither agree or disagree [] disagree [] strongly disagree []

    5. Content and applications available in Metsweding are relevant

    Strongly agree [] agree [] neither agree or disagree [] disagree [] strongly disagree []

    6. Content and applications are available in local language

    Strongly agree [] agree [] neither agree or disagree [] disagree [] strongly disagree []

    7. Devices that enable broadband access are available in Metsweding

    Strongly agree [] agree [] neither agree or disagree [] disagree [] strongly disagree []

    8. Devices that enable broadband access are affordable in Metsweding

    Strongly agree [] agree [] neither agree or disagree [] disagree [] strongly disagree []

    9. Institutions offering digital literacy exist in Metsweding Municipality

    Strongly agree [] agree [] neither agree or disagree [] disagree [] strongly disagree []

17. In your view what should government and the Telecom operators / ISPs (Internet Service Providers) do to enable / drive broadband adoption in Metsweding? ------

----

APPENDIX 7

Sample Interview Schedule: Households / Consumers in malls or shopping centre

1. What is your highest education Level?

Primary education or lower	[ ]
Lower secondary education	[ ]
Upper secondary or post-secondary non tertiary	[ ]
Tertiary	[ ]

2. What is your current household's gross monthly income? -------------------------------
3. Do you know what broadband or internet services are? Yes [ ] No [ ]
4. Do you currently use broadband services? Yes [ ] No [ ]
5. Please indicate whether you agree or disagree to the statement that having access to broadband services is valuable to you? --

5.1 If you agreed with the above statement please explain why?

----

6. Would you describe accessing broadband services in your areas as easy / average / difficult? --

6.1 If you answered difficult to question 6 please provide reasons as to why you feel getting access to broadband in your area is difficult?

----

7. Do you currently have broadband services in the home? Yes [ ] No [ ]

7.1 If you answered no to question 7 where did you access the internet from in the past 12 months from?

Work	[ ]
School	[ ]
Community Internet access facility	[ ]

Other Location (please specify) ---

----

8. What type of broadband access do you use in the home?

Narrowband:		
Analogue Modem	Yes [ ]	No [ ]
ISDN	Yes [ ]	No [ ]
Other Narrowband	Yes [ ]	No [ ]
Broadband:		
DSL	Yes [ ]	No [ ]
Cable modem	Yes [ ]	No [ ]
Satellite	Yes [ ]	No [ ]
WIMAX	Yes [ ]	No [ ]
WLAN	Yes [ ]	No [ ]
(Wireless Local Area Network)		
Fibre to the home (FTTH)	Yes [ ]	No [ ]
Mobile Broadband:	Yes [ ]	No [ ]

9. Which device do you use to access the internet in the home?

Mobile phone	Yes [ ]	No [ ]
Desktop PC	Yes [ ]	No [ ]
Laptop	Yes [ ]	No [ ]
Netbook	Yes [ ]	No [ ]
Tablet PC (i.e. Ipad)	Yes [ ]	No [ ]

Smartphone Yes [ ] No [ ]

10. Do you have any formal training on digital literacy?

Yes [ ] No [ ]

11. Would you describe the existence of educational institutions in Metsweding offering training courses on digital literacy as being existent / non-existent?

----

12. What factors influence your decision making when subscribing to a broadband service?

Price / affordability	Yes [ ]	No [ ]
Awareness of broadband services offered	Yes [ ]	No [ ]
Device cost (laptop, desktop, data modem etc.)	Yes [ ]	No [ ]
Total cost of ownership (device + broadband service)	Yes [ ]	No [ ]
Quality of service offered	Yes [ ]	No [ ]
Access to relevant applications offered by service provider	Yes [ ]	No [ ]
Access to content and applications in local language	Yes [ ]	No [ ]
Innovative broadband services	Yes [ ]	No [ ]
Ease of access to broadband services	Yes [ ]	No [ ]

13. Content is any work produced by an author, whatever the medium of expression (text, pictures, music or musical performances, computer programs, and so on). Content on the Internet is information and experiences created by individuals, institutions and technology to benefit users in contexts that they value. Examples of content include e-mail, search engines, news, maps, sales and marketing applications used by businesses, user-generated content and hundreds of thousands of more specialized uses. While applications is function-specific software that uses the data stream to deliver content to users. Examples include e-Government, social networking sites such as Facebook and tweeter which are being used as vehicles for advertising.

13.1 Do you have access / subscribe to any content or applications provided by your telecom network operator or ISP (Internet Service Provider)?

Yes [ ] No [ ]

13.2 If you answered yes to question 13.1 what language is the content or applications provided in by the broadband service provider? --

13.3 Would you agree or disagree to the statement that having access to content or applications in a local language is of importance to you? --------------------------------------

Please elaborate if you agree --

13.4 Would you agree or disagree to the statement that content or applications services provided by your broadband service provider are of relevance to you? ----------------------

Please elaborate if you agree --

13.5 In your view what content or application services do you feel would be of relevance to you? Please specify --

14. For each of the following statements please state whether you strongly agree, agree, neither agree or disagree, disagree or strongly disagree:

10. Broadband infrastructure is available in Metsweding

Strongly agree [] agree [] neither agree or disagree [] disagree [] strongly disagree []

11. Broadband services are available in Metsweding

Strongly agree [] agree [] neither agree or disagree [] disagree [] strongly disagree []

12. Broadband services are affordable in Metsweding

Strongly agree [] agree [] neither agree or disagree [] disagree [] strongly disagree []

13. Content and applications are available in Metsweding

Strongly agree [] agree [] neither agree or disagree [] disagree [] strongly disagree []

14. Content and applications available in Metsweding are relevant

Strongly agree [] agree [] neither agree or disagree [] disagree [] strongly disagree []

15. Content and applications are available in local language

Strongly agree [] agree [] neither agree or disagree [] disagree [] strongly disagree []

16. Devices that enable broadband access are available in Metsweding

Strongly agree [] agree [] neither agree or disagree [] disagree [] strongly disagree []

17. Devices that enable broadband access are affordable in Metsweding

Strongly agree [] agree [] neither agree or disagree [] disagree [] strongly disagree []

18. Institutions offering digital literacy exist in Metsweding Municipality

Strongly agree [] agree [] neither agree or disagree [] disagree [] strongly disagree []

In your view what should government and the Telecom operators / ISPs (Internet Service Providers) do to enable / drive broadband adoption in Metsweding? ------

----

APPENDIX 8

Sample Interview Schedule: SMME

1. How many employees do you employ in total? --
2. What is the total annual revenue for your business? --
3. How many of the people employed in your business use computers? ------------------------
4. Do you know what broadband or internet services are? Yes [ ] No [ ]
5. Do you currently use broadband services in your business?
   Yes [ ] No [ ]

If you answered no please explain why? --

6. How many of the people employed that use a computer have access to internet? -----------
7. Does your business have a website? Yes [ ] No [ ]
8. Does your business rely on the internet to bring in business?
   Yes [ ] No [ ]

If you answered yes please specify which internet activities your business is dependent on (i.e. online ordering, marketing etc.) --

9. Please indicate whether you agree or disagree to the statement that having access to broadband services is valuable to you? --

9.1 If you agreed with the above statement please explain why?

----

10. Would you describe accessing broadband services in your areas as easy / average / difficult? --

10.1 If you answered difficult to question 10 please provide reasons as to why you feel getting access to broadband in your area is difficult?

----

11. What type of broadband access do you use in the business?

Narrowband:		
Analogue Modem	Yes [ ]	No [ ]
ISDN	Yes [ ]	No [ ]
Other Narrowband	Yes [ ]	No [ ]
Broadband:		
DSL	Yes [ ]	No [ ]
Cable modem	Yes [ ]	No [ ]
Satellite	Yes [ ]	No [ ]
WIMAX	Yes [ ]	No [ ]
WLAN	Yes [ ]	No [ ]
(Wireless Local Area Network)		
Fibre to the home (FTTH)	Yes [ ]	No [ ]
Mobile Broadband:	Yes [ ]	No [ ]

12. Which device do you use to access the internet in the business?

Mobile phone	Yes [ ]	No [ ]
Desktop PC	Yes [ ]	No [ ]
Laptop	Yes [ ]	No [ ]
Netbook	Yes [ ]	No [ ]
Tablet PC (i.e. Ipad)	Yes [ ]	No [ ]
Smartphone	Yes [ ]	No [ ]

13. Do your employees have any formal training on digital literacy?

Yes [ ] No [ ]

14. Would you describe the existence of educational institutions in Metsweding offering training courses on digital literacy as being existent / non-existent?

----

15. What factors influence your businesses decision making when subscribing to a broadband service?

Price / affordability	Yes [ ]	No [ ]
Awareness of broadband services offered	Yes [ ]	No [ ]
Device cost (laptop, desktop, data modem etc.)	Yes [ ]	No [ ]
Total cost of ownership (device + broadband service)	Yes [ ]	No [ ]
Quality of service offered	Yes [ ]	No [ ]
Access to relevant applications offered by service provider	Yes [ ]	No [ ]
Access to content and applications in local language	Yes [ ]	No [ ]
Innovative broadband services	Yes [ ]	No [ ]
Ease of access to broadband services	Yes [ ]	No [ ]

16. Content is any work produced by an author, whatever the medium of expression (text, pictures, music or musical performances, computer programs, and so on). Content on the Internet is information and experiences created by individuals, institutions and technology to benefit users in contexts that they value. Examples of content include e-mail, search engines, news, maps, sales and marketing applications used by businesses, user-generated content and hundreds of thousands of more specialized uses.

While applications is function-specific software that uses the data stream to deliver content to users. Examples include e-Government, social networking sites such as Facebook and tweeter which are being used as vehicles for advertising.

16.1 Do you have access / subscribe to any content or applications provided by your telecom network operator or ISP (Internet Service Provider)?

Yes [ ] No [ ]

16.2 If you answered yes to question 16.1 what language is the content or applications provided in by the broadband service provider? --

16.3 Would you agree or disagree to the statement that having access to content or applications in a local language is of importance to your business? ---------------------------

Please elaborate if you agree ---

16.4 Would you agree or disagree to the statement that content or applications services provided by your broadband service provider are of relevance to your business? -----------Please elaborate if you agree ---

16.5 In your view what content or application services do you feel would be of relevance to your business? Please specify --

17. For each of the following statements please state whether you strongly agree, agree, neither agree or disagree, disagree or strongly disagree:

19. Broadband infrastructure is available in Metsweding

Strongly agree [] agree [] neither agree or disagree [] disagree [] strongly disagree []

20. Broadband services are available in Metsweding

Strongly agree [] agree [] neither agree or disagree [] disagree [] strongly disagree []

21. Broadband services are affordable in Metsweding

Strongly agree [] agree [] neither agree or disagree [] disagree [] strongly disagree []

22. Content and applications are available in Metsweding

Strongly agree [] agree [] neither agree or disagree [] disagree [] strongly disagree []

23. Content and applications available in Metsweding are relevant

Strongly agree [] agree [] neither agree or disagree [] disagree [] strongly disagree []

24. Content and applications are available in local language

Strongly agree [] agree [] neither agree or disagree [] disagree [] strongly disagree []

25. Devices that enable broadband access are available in Metsweding

Strongly agree [] agree [] neither agree or disagree [] disagree [] strongly disagree []

26. Devices that enable broadband access are affordable in Metsweding

Strongly agree [] agree [] neither agree or disagree [] disagree [] strongly disagree []

27. Institutions offering digital literacy exist in Metsweding Municipality

Strongly agree [] agree [] neither agree or disagree [] disagree [] strongly disagree []

In your view what should government and the Telecom operators / ISPs (Internet Service Providers) do to enable / drive broadband adoption in Metsweding? -----------
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